

## Summary

April was very dry in most areas in Canterbury, with a number of rain gauges recording less than 25% of their April long term means. Rainfall gauges at Arthurs Pass and Mt Cook recorded approximately 60 % of their annual means.

Canterbury foothill rivers and spring fed streams have remained low, with most flowing well below the long term averages for the month of April. Two sites had record low flows for April: the Selwyn River at Coes Ford (near Lincoln) and Omarama Stream (in the Waitaki District). The Selwyn was flowing at only 6 % of the long-term mean for April. Being spring-fed, this river is completely reliant on groundwater levels which are also very low in this area. The Waipara in North Canterbury and the Waihao in South Canterbury have April mean flows of only 12-14% of their long-term figures.

The Alpine Rivers have also recorded relatively low April flows. The Waiau, Hurunui, Waimakariri and Ahuriri rivers all recorded April mean flow less than 60% of the long-term means, while the Rakaia and Rangitata had slightly higher flows (68% of the long term April mean), although these were a sharp decrease from flows in March. The South Ashburton flow recorded was only 44% of the long term mean, which was the lowest April flow on record.

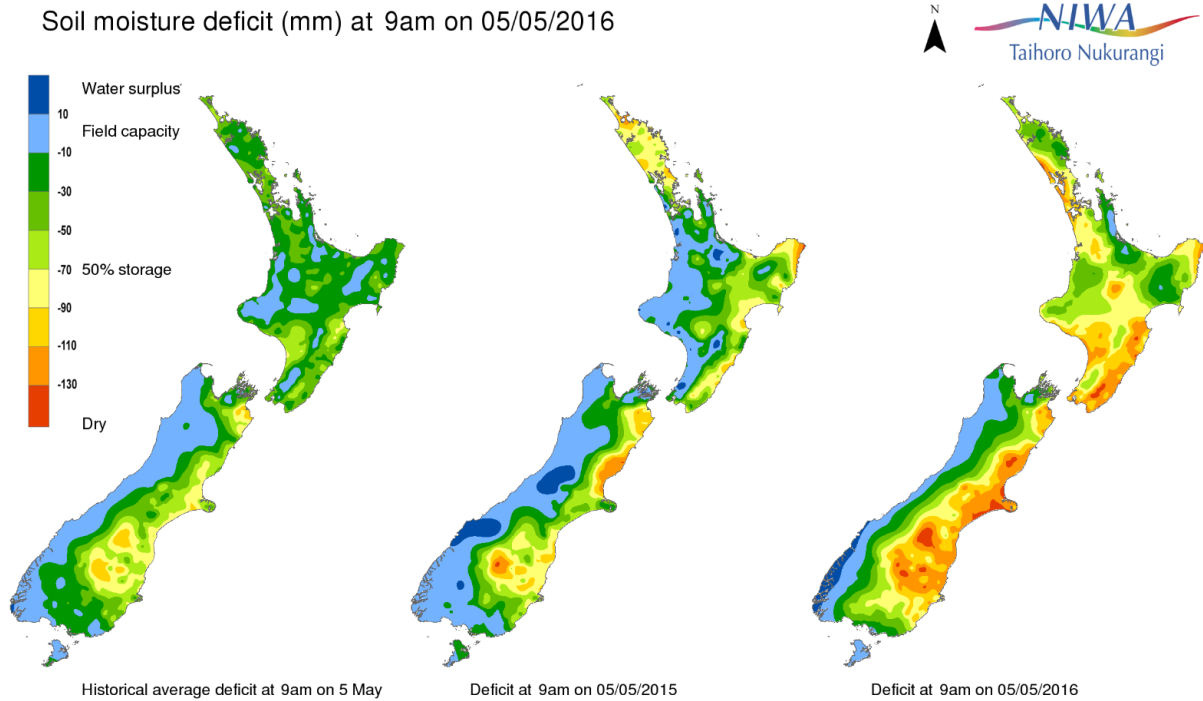
Groundwater levels in the Canterbury region for April 2016 were generally lower than the mean when compared to April records for previous years. Approximately 79% of the wells we monitor for groundwater levels across all of Canterbury had April 2016 readings below the April mean. In general, the spatial distribution of low groundwater levels remains the same as in previous months (September 2015 to March 2016).

The majority of wells with 'very low' water levels were located in the coastal Selwyn-Waihora area (near Lincoln & Leeston), the Ashburton plains and the West Melton area (immediately west of Christchurch). Some of these wells are showing record low levels.

