

# **NRRP Pre-hearing Meeting Briefing Document Schedule WQN9 and Irrigation Schemes**

**(prepared by Environment Canterbury Officers Anna Veltman and  
Malcolm Miller)**

## **1 INTRODUCTION**

This pre-hearing meeting has arisen because of the need to provide additional information to all submitters to the NRRP who submitted on Chapter 5, Policy WQN17 Reasonable and efficient use of water. In addition, there has been a specific request from submitters Trustpower Ltd, Rangitata Diversion Race Management Ltd and Irrigator Forum for such a meeting to discuss Schedule WQN9, as well as matters relating to irrigation schemes more specifically.

This pre-hearing meeting is being held pursuant to clause 8AA of Schedule 1 RMA.

## **2 BACKGROUND**

### **Supplementary Officer Report**

NRRP Hearing Stage 14 was held on 23 October, 1 and 2 November 2007 at the Environment Canterbury offices in Christchurch. The Hearing Stage was adjourned to allow officers to provide further information on a number of matters outlined in a Minute of the Hearing Committee dated 17 December 2007. The information sought related chiefly to:

- Schedule WQN9;
- the status of irrigation schemes with respect to Policy WQN17 Reasonable and efficient use of water; and
- the merits of proposed amendments to Policy WQN18 Transfer of the point of take or the use of water.

Officers provided this further information to the Hearing Committee on the 31 March 2008, and to all submitters on Hearing Stage 14 who wished to be heard.

### **Environment Canterbury workshops**

Independent of the NRRP plan hearing process, two workshops<sup>1</sup> were held at Environment Canterbury (18 June and 5 December 2008), as part of the Restorative Streams Programme, to critique technical methods for estimating seasonal allocations for irrigation and consider ways forward to improve data sets and knowledge to develop a modelled approach to determine water allocation requirements.

The two approaches currently available are:

---

<sup>1</sup> These workshops were hosted by ECan where recognised technical experts from both within and outside of Canterbury were invited to critique the two technical methods. Attendees included Steve Green, Lionel Hume, Brent Clothier, Ian Lloyd, Dick Martin, Dan Bloomer, Terry Heiler and Hamish Brown. A number of ECan staff also attended.

- the “WQN9” approach based on soil moisture monitoring, and
- the “Aqualinc” approach based on the IrriCalc irrigation simulation model that incorporates a soil water balance component.

The need for the workshops arose because of other processes that are occurring where estimates of seasonal irrigation demand are needed to determine annual volumes on resource consents. One such process is the review of resource consents in the Rakaia-Selwyn Groundwater Allocation Zone under the Restorative Streams Programme.

The critique of the two approaches in the workshops included consideration of:

- whether the two approaches are fundamentally different;
- whether further analysis could be helpful; and
- if further data could be gathered to assist in developing a more robust approach.

Following the first workshop, Environment Canterbury commissioned further technical analysis to be carried out by both Tony Davoren of HydroServices Ltd and John Bright of Aqualinc Ltd to try to understand more clearly some of the issues identified in the first workshop. This further technical analysis formed the basis of discussions at the second workshop.

At the second workshop, conclusions were drawn and recorded regarding the merits of each approach, and how we can move forward (see Attachment 1).

### **3 Implications for NRRP Policy WQN17 and Schedule WQN9 of the key conclusions from the workshop**

#### ***3.1 Continue to use WQN9v3 as the basis for defining the annual volume of water as a standard to be included in NRRP***

A primary focus of the workshops was on consideration of the technical merits of the two approaches currently available for estimating seasonal irrigation demand and therefore annual volumes. It was determined that both approaches had different strengths and weaknesses.

The concerns that have been raised by submitters and others with respect to the WQN9 approach were analysed and while not always accepted as scientifically robust, the adjustments made in estimating the values were considered generally appropriate (see 1 – 4 in Attachment 1).

With respect to the Aqualinc approach using the IrriCalc irrigation simulation model, this was considered to be a scientifically valid methodology, and has

the advantage of more easily providing estimates of seasonal irrigation demand taking into account different irrigation systems etc.

However, to date, the model has been calibrated on the basis of soil drainage data from a single location only. In running the model, the same criteria as outlined in Policies WQN14 and WQN17, and Schedule WQN9, for developing the irrigation demand standards, have not yet been consistently incorporated, for example - irrigation season length; reliability criteria of meeting demand conditions; irrigation application efficiency (- being an output of the model). For these reasons, the model outputs to date are not considered appropriate for inclusion as the irrigation demand standards in Schedule WQN9.

On this basis, it is considered that:

- Schedule WQN9: Seasonal irrigation demand standards that were recommended in Officer Report No 14 and that are based on what is commonly referred to as “WQN9v3” should remain unchanged;
- Amendments could be made to Policy WQN17 to make it clear that where a different seasonal volume is being sought and is based on a modelled approach, there must be sufficient data to calibrate and verify the model for the specifics of the location (see Attachment 2 – Change 1)

### **3.2 Assumption of an irrigation application efficiency of 80%**

As part of the analysis carried out for the workshops comparing the two approaches, soil drainage lysimeter data from Dunsandel was obtained and used to calibrate the IrriCalc model.

Initial analysis of the data itself indicated an issue of water loss to drainage below the crop root zone occurring even when the soil moisture is below field capacity. It was concluded that rather than irrigation management being the cause of the issue, it is as a result of the design limitations associated with the irrigation system being used.

A further conclusion from the workshop was that there will be existing irrigation systems with similar limitations, and that different irrigation systems will have different irrigation application efficiencies with many below the assumed irrigation efficiency of 80% set out in Policy WQN17, and on which the seasonal irrigation demand standards in Schedule WQN9 are based.

This realisation has implications for existing consent holders who may be operating irrigation systems that cannot be operated at the 80% level. Under these circumstances, the irrigation demand standards in Schedule WQN9 will not provide sufficient water.

The workshop participants considered it is reasonable and desirable for any new activities to be allocated a volume of water based on operating within an irrigation application efficiency of 80%, as they have yet to invest in infrastructure and should do so to meet NRRP requirements. It is noted that a

paper to the INZ conference to 2008 concluded that the Schedule WQN9 approach is appropriate for well designed and well managed centre pivot irrigation systems for example.

