Hydrology Update Winter 2024

Report prepared by Charlotte Tomlinson, 5th of September 2024.

Data from the Marlborough District Council's Environmental Monitoring network was primarily used in preparing this report and supplemented with data from the Marlborough Research Centre, MetService, NIWA, and FENZ.

Executive Summary

Winter was warmer than average with a mean air temperature of 9.5°C, 0.8°C above the long-term average. There were 23 ground frosts this winter, below the long-term average of 36. August was the first month in almost three years to record near-average wind run of 230 km after a prolonged period of below-average wind run.

Winter rainfall totalled 189 mm in Blenheim which is near average. Rainfall in the north-west of the region, including the Pelorus/Te Hoiere and Wairau Northbank, received above average rainfall over winter. For example Top Valley recorded 528 mm which is 115% of average winter rainfall. Rainfall in the Awatere catchment was near to slightly above average. The lower Waima rain gauge was the driest rainfall site in Marlborough over winter with 237 mm or 81% of average winter rainfall.

River flows were generally below average over winter. In the Wairau at Tuamarina, flows were particularly low in July, before additional rainfall-runoff in August returned flows to near average. Conversely, rivers in the north-west of the region had higher flow than average over winter. For example, the Rai River at Rai Falls had a mean flow of 20 m^3/s over winter, 128% of the long-term average winter flow. A small flood in the Rai River in late August had peak flow of 280 m^3/s, just below the mean annual flood (MAF) flow of 335 m^3/s.

After a slow start to winter soil moisture recharge, August saw soil moisture at the Blenheim monitoring site rise to above field capacity following two rain events on the 18th and 31st of the month. Soil moisture at the end of August is average to slightly above average across the region.

Water level in the Wairau Aquifer was in the lower quartile through July, reflecting the low baseflow in the Wairau River. Throughout August, higher flows in the Wairau River led to approximately 460 mm of aquifer recharge, with groundwater levels just below average at the end of August. Water level in the Riverlands Aquifer is near average at the end of August, with some pumping taking place over winter for domestic and industrial processes. As irrigation begins in October, aquifer levels will decline in relation to increased pumping demand.

Strong westerlies in the first half of September bring an unsettled start to spring, although high pressure is likely to build in the second half of the month. There is a 50% chance that an official La Niña event will be declared by the end of spring. Spring rainfall is expected to be near or above average.

Climate

Winter 2024 was warmer than average, with a mean air temperature of 9.5°C (0.8°C above the long-term average). For some it has felt like a cold winter, which may be due to the early introduction of colder than average temperatures in autumn. May was particularly cold, with a mean air temperature of 9.4°C (1.9°C below the long-term mean). August was the first month since September 2021 to record average wind-run of 230 km, with the second half of the month full of windy days. There were 23 ground frosts this winter, which is well below the long-term average of 36.6.

Blenheim has received 1,758 hours of sunshine from January to August 2024, placing Blenheim in second place behind Richmond as the sunniest town in New Zealand so far this year.

Rainfall

Blenheim at the Marlborough Research Centre recorded 78.6 mm of rainfall in August, which is 126% of the long-term average. Total winter rainfall at the site was 189 mm, which is 97% of the long-term average. Monthly rainfall totals along with monthly evapotranspiration from July onwards can be seen in Figure 1 below.

