



# Bowden Environmental

CRC213756 (Duncan's Road Block) &  
CRC214272 (Rakaia Highway Block –  
s92 Response

January 2023

## 1. Please Provide justification for the volume of water sought.

### Issue:

Canterbury Regional Council has requested that the reasonable use test under Method 1 of schedule 10 be assessed and considered in combination with Policy 4.50.

Policy 4.50 specifies that renewals must reduce to 90% and demonstrate that either there are significant and enduring improvements in the efficiency of water use OR it is demonstrated that the existing use of water is efficient, and that the efficiency is enduring.

### Response:

Following discussions with Mr M Smith in relation to the demand modelling provided in the s92 response, it was outlined that further refinement of the modelling was required as the rainfall factor adjustments were beyond the model thresholds. The modelling provided in this s92 response also provides a more accurate reflection of the farm system and demand for cropping situations. This has been undertaken by adjusting the crop coefficient ( $K_c$ ).

Crop coefficients ( $K_c$ ) are a ratio of crop evapotranspiration to reference evapotranspiration values, and related to a specified crop growth development stage, with varying requirements across these (Figure 1). Determination of  $K_c$  is important for estimating crop irrigation requirements using meteorological data from weather stations. Therefore, adjustments to the  $K_c$  will impact on the irrigation demand requirement modelled.

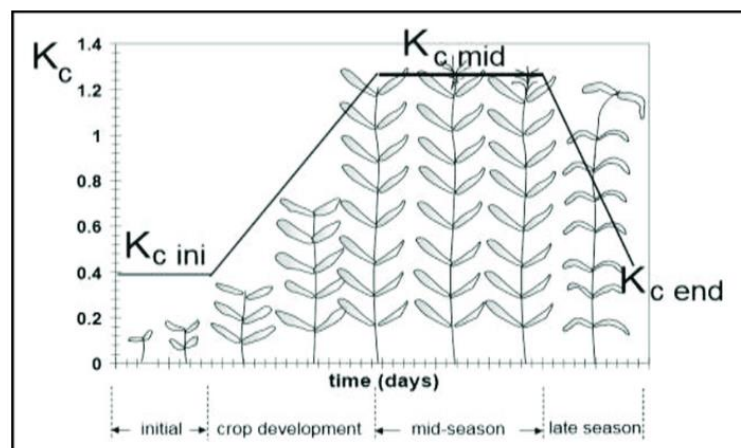


Figure 1: The variation in  $K_c$  for crops as influenced by weather factors and crop development (FAQ-56 Allen et al. 1998)

### **CRC213756 - Duncan Road Block:**

The assumptions to the daily demand model include:

- Amending the daily application rate to 5mm/ha (provided by L36/2318)
- PAW60 of 100mm (majority of irrigation area)
- Adjusting the (Kc) crop factor across the months to match the stages of development for cereal crops, limiting peak Kc to 1.0
- Adjusting the rain correction factor to 1.1

Water use demand curve modelling based on historic climate data has been developed for some areas by the Canterbury Regional Council. The closest area which has been modelled is Chertsey Cws station located approximately 5.8km from the subject property. Using this climate data and based on the demand requirements for a PAW60 of 100mm (P120077100) and based on the assumptions outlined above. Note that this will not fit with the IriCalc profile requirements as the IriCalc requirements are based on pasture rather than cropping. The water usage records which are held over the period from 2013-2015 the instantaneous flow rate is recorded as being more than 100L/s; the bore and infrastructure installed is not capable of abstracting these rates. This record has led to the statement from the regional council that irrigation has not been efficient, as the use exceeds the demand for those seasons. However, when removing the exceedances recorded for the overuse then the use of water can be considered efficient i.e., the water used does not exceed the seasonal demand calculated for the given irrigation season (Table one). Removing these false overuse records then –

- 2013-2014 irrigation period the reduced water usage is 245,186m<sup>3</sup> between September and 30<sup>th</sup> April, inclusive.
- 2014-2015 irrigation period the reduced water usage is 192,298m<sup>3</sup> between September and 30<sup>th</sup> April, inclusive.
- The 2019/2020 irrigation season has demand of 415mm and a percentile rank of 84. However, the meter was not recording prior to 18<sup>th</sup> December. Adjustment to the seasonal demand for the 2019/2020 season has been made by looking at the demand from the 18<sup>th</sup> of December onwards (the demand for this period is 315mm)

**Table One:** Water demand and use for the property, using the projection sheet of the attached excel document for Duncan's Road Block

Irrigation Season	Seasonal demand mm/ha/yr <sup>-1</sup>	Percentile rank	Water Used (m <sup>3</sup> /yr <sup>-1</sup> )	Adjusted for 90% reliability (modelled)
2019/2020	315***	84	85,885*	120,375
2018/2019	325	46	*	
2017/2018	410	78	*	
2016/2017	340	55	118,890	174,966
2015/2016	355	67	120,065	160,632
2014/2015	465	85	208,260**	218,921
2013/2014	340	58	245,186**	343,650
2012/2013	390	78	173,756	196,701

\*Meter malfunctions, in the 2019/2020 season the recordings started on the 18 December.

\*\* Meter malfunction, excessive L/s recorded above what pump and bore are physically capable of abstracting

\*\*\* demand based on period 18 December 2019 to 30 April 2021

Having regard to policy 4.50, a review of the past water use records has determined that under the current climate and adjusting the modelling to reflect the Kc of the current system, then a maximum of 83% of the current consented annual volume for the 78ha irrigation area. A summary of the NIWA climate change projections for the Canterbury Region are –

- Increase in annual mean temperature up to 0.5°C to 1.5°C by 2040
- Most of the region can expect small changes in annual rainfall within 5%
- Expect more potential for drought across most of Canterbury
- Expect 20 to 60 more hot days in most of Canterbury by 2090, with most of the hot days occurring in summer.
- Our warmer season could get longer with 5 to 10 more hot days in autumn and spring

Based on the research to date the Ministry for the Environment concludes that within the Canterbury Region

“Higher temperatures, less rainfall and greater evapotranspiration are likely to cause increasing pressure on water resources, particularly in North Canterbury” and for the agriculture sector the “warmer temperatures may provide for a longer growing season”.