To clarify this and overcome the issue for existing activities that may operate on a lower irrigation application efficiency, Policy WQN17 could be amended to make it clear that:

- for all new activities to take water for irrigation use, an irrigation application efficiency of 80% is to be assumed and any lower irrigation application efficiency would be in non-compliance with the policy (see Attachment 2 – Change 2); and
- for existing activities, a lower efficiency may be acceptable where mitigating circumstances exist. This would allow for a “bridging volume” of water to be provided for, above the relevant seasonal irrigation demand standard in Schedule WQN9, however this would be on the basis that;
  - it would be for a limited period of up to but not exceeding 2020 (say);
  - the additional volume cannot be transferred; and
  - the additional volume will be reduced where the actual use is determined to be less than the amount allocated (see Attachment 2 – Change 3).

#### **4 Irrigation schemes, dual supply, development of scheme protocols and transferability**

A document was prepared by officers following Hearing Stage 14 titled “Response to the Minute from the NRRP Hearing Committee re Hearing Stage 14” dated 31 March 2008<sup>2</sup>, which provides answers to questions from the hearing committee. Sections 3 and 4 address the matters of irrigation schemes and dual supply, and transferability respectively.

No additional comment is proposed here, and any discussion in the pre-hearing meeting can use that document as reference.

---

<sup>2</sup> The document was sent out to all submitters who wished to be heard, but for those submitters who did not want to be heard and have not received a copy, an electronic copy is available on our website through the following link: Also be aware that information on the hearing process including all officer reports is available on our website through the following link:  
<http://www.ecan.govt.nz/Plans+and+Reports/NRRPNEW/HearingsandOfficersReports.htm>

## **ATTACHMENT 1: Record of 5 December workshop written by Bryan Jenkins**

### **OUTCOMES OF WQN9 WORKSHOP, 5 December 2008**

Attendees – Bryan Jenkins, Lionel Hume, Dick Martin, Terry Heiler, Hamish Brown, David Scott, Anna Veltman, Ian Lloyd, Ken Taylor, John Bright, Malcolm Miller, Tony Davoren, Dan Bloomer, Christina Robb and (for some of meeting) Andy McFarlane.

The workshop on 5 December was to review additional analyses requested of Tony Davoren and John Bright from the workshop on 18 June 2008. This additional work was as follows:

- Whether the decoupling of the rainfall time series from the potential evaporation time series would influence the outcome of the WQN9 calculation
- Whether the adjustment factors to convert 1998/9 data to a 4-in-5 year rainfall season introduced inaccuracies
- Whether differences in irrigation efficiency inherent in the two methods could explain the predicted differences
- Undertake comparisons of further measured sites, particularly pivot systems on heavy soils.

The presentations addressing these issues that were made by Tony Davoren and John Bright are attached (see separate PowerPoint files).

A further presentation from Hamish Brown was also made using a simple water balance spreadsheet.

The main findings from the further work are set out below.

It should be noted that additional work after the meeting was undertaken to determine how the heavy soil results for the additional property analysed by Tony Davoren plotted on the WQN9 envelopes. There has also been feedback from some participants after the meeting that has relevance to determining the way forward for water allocations to different land uses. Key points from this feedback and Environment Canterbury's proposed way forward are also set out below.

#### **1. Decoupling Rainfall from Soil Moisture Record**

The soil moisture record depends on the rainfall pattern and irrigation applied in a particular year. It is not possible to apply the 20 percentile rainfall to the same site without having to make arbitrary assumptions about the adjustments to the soil moisture record. This remains a shortcoming of the WQNv3 method. The importance is not known – it could result in higher or lower predictions of volume. It may be possible to size the potential effect by identifying another year with the 80 percentile demand year.<sup>3</sup>

---

<sup>3</sup> One suggestion after the meeting was to consider effective summer rainfall during a 1-in-5 year drought rather than summer rainfall exceeded 80% of the time

## 2. Comparison of 80-percentile and 1998/99 Seasonal Use

Five farms were identified as having data for rainfall years close to the 80-percentile demand season. Two of these farms were analysed. For one farm (44) in comparing four sites the 80-percentile demand season results varied from being the same as the 1998/99 season, 20mm more, 100mm more, to 200mm more in relation to total demand. For the second farm (47) in comparing three sites, the 80-percentile demand season varied from being the same as the 1998/99 season, 100mm less to 150mm less. This indicates no systematic bias and the indicative range of variability.

It was agreed that analyses for the other three sites would be useful only if the sites were close to the upper envelope line for the plot of water used for the relevant land use.

## 3. Adjustments for Application Efficiency

The Davoren method assumes an 80% application efficiency while the Irricalc model has efficiency as an output depending on the irrigation equipment being used. To test the two methods, Irricalc results for centre pivots (with about 98% efficiency) were compared with the Davoren Method, and the Davoren Method for a 60% efficiency was compared with Irricalc for Rotorainers (with about 60% efficiency).

PAW class	Davoren Method		Irricalc Method	
	80% application efficiency	60% application efficiency	Centre pivot 98% efficiency	Rotorainer 59% efficiency
60 mm	625		567	
		810		850
80 mm	610		572	
		795		715
120 mm	550		520	
		759		720

The table shows that centre pivots with a 98% application efficiency need less water than WQN9. It also shows that with a 60% application efficiency assumption then the Davoren Method shows comparable results to the Irricalc method.

It would appear that a major factor in the difference between the two methods relates to the application efficiency used or implied in the irrigation demand estimates.<sup>4</sup>

## 4. Heavy Soil Comparison

At the time of the workshop the analysis of a farm with heavy soils and ryegrass was being processed using the Davoren Method. This is a farm with water meters, soil moisture measurement and irrigation trigger points. Data for 2007/8 have been used; this was considered to be representative of a 1-in-5-year drought based on analysis by David Scott on the day.