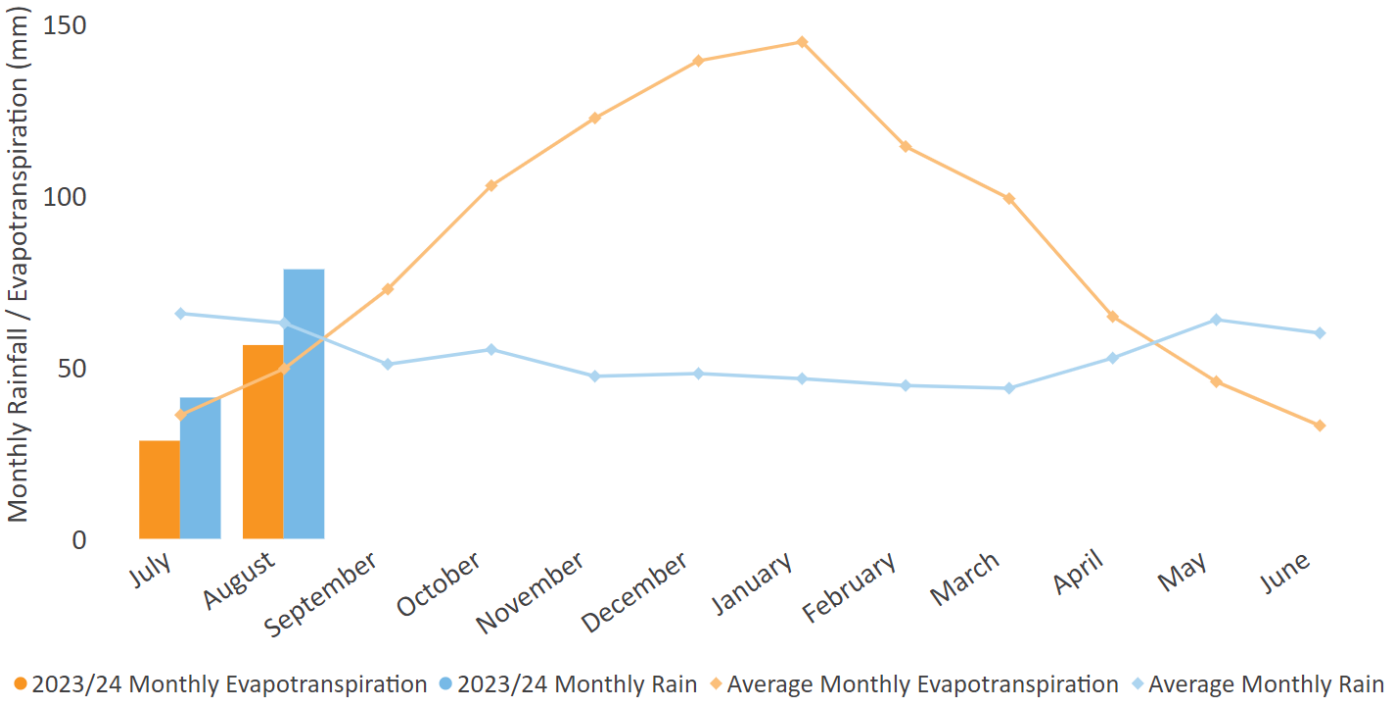

Figure 1. Monthly rainfall and evapotranspiration in Blenheim (Marlborough Research Centre) for the 2024-25 hydrological year, compared to average monthly totals.

Figure 2 shows total winter 2024 rainfall (June to August) for sites around Marlborough as a percentage of average winter rainfall.

The Te Hoiere/Pelorus shows the furthest departure from normal winter rainfall, with 129-145% of average rainfall recorded at four sites in the area.

Rainfall on the northbank of the Wairau was above average, with Top Valley recording 528 mm (115% of average winter rainfall). Rainfall on the Wairau Plains was near or slightly below average over winter.

Along the Blairich and Black Birch Ranges, rainfall was at or slightly above average. Similarly, rainfall in the lower, mid and upper Awatere Valley was also slightly above average (between 100-110%) for the winter months. Along the East Coast, rainfall was slightly below average. Rainfall in the lower Waima catchment was 237 mm, 81% of average winter rainfall. This was the driest location in the region over winter when compared to average rainfall.