## April 2016

### Soil moisture

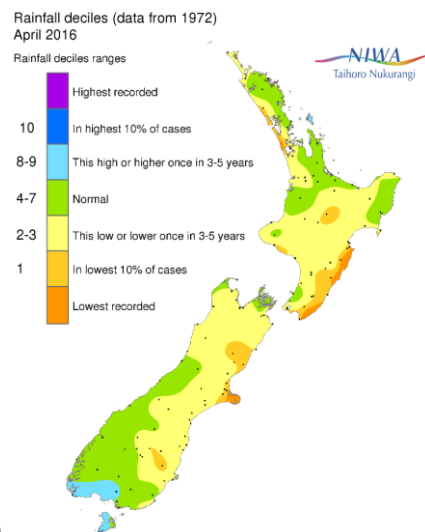
NIWA plots of soil moisture deficit (Figure 1) show that there are small patches of Canterbury soils that are much drier than normal. Inland South Canterbury, the plains around Te Waihora / Lake Ellesmere and the Cheviot area have very low soil moisture.



**Figure 1:** Soil Moisture Deficit 5/5/2016 compared with same date 2015 and historically (from niwa.co.nz)

### Rainfall

Recent NIWA reports show that rainfall deciles in the Canterbury Region for the month of April were fairly low for the majority of the region, while Banks Peninsula appears to have had a very dry month (see Figure 2).



**Figure 2:** Rainfall decile ranges for April 2016 (from niwa.co.nz)

Table 1 shows representative rain gauges across Canterbury with February to April rainfall totals as well as a percentage of the long-term Feb-April totals. Stanton and Lowry Hills rain gauges in the Cheviot area, Ridgens on the Central Plains, and Hadlow, just inland from Timaru, all have rainfall total which are less than 45% of the long-term means for the same months.

Table 1: Representative rain gauges and February - April rainfall- see Appendix 1 for locations

Site	Feb- Apr rainfall (mm)	% LT Feb - Apr
Luke Creek (1969-2016)	305	66%
Stanton (1973-2016) (NIWA)	64	<b>32%</b>
Lowry Hills (1967-2016)	84	<b>43%</b>
White Gorge (1989-2016)	81	58%
Cust Main Drain (1998-2016)	63	48%
Arthurs Pass (1955-2016)*	745	85%
13 Mile Bush (1963-2016)	151	53%
Ridgens Road (1990-2016)	58	<b>39%</b>
Blandswood (1993-2016)	245	71%
Mt Cook (1989-2016)*	730	80%
Geraldine (1985-2016)	142	59%
Kimbell (1988-2016)	127	60%
Rocky Gully (1963 -2016)	147	61%
Hadlow (1988 -2016)	69	<b>32%</b>
Bluecliffs (1989-2016)	90	51%
Morven (1988 -2016)	69	50%
Sunny Peaks (1990-2016)	123	73%
Dunstan Peaks (2008-2016)	82	81%