<sup>4</sup> It was noted in a post workshop comment that matching of efficiencies still results in different volumes. It would be of interest to see soil moisture predictions from the Irricalc model as a basis of comparison between the two approaches.

The plots of the results are included as an attachment to this document (see Attachment A). The results plots are close to the envelope line indicating that an efficient irrigator comes within the Schedule WQN9 criteria.<sup>5</sup> This means that on the basis of this set of results the envelope for heavy soils is in about the right location.

The Irricalc model could not be applied in the absence of drainage data. This illustrates the need for more comprehensive datasets to be able to calibrate and verify models for site specific application.

## 5. Crop Production Requirements

Hamish Brown presented a spreadsheet model of water requirements to maintain maximum crop production for different irrigation equipment depending on uniformity efficiency and retention efficiency. It calculates water requirements that allows plants to achieve optimum yield in 80% of years in the less efficient parts of the field. Of the two components of efficiency – uniformity and retention – there is a lack of research on retention efficiency. The results showed different irrigation volumes related to different assumed efficiencies for different irrigation systems. The results for an 80-percentile year are set out in the table below.

PAW class	Centre pivot	Rotorainer	Border dyke
60	729	1200	2880
90	684	1000	1800
120	663	950	1272

Water allocation requirements vary significantly depending on the irrigation equipment used. Differences are also evident for soil type with heavier soils needing less water.<sup>6</sup>

## 6. Way Forward

In general discussion, there appeared to be agreement in relation to a policy position of a base allocation of water to meet a one-in-five-drought with 80% irrigation application efficiency. This would be the allocation for any new applicant if the zone had further water available. There may also be a need for a bridging allocation for existing irrigators where their current equipment did not meet the 80% irrigation application efficiency benchmark. The bridging allocation would only be available for a transition period with shorter transition periods for older technology or larger bridging allocations.

The Davoren method could be used for calculating the base allocation. Irrigation NZ were contemplating the extension of the Irricalc model to cover all of Canterbury for base and bridging allocation calculations.<sup>7</sup>

There was also a desire for finding incentives to encouraging the use of the least volume of water in any season.

<sup>5</sup> As discussed during the meeting (and reinforced by one commentator after the meeting), it means that existing irrigators not operating at 80% irrigation application efficiency will use more than a WQN9 allocation.

<sup>6</sup> From first principles heavier soils are more likely to retain a greater volume of rainfall.

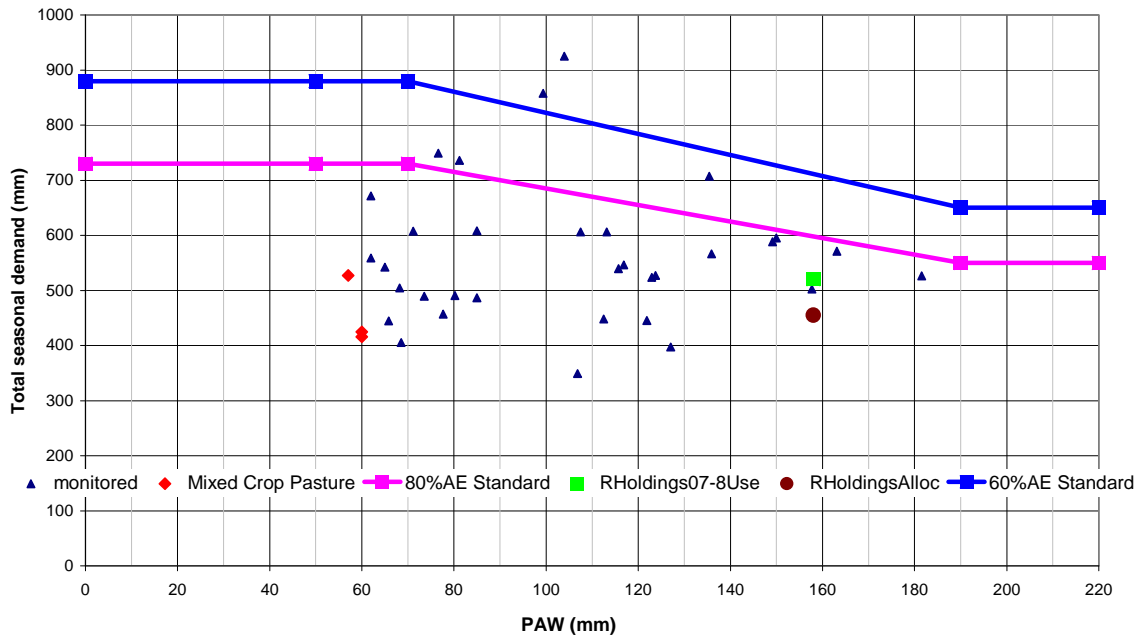
<sup>7</sup> Following the workshop, advice was received from Irrigation NZ that a scope of work had been defined to apply the Irricalc model to pasture across Canterbury using the same input data for soils and rainfall as WQN9.