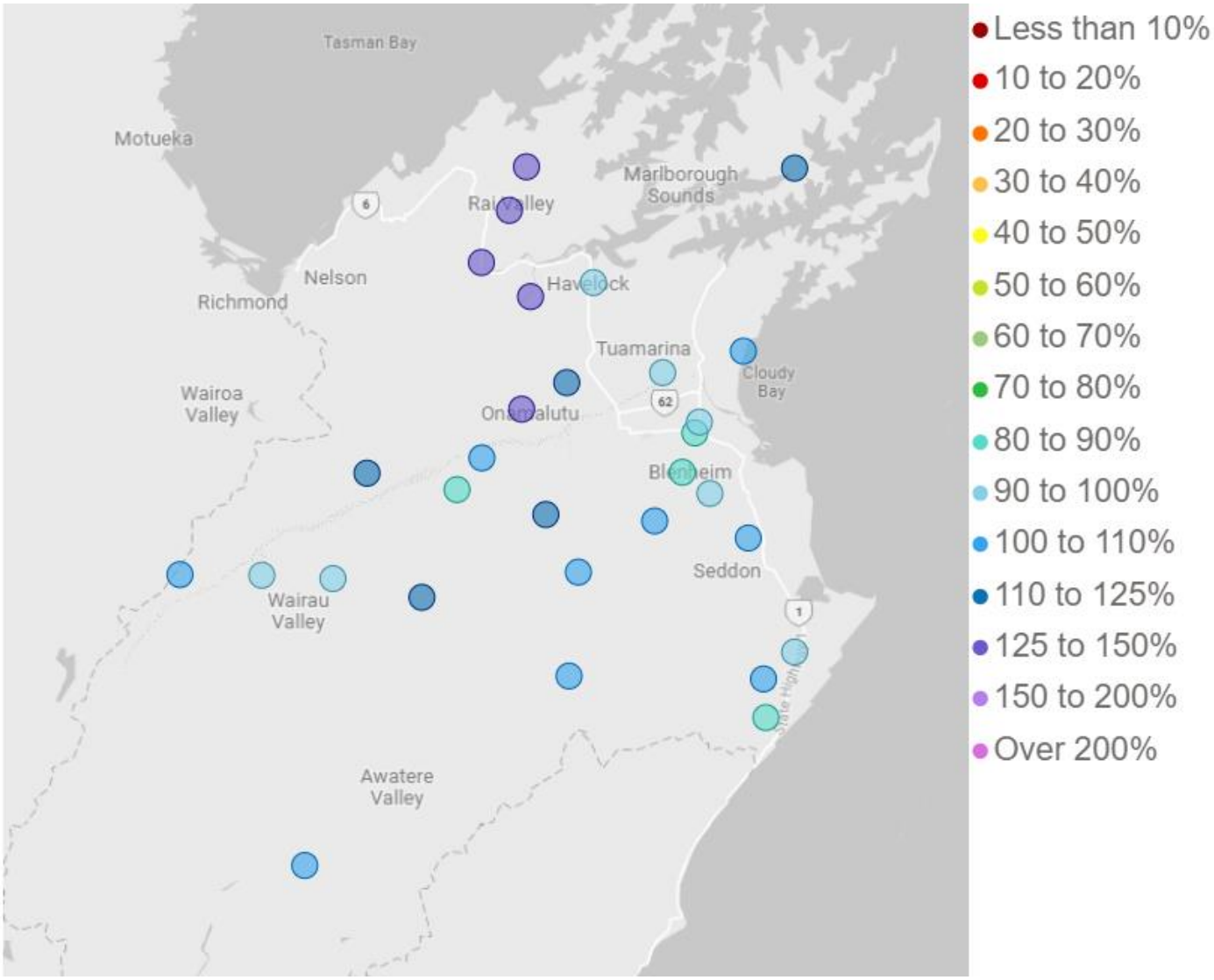

Figure 2. Winter 2024 rainfall at monitoring sites around Marlborough, as a percentage of average winter rainfall.

Figure 3 shows monthly rainfall from July 2024 onwards at four key sites in South Marlborough, compared to monthly averages. Rainfall was below average at all four sites in July, and near or slightly above average in August.