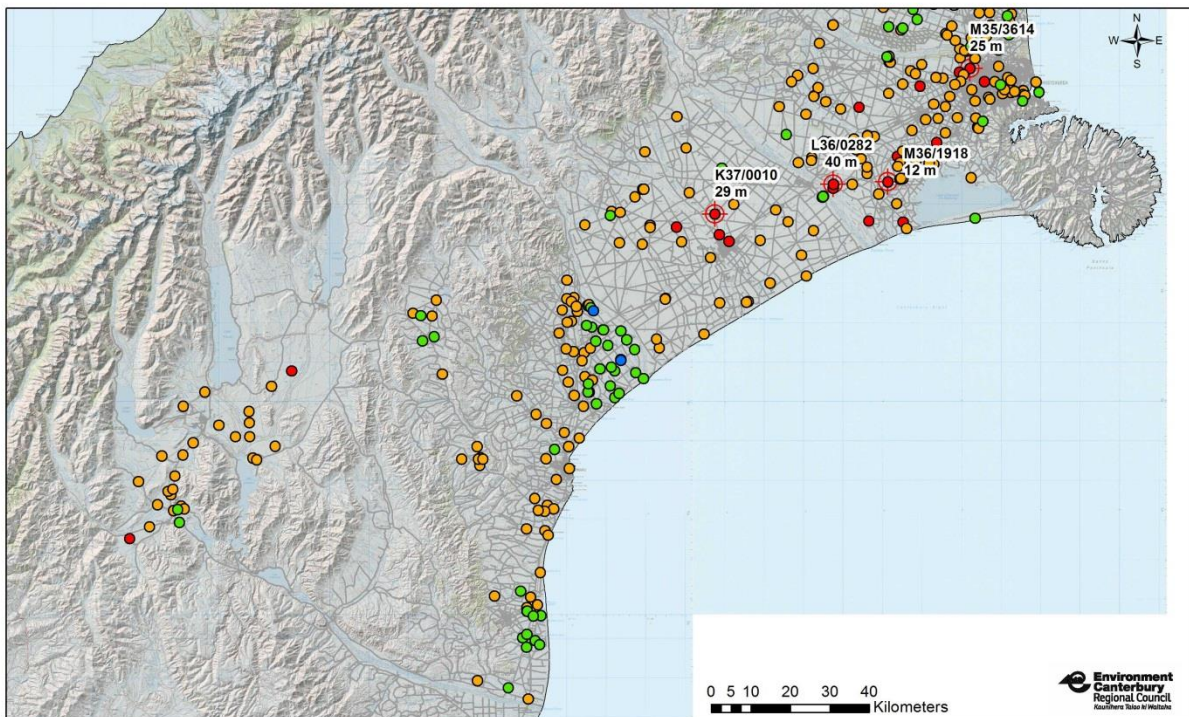
\*Alpine

## Groundwater levels

Groundwater levels in the Canterbury region for April 2016 were generally lower than the mean when compared to April records of previous years (see Figure 3 and 4). 79% of the wells we monitor for groundwater levels had readings below the mean value for April. Approximately 72% were 'low' (between 0 to 1 standard deviations below the mean) and 7% were 'very low' (greater than 1 standard deviation below the mean). As an illustration, plots of the previous 12 months of groundwater levels relative to each month's mean for selected wells with 'very low' water levels within the Canterbury Region are provided in Figure 5.

The 'low' and 'very low' April 2016 groundwater levels, shown by orange and red dots on Figures 3 and 4, were observed in wells of all depths across the region. In general, the spatial distribution of these low groundwater levels remains the same as in previous months (September 2015 to March 2016). The number of wells with 'low' water levels (orange dots) and 'very low' water levels (red dots) in April 2016 was very similar to March 2016. The majority of wells with 'very low' water levels were located in the coastal Selwyn-Waihora area (in particular the spring-fed tributaries of Te Waihora / Lake Ellesmere), the Ashburton plains and the West Melton area.

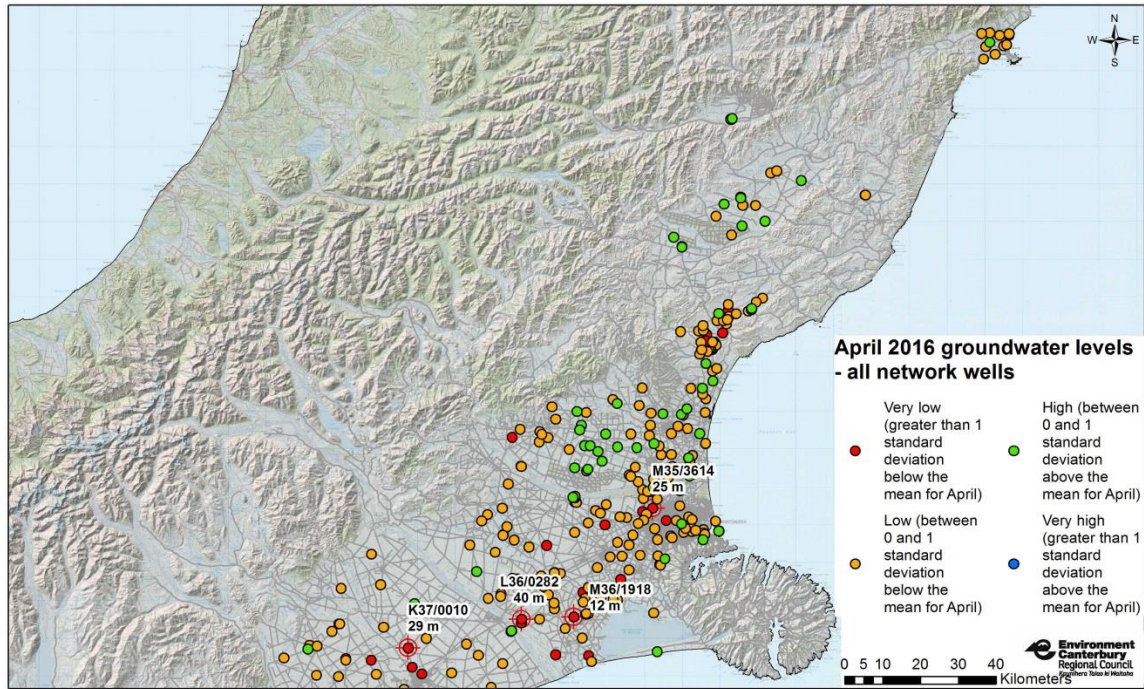
Figure 5 illustrates the groundwater levels in four wells (L36/0282, K37/0215, M36/1918 and M35/3614) where the levels were 'very low' in April 2016. The locations of these wells are labelled on Figures 3 and 4.