On the basis of the outcome of the workshop, Environment Canterbury will

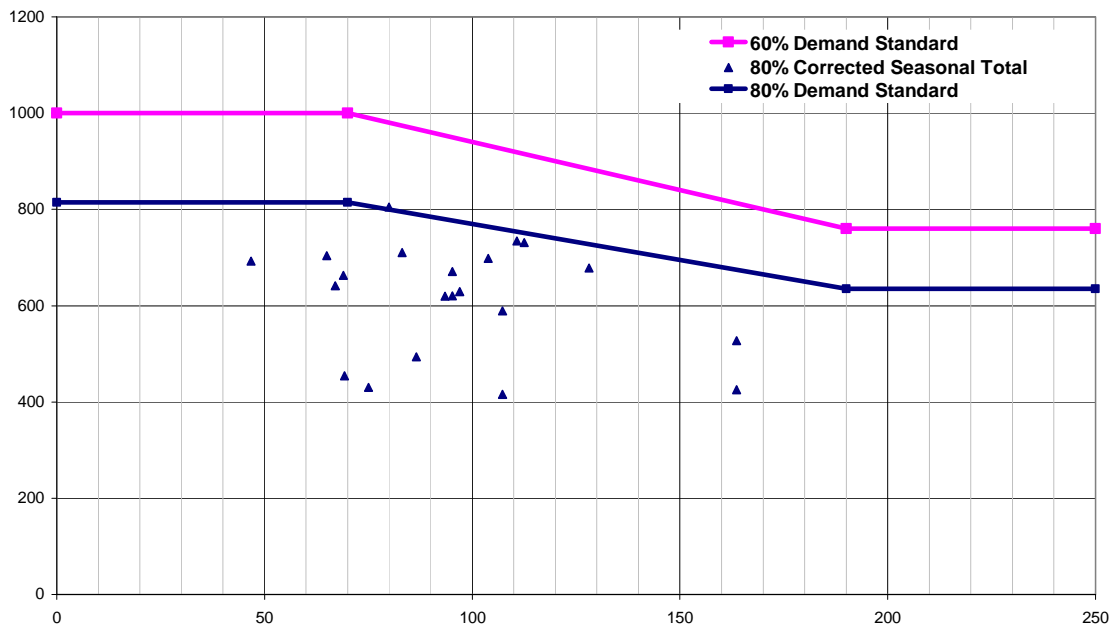
- Continue to use the WQN9 v3 as the basis for defining the volume of water that can be allocated for consent applications for a particular land use unless additional site specific information is provided to demonstrate that an alternative allocation is warranted or use a modelled approach with the model and its site application meeting performance criteria relating to calibration, verification and transparency of approach and assumptions.
- Explore an approach for consent reviews of existing consent holders using a base allocation derived from WQN9 (or a modelled alternative where the model meets the calibration and verification performance criteria) with a bridging volume for a specified transition period plus a review provision based on metered data.
- Commence a data collection programme based on lysimeters that is administered through the new university water centre to enable model verification for representative sites and land uses across Canterbury.
- Work with Irrigation NZ and others on the development of a modelled approach to determining water allocation requirements.

# ATTACHMENT A

## Arable Standards Comparison



## Pasture CorrSeasonal Total Demand v AdjPAW, 80% and 60% AE



## Attachment 2: Policy WQN17

This version of Policy WQN17 comes from the supplementary officer report circulated to all submitters wishing to be heard in relation to Variations 1 and 2 NRRP - Policy WQN17 and Schedule WQN9. The supplementary officer report was titled "Response to the Minute from the NRRP Hearing Committee re Hearing Stage 14" and dated 31 March 2008. This is available on the Environment Canterbury website under NRRP Hearing Stage 24.

The different colours below have the following meaning:

**Black:** original proposed plan text

**Black and underlined:** Changes recommended to the NRRP hearing panel by officers at various hearing stages

**Red and underlined:** Changes recommended by officers in the supplementary officer report titled "Response to the Minute from the NRRP Hearing Committee re Hearing Stage 14" and dated 31 March 2008.

**Blue:** Possible changes being suggested by officers in the above Pre-hearing Meeting Briefing Document to assist discussion at this meeting

### Policy WQN17 Reasonable and efficient use of water

(1) Ensure that:

**(a) the instantaneous rate of abstraction, the return period, return period volume<sup>8</sup> and the annual volume of water permits for taking, using or diverting water are no more than reasonable for the intended end use; and thereby**

**(b) ~~avoid~~ significant wastage of water is avoided; and**

**(c) ~~avoid or limit the any~~ adverse effect on water quality is avoided or limited to meet the requirements of (See also to Policies WQL4, WQL9 and WQL12).<sup>9</sup>**

(2) When assessing water permit applications for irrigation (new or replacement) in terms of (1) above:

**(a) the instantaneous rate of abstraction, the return period, the return period volume<sup>10</sup> and the seasonal volume of the proposal to take, divert or use water will be required to meet a reasonable use test, including:**

**(a) consideration of on-site physical factors such as soil water-holding capacity, climatic factors such as rainfall variability and potential evapotranspiration and land use activity; and**

**(b) assuming that there is an irrigation application efficiency of at least 80% even if the actual system being used has a lower application efficiency. Where the water permit application is for an irrigation system with a higher application efficiency, the higher figure will be used; and**

**(b) the use of water is to be managed in accordance with Policies WQL4, WQL9 and WQL12.**<sup>11</sup>

(3) Further to Policy WQN17(2) above, provide for the use of water for irrigation to be:

**(a) a permitted activity where:**

**(i) the property is supplied entirely from private surface or groundwater takes and the seasonal irrigation demand standards in Schedule WQN9 for the intended land use are met not exceeded for seasonal irrigation use and where seasonal irrigation use is managed in accordance with Policies WQL4, WQL9 and WQL12;**<sup>12</sup>

or

- (ii) the property is supplied entirely from an irrigation scheme, and either the principal water supplier or the component irrigation scheme has a water permit for the use of that water; and

(b) a discretionary activity:

(i) for a property where:

(1) the intended land use is not included in Schedule WQN9, provided that it can be demonstrated it will meet Policy WQN17(1) and (2) above; or

(2) water is supplied entirely from private surface or groundwater takes that supply the property, and

a) there is a discharge of a contaminant onto or into land from an industrial or trade process (excluding animal effluent produced on the property); or

b) the seasonal irrigation use is not managed in accordance with Policies WQL4, WQL9 and WQ12,

provided that the water quality outcomes set in Objectives WQL1 and WQL2 will be achieved; or

(3) water is supplied either entirely from private surface or groundwater takes that do not meet Policy WQN17(3)(a)(i) above, or from both private surface or groundwater takes and an irrigation scheme; provided that where the seasonal irrigation demand standards in Schedule WQN9 for the intended land use are ~~not met~~ exceeded or where the seasonal irrigation use is not managed in accordance with Policies WQL4, WQL9 and WQL12, provided that exception shall only be made:

i) where it can be demonstrated that the on-site physical factors such as water holding capacity, climatic factors such as rainfall variability and potential evapotranspiration demand conditions are different to those used to estimate the seasonal irrigation demand in Schedule WQN9, mapped on the Proposed NRRP Map Volume Part 1 Planning Maps, due to micro-climatic or other variations. Any method used to demonstrate this must be verifiable, and where a modelled approach is used, there must be sufficient data available to calibrate for the specifics of the location; or