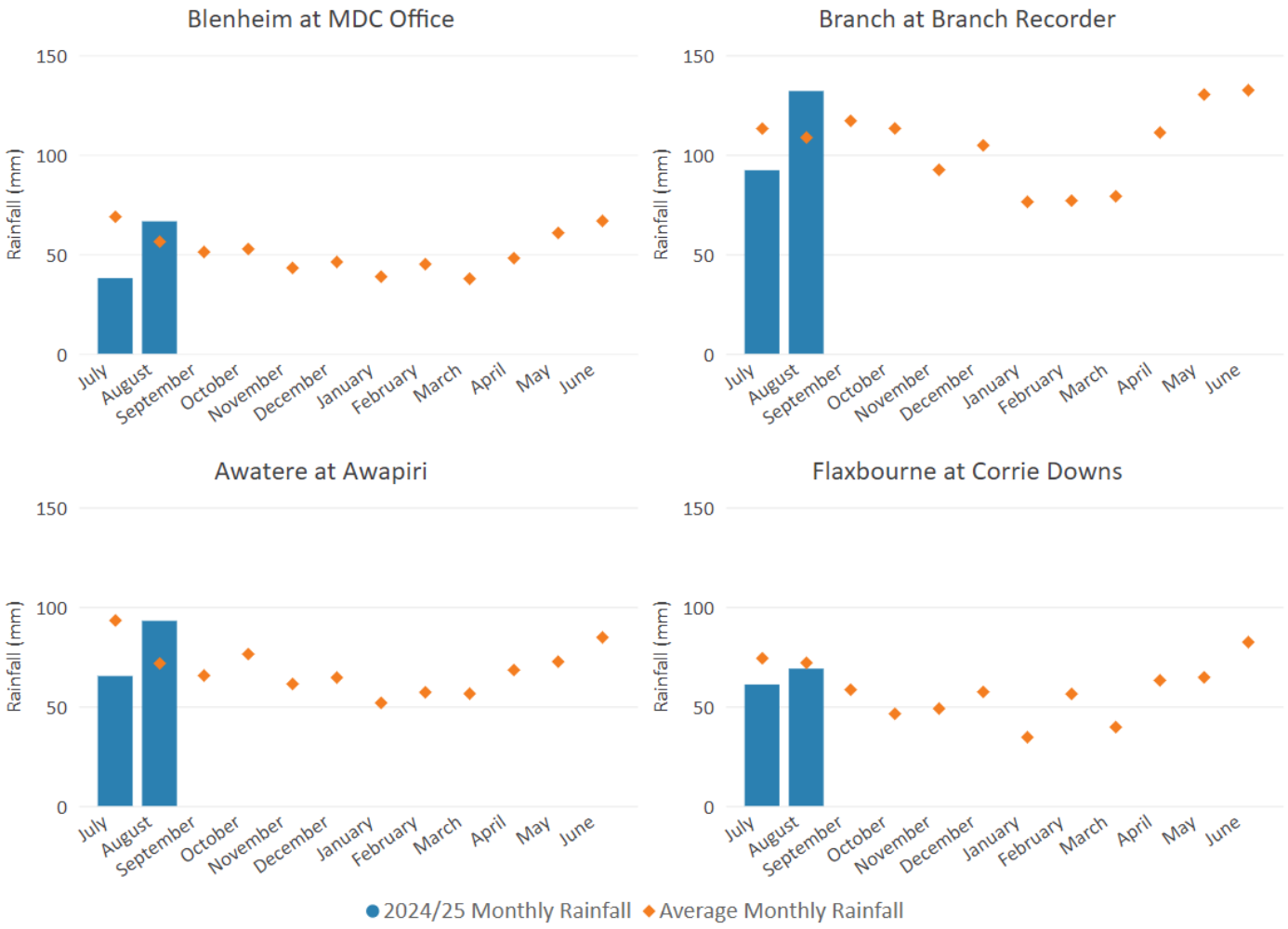

Figure 3. Monthly rainfall totals (mm) for the 2024-25 hydrological year from four key sites in South Marlborough, compared to average monthly rainfall totals.