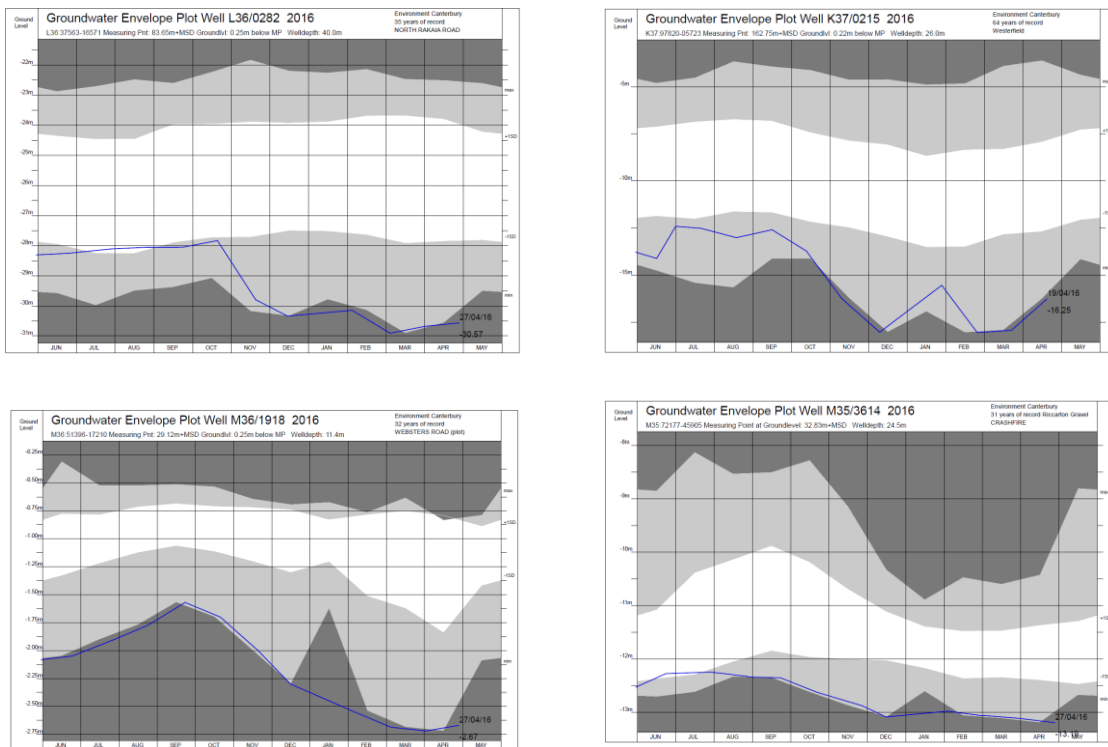
**April 2016 groundwater levels - all network wells**

- Very low (greater than 1 standard deviation below the mean for April)
- Low (between 0 and 1 standard deviation below the mean for April)
- High (between 0 and 1 standard deviation above the mean for April)
- Very high (greater than 1 standard deviation above the mean for April)

**Figure 3:** April 2016 groundwater levels - South Canterbury. Wells selected for envelope plots (Figure 5) are identified by well number and depth.



**Figure 4:** April 2016 groundwater levels - North Canterbury. Wells selected for envelope plots (Figure 5) are identified by well number and depth.