The applicant is proposing to reduce the annual volume  $413,392\text{m}^3/\text{yr}^{-1}$  to  $343,650\text{m}^3/\text{yr}^{-1}$  i.e. 17% reduction in line with Policy 4.50. For the combined between consents CRC213756 and CRC030538.3 the maximum volume is proposed to be reduced to  $485,330\text{m}^3/\text{yr}$  i.e., the maximum irrigation demand for a pastoral system. Further reduction is not proposed for the following reasons –

- These limited waters use records are reflective of the unique combination of climate and farm system for each individual season, whereas and the demand modelling has been developed around a pastoral system; and
- The figures reported in Table 13(f) of the LWRP for the Chertsey and Ashburton-Lyndhurst have not accounted for the findings of technical report R09/55; and
- The original consent CRC091638 was granted via the Chertsey hearing, where a panel of independent hearing commissioners determined that on the basis of evidence presented that further groundwater could be allocated over and above the limit at the time (note this is the same limit which is reported in Table13(f) of the LWRP); and
- The applicant is proposing to retain mitigation measures imposed by the independent hearing commissioners to address the potential cumulative effects of the full consented volume of  $413,392\text{ m}^3/\text{yr}$  even though the annual volume is proposed to reduce.

#### **CRC214272 - Rakaia Highway Block:**

The assumptions to the daily demand model include:

- Amending the daily application rate to 5mm/ha (provided by L36/2318)
- PAW60 of 100mm (majority of irrigation area)
- Adjusting the (Kc) crop factor across the months to match the stages of development for cereal crops
- Adjusting the rain correction factor to 1.1

Water use demand curve modelling based on historic climate data has been developed for some areas by the Canterbury Regional Council. The closest area which has been modelled is Chertsey Cws station located approximately 3.7km from the subject property. Using this climate data and based on the demand requirements for a PAW60 of 100mm (P120077100) and based on the assumptions outlined above; the maximum projected volume of water required was 514,824m<sup>3</sup>/yr<sup>-1</sup> or 84% of the existing consented annual volume for the irrigation area of 175ha (Table 2).

**Table Two:** Water demand and use for the property, using the projection sheet

Irrigation Season	Seasonal demand mm/ha/yr <sup>-1</sup>	Percentile rank	Water Used (m <sup>3</sup> /yr <sup>-1</sup> )	Adjusted for 90% reliability (modelled)
2022/2023	-	-	232,583 **	
2021/2022	305	56	225,479	326,930
2020/2021	465	90	-	
2019/2020	415	84	83,882*	89,238
2018/2019	275	46	-	
2017/2018	390	78	111,743*	126,499
2016/2017	300	55	349,824	514,824
2015/2016	330	67	-	
2014/2015	420	85	337,545	354,824
2013/2014	315	58	251,123	351,971
2012/2013	390	78	-	
2011/2012	160	12	64,995*	179,346
2010/2011	305	56	-	
2009/2010	390	78	101,620*	115,039

\*Data Gaps, years with significant data gaps are not included and represented with (-),

\*\* Part season data as 22/23 irrigation season is yet to conclude.

Having regard to policy 4.50, a review of the past water use records has determined that under the current climate that a maximum of 84% of the current consented annual volume for the 175ha irrigation area currently consented under CRC214272. A summary of the NIWA climate change projections for the Canterbury Region are –

- Increase in annual mean temperature up to 0.5°C to 1.5°C by 2040
- Most of the region can expect small changes in annual rainfall within 5%
- Expect more potential for drought across most of Canterbury
- Expect 20 to 60 more hot days in most of Canterbury by 2090, with most of the hot days occurring in summer.
- Our warmer season could get longer with 5 to 10 more hot days in autumn and spring

Based on the research to date the Ministry for the Environment concludes that within the Canterbury Region

“Higher temperatures, less rainfall and greater evapotranspiration are likely to cause increasing pressure on water resources, particularly in North Canterbury” and for the agriculture sector the “warmer temperatures may provide for a longer growing season”.

The applicant is proposing to reduce the annual volume  $610,750\text{m}^3/\text{yr}^{-1}$  to  $514,824\text{m}^3/\text{yr}^{-1}$  i.e., 16% reduction in line with Policy 4.50 and considering the limited water use records. Further reduction is not proposed for the following reasons –

- Water use records, unfortunately include data gaps; and
- These water use records are reflective of the unique combination of climate and farm system for each individual season, whereas the demand modelling has been developed around a pastoral system; and
- The irrigation under each individual season represents a unique combination of climate and farm system, which is not as easily replicated as a pastoral based system. Additionally, each irrigation season use may not reflect irrigation of the full potential area;
- The figures reported in Table 13(f) of the LWRP for the Chertsey and Ashburton-Lyndhurst have not accounted for the findings of technical report R09/55; and
- The original consent CRC054208 was granted via the Chertsey hearing, where a panel of independent hearing commissioners determined that based on evidence presented that further groundwater could be allocated over and above the limit at the time (note this is the same limit which is reported in Table 13(f) of the LWRP); and
- The applicant is proposing to retain mitigation measures imposed by the independent hearing commissioners to address the potential cumulative effects of the full consented volume of  $610,750\text{ m}^3/\text{yr}$  even though the annual volume is proposed to reduce.