Figure 4 shows monthly rainfall from July 2024 onwards at four key sites in North Marlborough, compared to monthly averages.

Rainfall was near average in July. In August, Tunakino received 441 mm of rainfall, which is 170% of average August rainfall. Nearby, the Wakamarina rainfall site received 362 mm of rainfall in August, which is double the average August rainfall at the site.

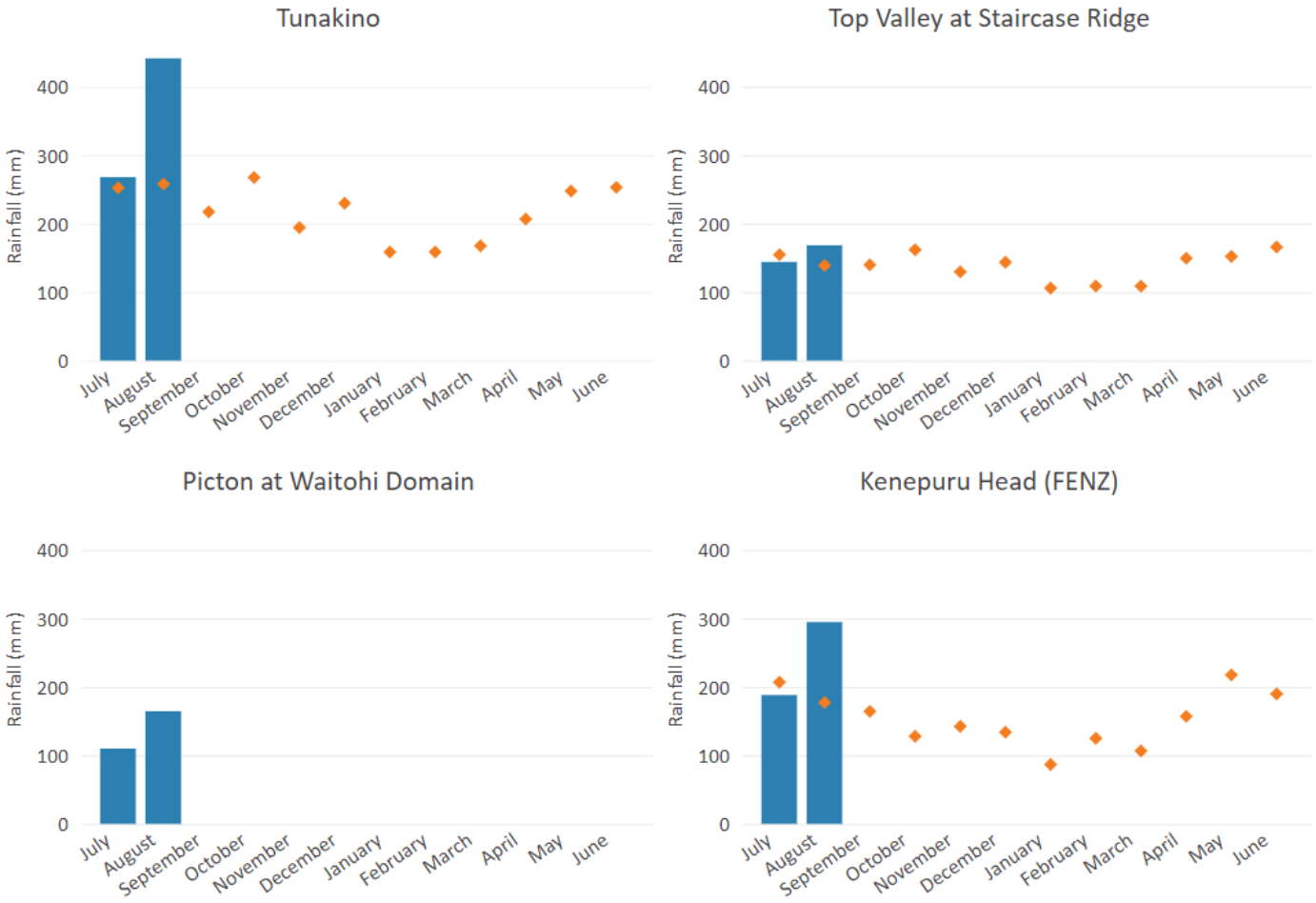

Figure 4. Monthly rainfall totals for the 2024-25 hydrological year from four key sites in North Marlborough, compared to average monthly rainfall totals. Note the adjusted scale when compared with the graphs for South Marlborough rainfall sites.

A full list of monthly rainfall totals for the 2024/25 hydrological year at all rainfall monitoring sites can be found in the appendix, Table 1.

River Flows