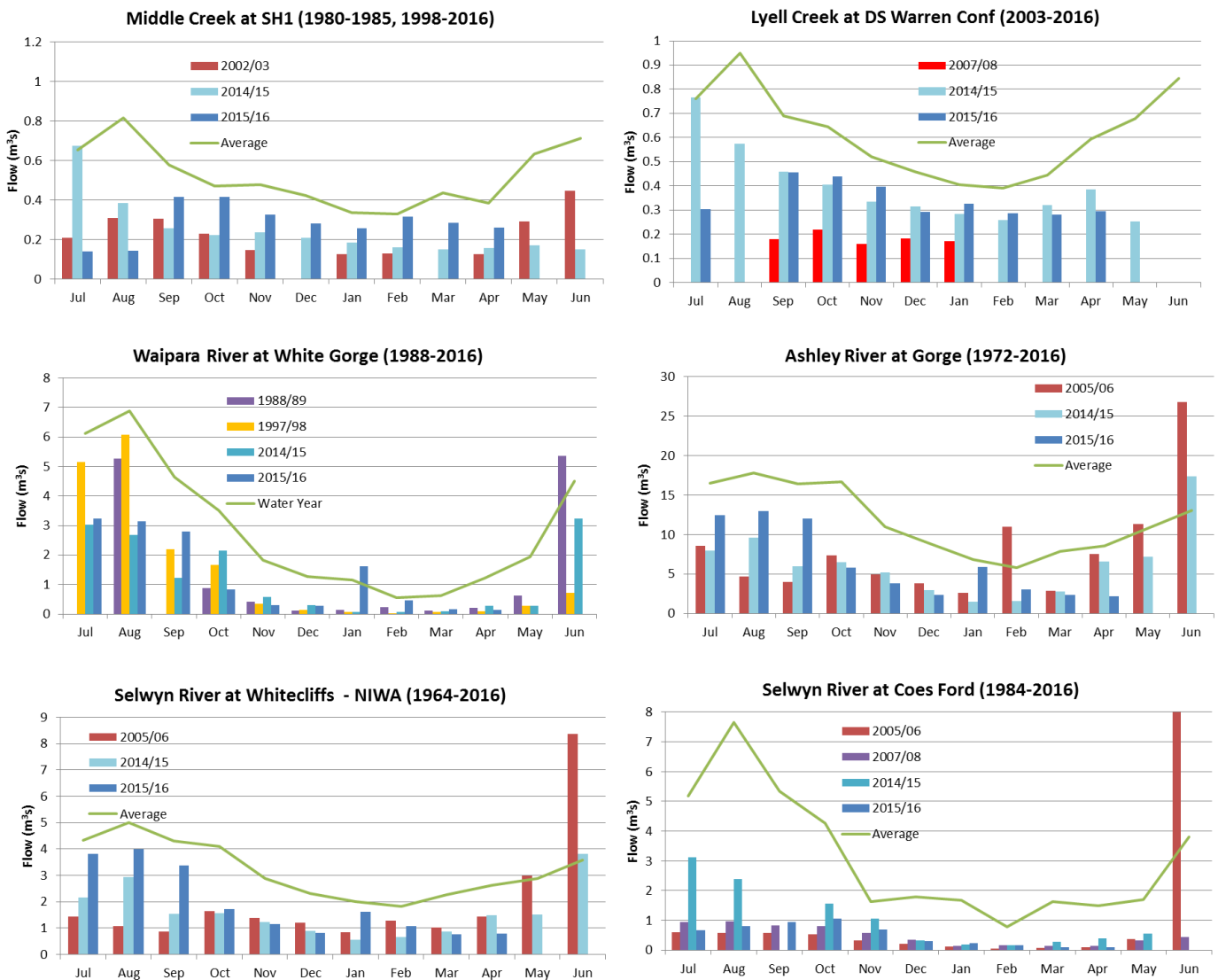


**Figure 5:** Groundwater level envelope plots for wells L36/0282, K37/0215, M36/1918 and M35/3614. The blue line indicates the groundwater level for each of the previous 12 months. The dark grey areas indicate groundwater levels greater than 2 standard deviations from the mean. The light grey areas indicate groundwater levels greater than 1 standard deviation from the mean. The white areas indicate groundwater levels within 1 standard deviation of the mean.