Change 1

ii) for a lower efficiency level, only in the case of activities that have been authorised prior to 1 January 2009 and where there is not already an annual volume specified on the resource consent. Where any additional volume is provided for above the relevant Schedule WQN9 standard or above that based on (a) above, then under this provision, the additional volume shall only be made available for a period up to 2020, and that all or part of the additional volume cannot be transferred to a new location at any time during this period. Where the actual use is determined to be less than the additional amount allocated, the excess volume will

Change 3

~~be reduced or a greater seasonal volume where mitigating circumstances are clearly demonstrated. These circumstances may include beneficial effects such as energy savings or prevention of wind erosion that would not be achieved otherwise, or recharge to groundwater, surface water or wetlands.~~

- (ii) for a principal water supplier or a component irrigation scheme for any group of properties, and the matters to be considered when assessing the reasonableness of use of water should include:
1. soil types and demand conditions across the area supplied and overall design efficiency of the scheme. Where the application efficiency is lower than 80% or a greater seasonal volume is sought than would be estimated using Schedule WQN9 across the area to be irrigated, mitigating circumstances must be clearly demonstrated. These circumstances may include beneficial effects such as energy savings or prevention of wind erosion that would not be achieved otherwise, or recharge to groundwater, surface water or wetlands. There should be a demonstrable long-term community benefit from the proposal consistent with Objective WQN4(1). Where a long-term community benefit cannot be demonstrated, a programme of staged improvement may be considered as mitigation;
  2. the effectiveness and efficiency of the method of conveyance and appropriateness of this; and
  3. the effects of the use of the water across the area supplied on water quality. Where the seasonal irrigation is not managed in accordance with Policies WQL4, WQL9 and WQL12, the water quality outcomes set in Objectives WQL1 and WQL2 will need to be achieved.
- (4) For existing users, ensure that the water allocation specified on the water permit reflects the actual quantity needed to undertake the land use activity intended use that was specified at the time of granting the water permit<sup>13</sup>. Review the conditions of water permits where necessary when an allocation regime becomes operative under Schedule WQN1 or Schedule WQN3 as per Policy WQN14(11) and Policy WQN16(3),<sup>14</sup> or where monitoring indicates that they have been allocated more than is needed and have actually used, taking into account variable factors such as climatic conditions.<sup>15</sup>
- (5) In addition to requiring the measuring and recording of water that is taken in accordance with Policy WQN16, encourage irrigators to monitor their water application rates, soil moisture, and production as a method for achieving more efficient use of irrigation water.
- (6) Develop guidelines in conjunction with water users, other agencies and the community for cost-effective improvements in water efficiency and conservation, and promote and encourage the use of<sup>16</sup> these across the region.
- (7) Encourage, and where appropriate, require ~~Promote~~<sup>17</sup> the use of water audits for agricultural, industrial, hydro electricity and community water supply activities to identify areas for improvements in water use efficiency.
- (X) Promote the capture and use of stormwater, and the re-use of water and greywater to improve water use efficiency.<sup>18</sup>
- (8) Encourage and, where appropriate, require the progressive upgrade and

pipings of stock water races where there is an environmental or economic benefit for so doing, but recognise that some stockwater races may provide important habitats for indigenous species and provide additional base flow to spring-fed streams and wetlands, and may justify strategic continuance or other management to protect these values<sup>19</sup>. (Refer to Policy WQN14(9)(f)).

- (9) Encourage, and where appropriate, require territorial local authorities, and other suppliers of stockwater, and community and group drinking water<sup>20</sup> to take all reasonable steps to progressively upgrade those reticulated supply systems where there is a significant amount of leakage.
- (10) Encourage, and where appropriate, require<sup>21</sup> owners and managers of irrigation schemes to minimise water losses through the beds of irrigation canals.

### Explanation and principal reasons

To meet the objective it will be necessary to improve the level of efficiency currently achieved by many activities that use water, and, in particular, irrigation use. The policy gives particular attention to improving the overall efficiency of water allocated and used for irrigation purposes because irrigation makes up over 80% of the total amount of water allocated in the region. Efficiency improvements achieved in this area would provide the greatest gains for the region in terms of making water available to more people, and getting the greatest benefits in terms of community, social and economic wellbeing.

Policy WQN17(1) seeks to ensure that only the amount of water needed for the efficient operation of each activity is taken. It is important that water that is taken is not wasted. Using water more efficiently means greater production from each unit of water used, allowing abstraction amounts to be reduced, redistribution of the surplus to occur, reliability of supply to improve or production to increase, or a combination of these benefits. Additionally, it can also lead to the avoidance or reduction of leaching and the degrading of groundwater quality and connected surface water, and the possible raising of the water tables. The use of water, particularly for irrigation, in combination with other land use practises such as the application of soluble fertilisers and cultivation, can contribute to an increase in leaching of nutrients into groundwater. Any degradation of water quality could affect existing domestic and community water supplies or other sensitive water uses and limit similar future uses. Where new community water supply uses are proposed, there will be a need for them to consider the effects of existing activities on the water quality. Chapter 4 Policies WQL4, WQL9 and WQL12 addresses the issues of preventing the leaching, run-off of nutrients and<sup>22</sup> community supply zones.

Policy WQN17(2) requires that any take for irrigation use meets a reasonable use test and that the effect of that use of water on water quality is managed in such a way as to met the requirements of Policies WQL4, WQL9 and WQL12. It<sup>23</sup> sets a target irrigation application efficiency level of 80% that is to be used when applying this test. The reasonable use test is a test of the technical efficiency of the water application and use. It requires an understanding of the use of the water, the water-holding capacity of the soils, the climate of the area, including the potential evapotranspiration, and the rainfall. Water allocation will be limited to what is reasonable as a peak rate of application, relative to the return period of the irrigation system and it will also be limited to what is a reasonable seasonal volume.