At the Awatere at Awapiri flow site, flows were below average over the winter months. Mean flow was 12.2 m^3/s this winter, which is 66% of the long-term average winter flow of 18.5 m^3/s. Small flow peaks throughout August meant that mean flow for the month was slightly higher than for winter as a whole, with an average of 15 m^3/s or 75% of the long-term average August flow.

Baseflow at the Awapiri site has been below average since the start of July, although still sitting within the middle 50% of data (see Figure 5 below). With the combined effect of several small flow peaks in August, baseflow was just below average at the end of the month.

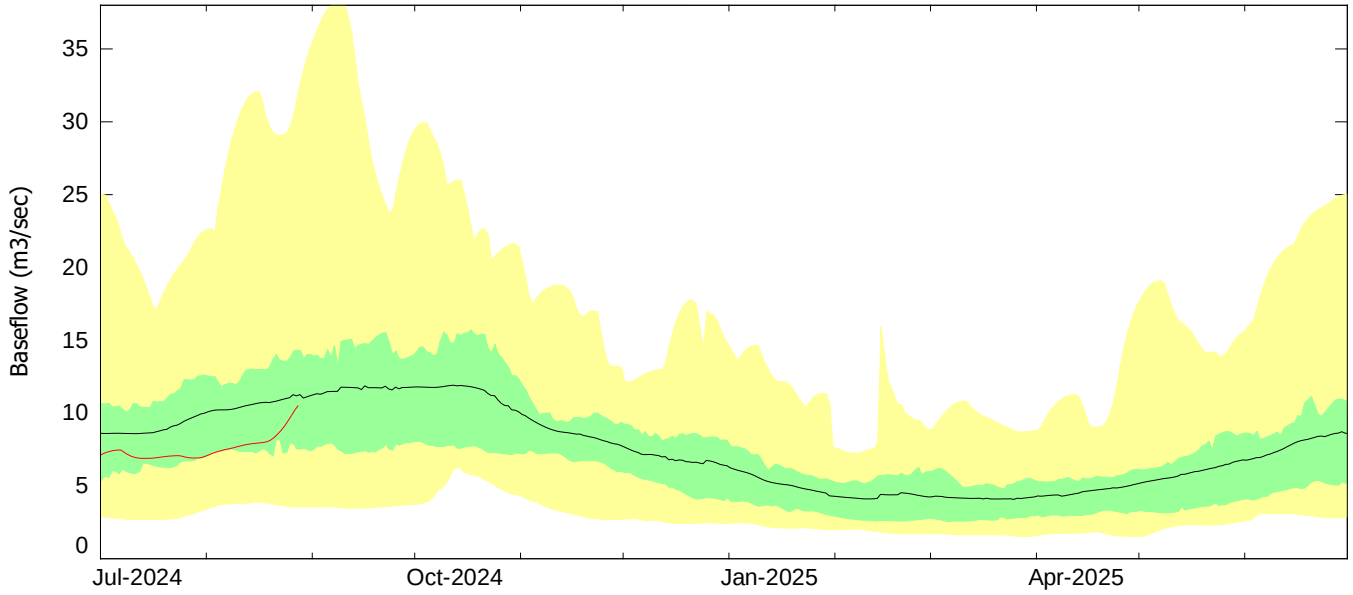

Figure 5. Awatere River at Awapiri baseflow, from 1 July 2024 to 30 June 2025. The black line is average baseflow and the red line is the 2024/25 baseflow. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