## River flows

### Foothills and plains rivers north of the Rakaia River

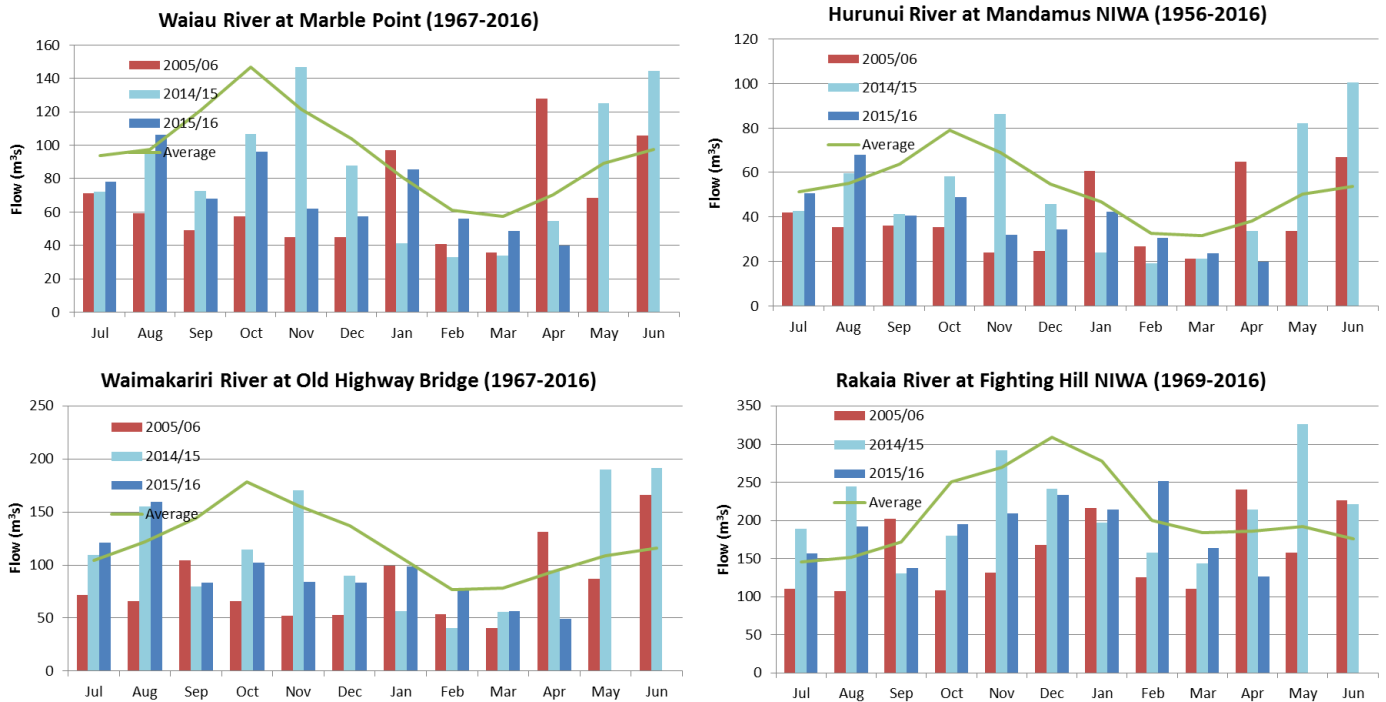
Selected Canterbury streams in the northern foothills and plains area are presented in Figure 6 with mean monthly flows for 2015-2016 which are compared with other low flow years (some of partial record). In all cases represented here we have seen continued low flows, which is not surprising due to the lack of rain. One of the most affected sites is the Selwyn at Coes Ford, at only 6 % of the long-term mean for April, also the lowest April on record. Being spring-fed, this river is completely reliant on groundwater levels which are also low in this area. The Waipara in North Canterbury had April mean flows of only 12% of the long-term figures.



**Figure 6:** Mean monthly flows for streams in the North Canterbury foothills and central plains compared to other 'dry' years – see Appendix 1 for location maps