Irrigation application efficiency is to be calculated as the amount of applied water reaching that is stored in the crop root zone as a proportion of the total amount of water taken average depth of water applied to the crop.<sup>24</sup> By taking this approach, Environment Canterbury is not saying that less efficient systems cannot be used, rather that if they are used, the amount of water given may be insufficient to irrigate all the area. The remedy to this problem is to install an irrigation system that achieves the 80% application efficiency. In the case of any new activities established since 1 January 2009, the amount of water allocated for irrigation will only provide for an assumed irrigation application

of 80% or more, while for activities that may have existed prior to that date, exemptions to this criteria may be considered under some circumstances (see Policy WQN17(3)(b)(i)(3)(ii).

Consideration must also be given to the potential adverse effect of the use of water for irrigation on water quality. Policies WQL4 and WQL9 require that the use of water for irrigation does not result in the maximum concentration of contaminants exceeding the values set out for surface water and groundwater in Objectives WQL1 and WQL2. Policy WQL12 limits the use of water for irrigation within specified areas in order to protect the quality of community drinking water supplies.<sup>25</sup>

Policy WQN17(3)(a)(i) identifies that Schedule WQN9 has determined amounts that are reasonable assuming the irrigation system is 80% efficient and given the use that the water is to be put to, the soils and the climatic conditions of the locality. Activities that are within this standard and which meet the water quality provisions set out in Policies WQL4, WQL9 and WQL12 in Chapter 4 are provided for as a permitted activity in Rule WQN25. Schedule WQN9 only applies to the activity of using water for irrigation purposes, and does not apply to wastes that are discharged to land under an authorised discharge permit. Such discharges will be subject to the relevant policy provisions and rules set out in Chapter 4. Where there is both the discharge of contaminants to land from an industrial or trade process (excluding animal effluent produced on the property) and the use of water, both occurring as irrigation, then the use of the water will be considered as a discretionary activity.<sup>26</sup> In addition, Policy WQN17(3)(a)(ii) also identifies that when either a principal water supplier or a component irrigation scheme has a resource consent to use water across the scheme area, where that water is used on a property supplied entirely from the scheme, that use is also permitted.

Policy WQN17(3)(b) provides for ~~the situations not covered in Policy WQN17(3)a and specifies that these will be discretionary activities subject to meeting a number of provisions, where a greater amount of water is sought than is provided for in Schedule WQN9.~~

Policy WQN17(3)(b)(i) identifies situations where water which is used on a property for irrigation is a discretionary activity. This includes when it is for a land use not include in Schedule WQN9 for example. Also, where there will be the use of water for irrigation together with a discharge of a contaminant onto or into land from an industrial or trade process onto the same land area, or where seasonal irrigation use will not be managed in a way that will meet Policies WQL4, WQL9 and WQL12. Finally, where there is either only private sources of water being used, or both private and from an irrigation scheme, and the seasonal irrigation demand standards in Schedule WQN9 for the intended end land use are exceeded.

Both Policy WQN17(3)(b)(i)(3) specifically sets out the circumstances when exceeding the seasonal irrigation demand standards in Schedule WQN9 for the intended land use on a property will be accepted. Firstly, where it can be demonstrated that demand conditions such as evapotranspiration, soil type or effective summer rainfall, for example, are sufficiently different to those used to determine the relevant seasonal irrigation demand standard in Schedule WQN9, a greater amount of water may be considered reasonable. Secondly, in the case of activities that have been authorised prior to 1 January 2009, when the application efficiency is lower than the 80% assumed in estimating the seasonal irrigation demand standards, an additional bridging volume may be considered reasonable where the existing irrigation system cannot be operated to achieve that level of application efficiency because of inherent irrigation system design limitations, This will be considered on a case by case basis, however, any additional volume will only be available for a limited period of time to allow such irrigators time to adjust their systems to the Schedule WQN9 volume, and that none of the additional bridging volume will be able to be transferred to another location as this will be considered a new activity that will be required to meet an irrigation application efficiency of 80%. Where water use monitoring indicates an excessive amount of water has been allocated and is not being used, taking into account the demand conditions during the monitoring period, then the excess volume will be reduced to what is determined to be reasonable. ~~and/or where a greater seasonal volume is sought and there are mitigating circumstances such as the beneficial effects of energy savings, prevention of wind erosion that would not otherwise be achieved, or recharge to groundwater, surface water or wetlands, then a greater amount of water may also be considered reasonable.~~

Policy WQN17(3)(b)(ii) identifies the use of water on any group of properties that are supplied by either a principal water supplier or a component irrigation scheme to be a discretionary activity also.

Change  
3

~~The p~~Policy WQN17(3)(b)(ii)(1) provides for considerations such as energy efficiency of the method and other beneficial consequences of the less efficient option. The policy asks that the benefits to the community of any alternative method that does not meet the standard determined from Schedule WQN9 be demonstrated, and it refers back to Objective WQN4. This aims to ensure that water is being used to maximise the communities wellbeing. If water is being taken and used in a relatively inefficient manner by one or more party, this may deprive others of access to the resource. This may be more so in the future with the setting of allocation limits. The justification for allowing this lesser efficiency should be that the community is better off for this approach over the long-term. The "community" will need to be determined in each situation, but it will generally be those who have an interest in the same water resource or who are affected (beneficially or adversely) by the use of the water that is taken from this resource. Where it cannot be demonstrated that the amount of water sought, or being used, is in the long-term community benefit then a lesser amount that can be justified, will be allocated.

Where this is an existing activity, provision may be made for the transition where this requires changes to systems and schemes. If Environment Canterbury does not take this approach then it will be difficult to achieve full benefit of the region's available water resources. There is also a risk that other resources will be targeted, additional adverse environmental effects will be caused, and investment will be made in more expensive methods of water capture and distribution, when this same amount water may be available through improvements in water use efficiency.

While the emphasis here is on irrigation use efficiency including irrigation application efficiency, Policy WQN17(3)(b)(ii)(2) requires a demonstration of a reasonable level of efficiency in conveyance of water to the component irrigation schemes and/or farms. Where water is conveyed via an open channel, Policy WQN17(10) is relevant.