Waihopai at Craiglochart flows were below average over the winter months, with mean flow of 13.2 m^3/s, or 69% of the long-term average winter flow of 19.2 m^3/s. Small flow peaks throughout August gave a slightly higher average flow of 16 m^3/s for the month, which is 80% of the long-term average August flow.

Baseflow at Craiglochart began above average in early July, before dropping to below average throughout July and early August. Following several small flow peaks in August, baseflow increased to the upper quartile near the end of the month (see Figure 6 below).

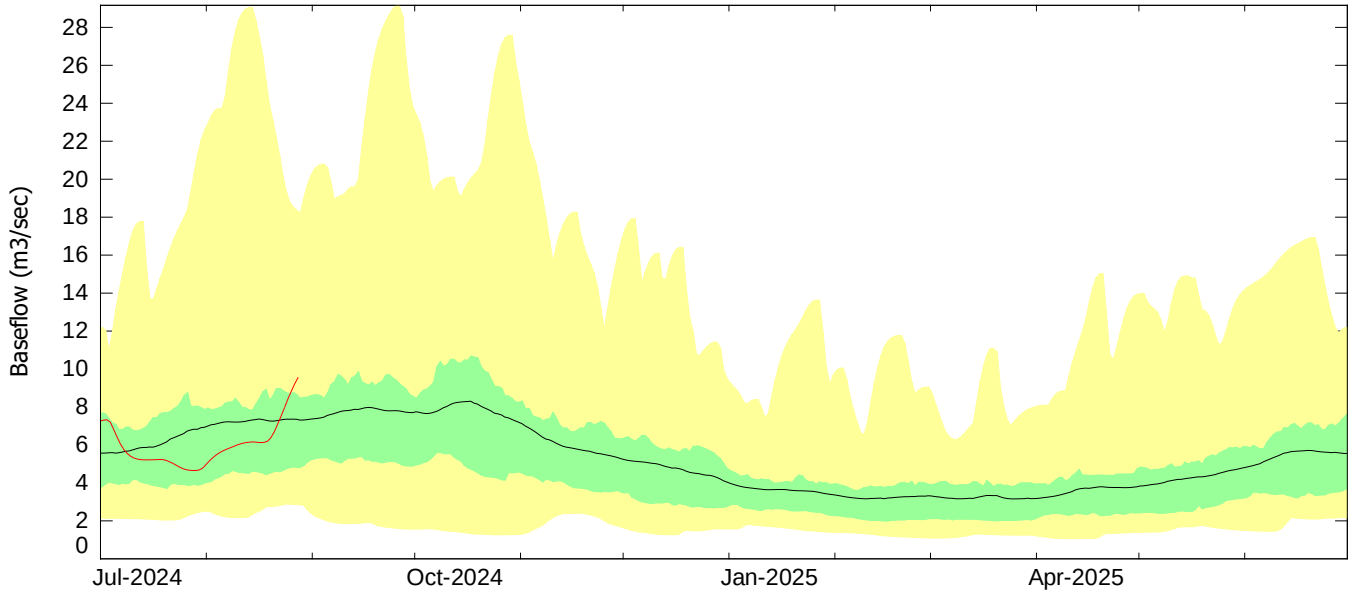

Figure 6. Waihopai River at Craiglochart baseflow, from 1 July 2024 to 30 June 2025. The black line is average baseflow and the red line is the 2024/25 baseflow. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

Flows in the Wairau River at Tuamarina were below average over the winter months, with a mean flow of 92 m^3/s, which is 77% of the long-term average winter flow of 120 m^3/s. Mean flow was especially low in July, as the river was in recession for most of the month. July average flow was 65 m^3/s, which is just 52% of the long-term average flow for the month. A series of small flow peaks in August meant mean flows for the month were near the long-term average.