## Alpine river flows, Rakaia and north

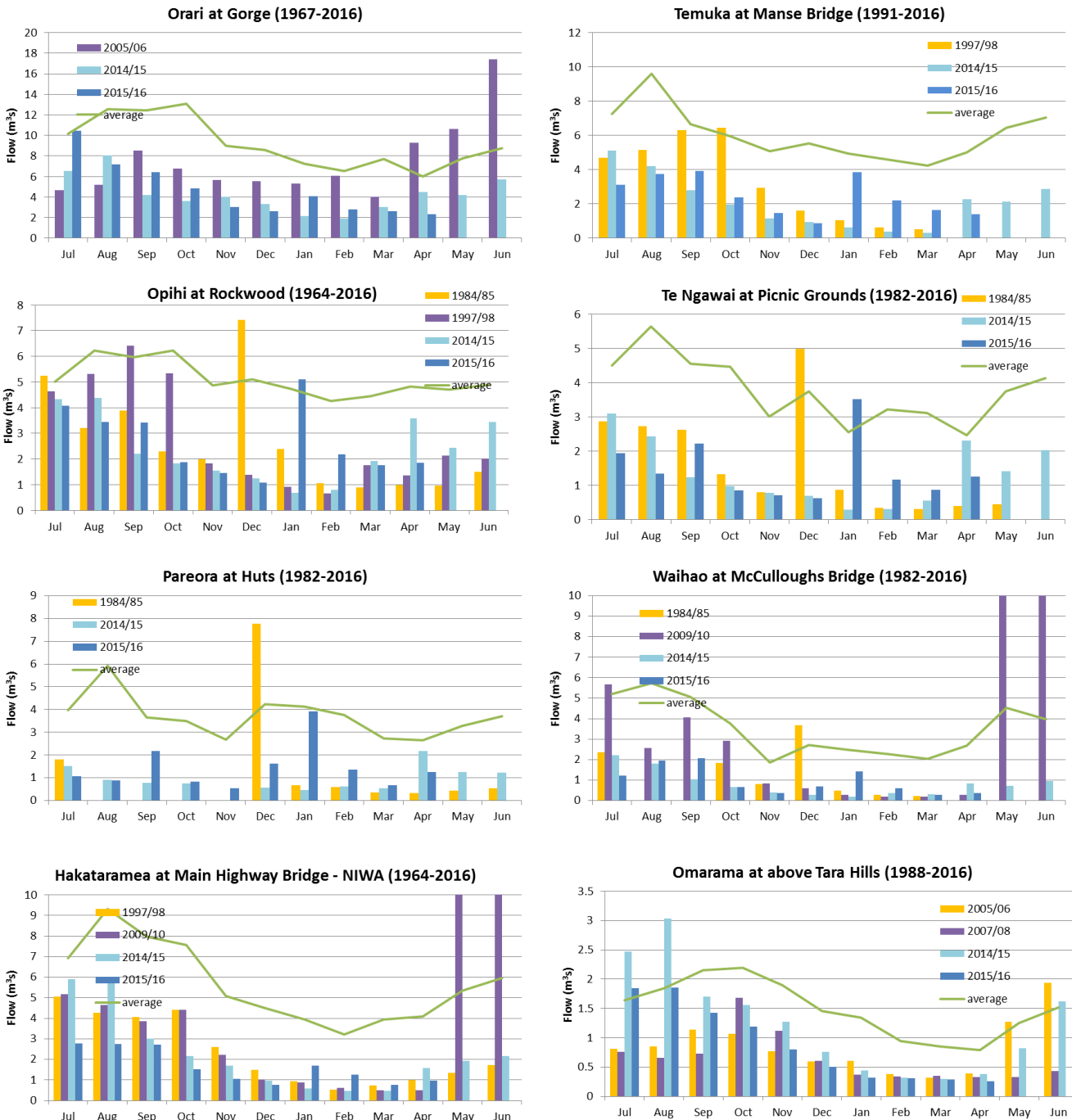
Mean monthly flows for April in four selected alpine rivers (Figure 7) have all shown a decrease from March flows. The Waiau, Hurunui, and Waimakariri all recorded April mean flows less than 60% of the long-term means, while the Rakaia was slightly higher with 68%, but this was a sharp decrease from flows during March.



**Figure 7:** Mean monthly flows for alpine rivers compared to other ‘dry’ years – see Appendix 1 for location maps

### Foothills and plains south of the Rakaia River

Flows in the Foothill Rivers south of the Rakaia (Figure 8) are all showing little response to any rainfall that has fallen in the month of April. As in North Canterbury all rivers represented here are flowing well below the long term means for the month of April. The Waihao in South Canterbury have April mean flows of only 14% of their long-term figures. Omarama Stream had its lowest April on record, following on from record lows since December 2015.