In addition, Policy WQN17(3)(b)(ii)(3) requires that where the seasonal irrigation use will be not managed in accordance with Policies WQL4, WQL9 and WQ12, it should be demonstrated that the activity will still achieve the water quality outcomes set in Objectives WQL1 and WQL2.

To give full effect to Policy WQN17(3), whether water is to be used for irrigation of an individual property, or for a new or existing principal water supplier or component irrigation scheme for a group of properties, account must be taken of all sources of water being used to irrigate the land area. This must include any other sources of water being used as either a previously permitted activity or for which a resource consent is already held. Where a principal water supplier, or component irrigation scheme has a resource consent to use water, as long as there are no other sources of water being used on the same property, it is a permitted activity to use the scheme water for irrigation.

However, where an additional source of water (for example groundwater) is also to be used for irrigation on the same property, the use of the scheme water for irrigation that had up till now been a permitted activity, will no longer be so and a resource consent will be needed to use both the scheme water and the groundwater on the same property.

It is not intended that the resource consent held by a principal water supplier or component irrigation scheme would need to be varied via a change of conditions in such circumstances, only that the individual wishing to operate with two sources of water obtain a resource consent. In this way, any potential adverse effects can be addressed at the property level. Notwithstanding this, when a new resource consent is required for the use of water for irrigation for an existing irrigation scheme, any assessment of environmental effects will need to take account of any other existing resource consents for irrigation of any of the same land area. This will also help ensure fair and equitable access to the available resource by only allocating water that can be reasonably used.

Policy WQN17(4) reviews consents with excess "paper allocation" to free up water within an allocation block. Many existing consents currently do not have annual volumes as part of their consent conditions. Such consents will need to be reviewed to ensure the annual volume is clearly and unambiguously stated on the consent, and that the volume is based on the actual quantity needed for the intended use for which the consent was granted. Policies WQN14(11) and WQN16(3) set out when such reviews should be instigated, and include the need for the measuring and recording of water use.<sup>27</sup> Where the actual use is significantly different to that which was applied for in the consent application and supporting documents and for which the consent was granted, then it may be appropriate to review the consent to include an annual volume that more closely represents that actual

use.<sup>28</sup> It also means that restrictions are more effective and equitable during water shortages. Monitoring of takes will help verify actual use, and when this is taken into consideration with other variable factors such as climatic conditions, this will ~~and~~<sup>29</sup> provide opportunity to better allocate the resource. Where consents for the taking and using of water for stockwater, or community or group drinking water supplies are being reviewed, consideration also needs to be given to Policy WQN14(9)(e) to ensure provision is made to reserve water for future stockwater, and community and group drinking water supplies in an allocation block.<sup>30</sup>

Policy WQN17(5) and (6) recognise that information on how to monitor takes and make efficiency improvements needs to be developed and disseminated. This can help provide individuals with the tools and the knowledge to improve their water-use efficiency.

Policy WQN17(7) ~~promotes~~ recognises the use of water audits to determine ways of increasing water-use efficiency. Having identified efficiency improvements, it is important that users are encouraged, and at times, required to implement them in order to achieve a high level of efficiency of use of water. Environment Canterbury sees merit in promoting and facilitating these initiatives, and when necessary, requiring the use of such a tool via resource consent conditions.<sup>31</sup>

Policy WQN17(X) promotes the capture and use of stormwater, and the re-use of water and greywater (as defined in Rule WQL10). This has the potential to increase the efficiency of water use by reducing the demand for water if what is taken and used is re-used, or in the case of stormwater, if it is captured and used. This will help meet Objective WQN5, and will help meet the requirements of the Local Government Act to give consideration to the re-use of greywater during the process of carrying out water and sanitary services assessments for communities.<sup>32</sup>

Policy WQN17(8), (9) and (10) recognise that significant water savings could be made by moving from inefficient open race systems to piped water supply schemes, or by reducing leakage from community and group drinking water, and stock water supply systems, and from the beds of irrigation canals.<sup>33</sup>

In the Ashburton River/Hakatere catchment, over five cumecs of water is taken for stockwater when about 0.25 cumecs is required for actual stock drinking purposes. Evidence<sup>34</sup> presented to the Rangitata River Water Conservation Order hearings indicated that one cumec of water provides an increased farm gate income of \$4 million (in 2000/2001 dollars). This suggests that if four cumecs of water, taken but not used for stock drinking, was freed up for other irrigation use this would amount to additional farm gate earning of \$16 million per year. Losses can be exacerbated where water conveyance systems are poorly constructed and maintained. However, upgrading is expensive and may need to be done progressively. The adequacy of a system will be reviewed once a flow and allocation regime is included in Schedule WQN1. Necessary improvements will be required on a strategic basis at any water permit review or replacement stage but improvements will be encouraged throughout the duration of a water permit.

Some sections of stockwater races have important conservation values that may justify protection or offsetting habitat creation where a race is closed. For example, there are areas where Canterbury mudfish are established. There are other situations where the leakage from the stockwater races provides groundwater augmentation to the base flow of spring-fed streams and wetlands such as in the area of the Paparua Main Drain which discharges into the Heathcote River. When upgrading occurs it may be appropriate to supply these open race areas with water in order to protect these values, or alternately, create suitable sites for them elsewhere. It may also be possible to consider using alternative localised water sources such as groundwater from a bore to provide for strategic augmentation of stream flows or wetlands to ensure environmental values are protected.<sup>35</sup>

## Methods

The methods used or to be used to implement Policy WQN17 are:

### **"Method WQN17(X) Investigations**

**Environment Canterbury will:**

- (a)** ~~Environment Canterbury will~~ undertake investigations, and work with grower associations, Federated Farmers, and other agencies, to develop irrigation demand standards for land use activities that are not yet included in Schedule WQN9, with the intention of introducing any new standards into Schedule WQN9 by way of a plan change.<sup>36</sup>

- (b) undertake investigations, including the use of analyses of water use data carried out in Methods WQN16(a)(b) and WQN16(d) and more comprehensive monitoring of water budget components (including measurement of drainage). This will be used to review the seasonal irrigation demand standards in Schedule WQN9 and the effects of applying these via the allocation regimes for groundwater zones and resource consent conditions, and where relevant, surface water allocation regimes. These investigations should also take into account the effects of any restrictions arising from water management regimes, and test options of carrying unused annual allocation forward into subsequent seasons.