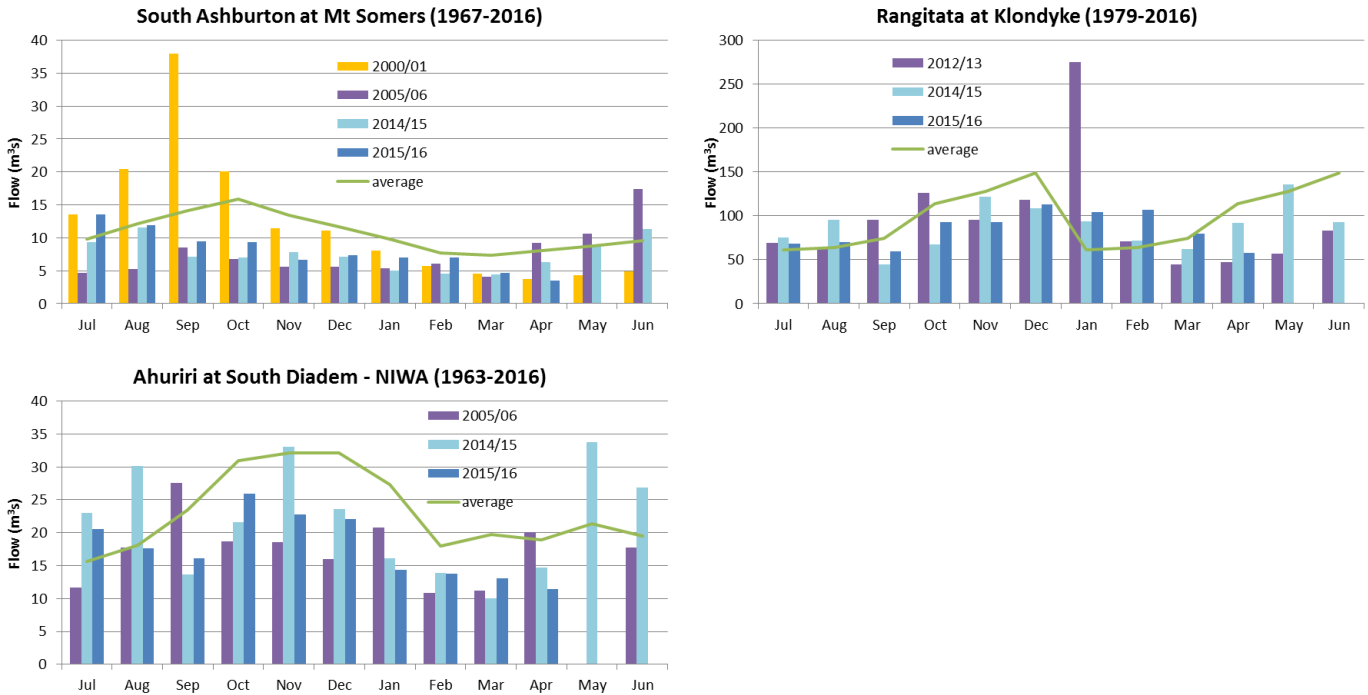


**Figure 8:** Mean monthly flows for streams in the South Canterbury foothills compared to other ‘dry’ years - see Appendix 1 for location maps. Please note some of the Waihao and Hakataramea flows have been truncated to show low flows better.



### Alpine river flows, south of the Rakaia River

The southern Alpine Rivers have also recorded relatively low April flows (Figure 9). The Ahuriri recorded April mean flow less than 60% of the long-term mean, while the Rangitata was slightly better off with 68%, but quite a sharp decrease from the month of March. The South Ashburton flow recorded was only 44% of the long term mean and was the lowest April flows on record.



**Figure 9:** Mean monthly flows for streams in the South Canterbury Alpine areas compared to other ‘dry’ years – see Appendix 1 for location map

## Irrigation Restrictions

Table 2 shows the percentage of time on full restriction and partial restriction based on flows at all of the minimum surface water flow sites and associated consent bands across the region. The irrigation season to date has seen almost twice as many restrictions than average, with greater rates of restriction than 2014/2015.

**Table 2: October - April 2016 irrigation restrictions compared with previous years and the average**

Irrigation October-April	Full	Partial
<b>2007-08</b>	6%	8%
<b>2008-09</b>	5%	6%
<b>2009-10</b>	7%	5%
<b>2010-11</b>	5%	4%
<b>2011-12</b>	5%	4%
<b>2012-13</b>	10%	8%
<b>2013-14</b>	5%	5%
<b>2014-15</b>	11%	9%
<b>2015-16</b>	14%	10%
average for October-April 2007 - 2015	<b>7.6%</b>	<b>6.5%</b>

Abstraction of groundwater for irrigation in the West Melton Special Zone is restricted based on the groundwater level in five monitoring bores (M35/1000, M35/1110, M35/1691, M35/5696 and M36/0217); one for each of five sub-zones. Water permits require abstractions to be restricted by specified percentages when water levels decline below the associated “trigger levels” in the monitoring bores. In April 2016, groundwater levels in the five bores were below their respective trigger levels, so groundwater takes tied to those five bores are on restriction.

Similarly, 2015/2016 groundwater abstraction for some irrigation consents in the Selwyn-Waimakariri, Rakaia-Selwyn and Valetta-Ashburton River groundwater allocation zones is restricted by an adaptive management programme. The adaptive management programme acts to adjust the maximum volume of water available to consented users based on the state of the resource. For the Selwyn-Waimakariri and Rakaia-Selwyn groundwater allocation zones, approximately 10-15% of the assessments resulted in partial or full restriction to the adaptive allocation. For the Valetta-Ashburton River groundwater allocation zone, approximately 70% of the assessments resulted in partial or full restrictions to the adaptive allocation.

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10 May, 2016

**Appendix 1: Location maps of representative rain gauges and water levels sites**