### **Method WQN17(a) Advocacy**

Environment Canterbury will:

- (a) advocate to district councils and private water supply scheme operators to progressively upgrade stockwater or irrigation schemes under their management, and for district councils, in Environment Canterbury's Community Plans, to provide for this for their own supply schemes; and
- (b) advocate to water permit holders in high water demand areas that they form water users groups to encourage water sharing and to foster measures to increase the efficiency of water allocation and use during times of restriction; and
- (c) advocate the use of monitor farms to apply and demonstrate best irrigation practises and so encourage efficiency improvements across the broad irrigation community, taking advantage also of water use metering and recording; and
- (d) advocate to irrigation scheme companies for the development of:
  - (i) protocols to be followed when processing both the sale of irrigation company shares and/or a resource consent application for the use of water on a property supplied from both private surface or groundwater takes and an irrigation scheme to help ensure water allocated for use for irrigation is fairly and equitably shared, and
  - (ii) self-monitoring regimes to demonstrate water use efficiency in terms of both conveyance and on-farm use, to demonstrate compliance with consent conditions and possible improvements over time.

### **Method WQN17(b) Information and promotion**

Environment Canterbury will produce information brochures and, as appropriate, work with territorial authorities, landcare groups, Federated Farmers, growers associations,<sup>37</sup> industry, and other agencies to inform them of:

- (a) the conditions and standards and terms that apply to the use of water;
- (b) the availability of water within the allocation blocks;
- (c) methods for monitoring water use, monitoring soil water-holding capacity, and optimising water use;
- (d) methods for improving the efficiency of water use, including the capture and use of stormwater, and re-use of water and greywater,<sup>38</sup>
- (e) measures for transferring permits;
- (f) methods to minimise household use of water;
- (g) field days and workshops which are being run with industrial and commercial water users to demonstrate and promote measures to improve the efficient use of water;
- (h) good examples of water efficiency recognised through Resource Management awards; and
- (i) the value of Resource Care and rural community groups to disseminate information on best irrigation management practices.

### **Method WQN17(c) Economic instruments**

Environment Canterbury will encourage district councils and water supply agencies to develop a charging system for water that promotes efficient use of water supplied within community supply schemes.

### **Method WQN17(d) Water audits**

Environment Canterbury, in conjunction with relevant industry groups,<sup>39</sup> will:

- (a) Identify areas of water use where auditing guidelines do not exist, and develop appropriate guidelines; and
- (b) promote audits of industrial, irrigation and community domestic and stock water schemes to assist in monitoring of compliance and to identify water losses, leakage, wastage and opportunities for increasing the efficient use of water.

### **Method WQN17(e) Regional rules**

Environment Canterbury will apply regional rules WQN1–WQN3, WQN5-WQN11, WQN13-WQN16, WQN19-WQN23 and WQN25-WQN32 to better achieve the efficient use of water, and/or discourage inefficient use of water and its consequent effects. Water take rules are included here because this is an important opportunity to determine and allocate efficient amounts of water. Refer also to water quality Rule WQL3.

### **Method WQN17(f) Resource consents**

Environment Canterbury, when processing applications for water permits, will consider the efficiency of water use of the proposed activity, and of the measures intended for maintaining efficient use of the water.

### **Method WQN17(g) Review of permits**

- (a) Environment Canterbury will review consent conditions of water permits in accordance with s. 128, when flow and allocation regimes set under Schedules WQN1 or WQN3 become operative, or at such later time as specified in the Schedule, to ensure the permit holders are achieving efficient use of water.
- (b) Environment Canterbury may also review consent conditions in accordance with s. 128,<sup>40</sup> where:
  - (i) an interim groundwater allocation block has been determined in accordance with Schedule WQN4, in order to assign annual volumes based on water use efficiency; and
  - (ii) monitoring has shown that there is a large discrepancy between the allocated amounts and the actual amounts taken.

Where Environment Canterbury has determined to review water permits as above, notice will be served on holders of water permits affected.

### **Method WQN17(h) Compliance and enforcement**

Environment Canterbury will:

- (a) monitor and enforce compliance with conditions of permitted activities and of any resource consent it has granted affecting water quantity. To achieve compliance, Environment Canterbury may apply for enforcement orders, issue abatement or infringement notices, or use any other enforcement mechanisms available to it in Part 12 of the RMA, to enforce the rules of Chapter 5, or a breach of resource consent conditions; and
- (b) maintain a database recording details of any complaints received about activities adversely affecting water quantity, reporting regularly on the response to complaints, including the results of any investigations and/or enforcement action.

### **Method WQN17(i) Response to complaints and enquiries.**

Environment Canterbury will:

- (a) provide a 24-hour hotline to respond to any complaints about water use that is contrary to the rules or water permits;

- (b) maintain a database to record the details of any complaints received about water use;
- (c) undertake enforcement of the provisions of the Proposed NRRP where necessary.

#### **Method WQN17(i) Territorial Authorities and other stock water supply scheme operators**

Territorial local authorities and other groups who manage community stockwater supply schemes that involve open races, ~~should~~ will need to<sup>41</sup> progressively upgrade these to reduce the inefficiencies associated with these schemes. At the time of resource consent applications for replacement of expiring water permits, applicants should provide a strategic plan that demonstrates how these upgrades are to be staged.

#### **New definitions of terms**

**“Principal water supplier** is a publicly or privately owned supplier that is the sole abstractor of water which is subsequently conveyed and distributed to component irrigation, community and/or stockwater schemes, hydro-electricity generators and/or other users of the water.”

**“Component irrigation scheme** is either a stand-alone irrigation scheme that abstracts, conveys and distributes water to a group of properties for the purpose of using water for irrigation, or is one of a number of irrigation schemes that are being supplied water by a principal water supplier.