Baseflow was below average at the start of July and fell into the lower quartile near the end of the month after minimal inputs to the river. Several smaller flow peaks throughout August replenished baseflow, which reached into the upper quartile near the end of August. This can be seen in Figure 7 below.

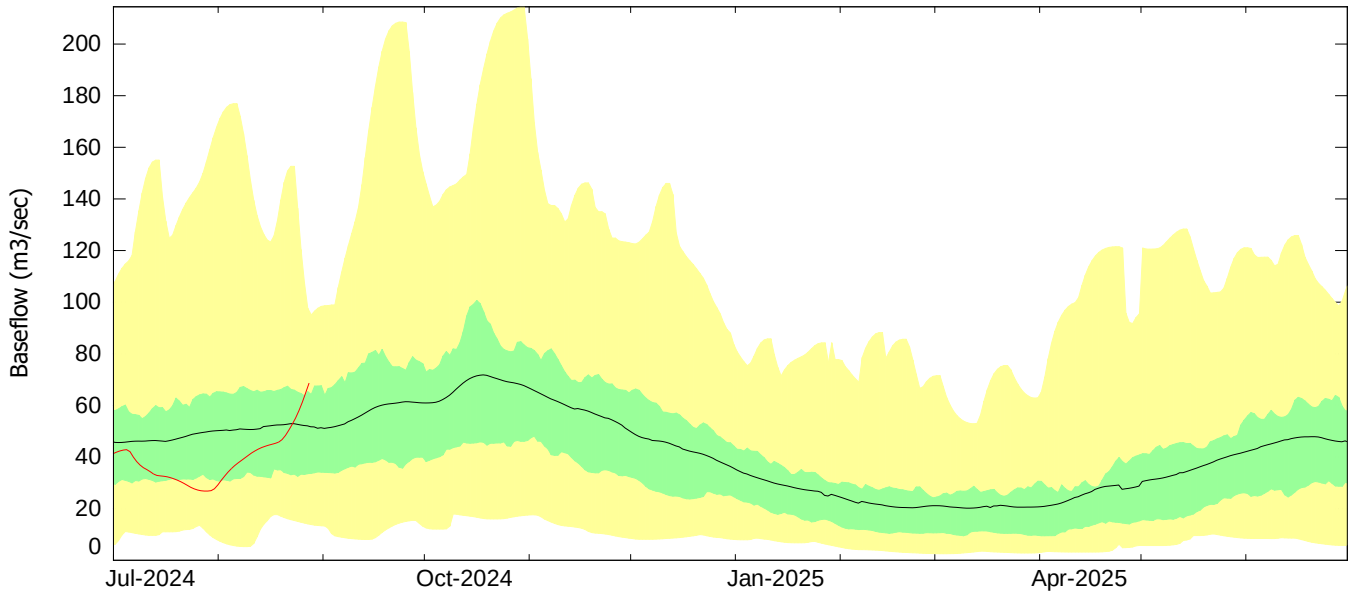

Figure 7. Wairau River at Tuamarina baseflow, from 1 July 2024 to 30 June 2025. The black line is average baseflow and the red line is the 2024/25 baseflow. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

Flows in the Rai River at Rai Falls were above average over the winter months, with a mean flow of 19.7 m^3/s, or 128% of the long-term average winter flow (15.4 m^3/s). On the 24th of August there was a flood with peak flow of 280 m^3/s, which is just below the mean annual flood (MAF) flow of 335 m^3/s.

Baseflow was in the upper quartile in early July, dropping to just below average towards the end of the month. Following a flow peak towards the end of July and further flow peaks throughout August, baseflow rose steadily throughout August, reaching into the upper quartile and to a new maximum baseflow for this time of year.

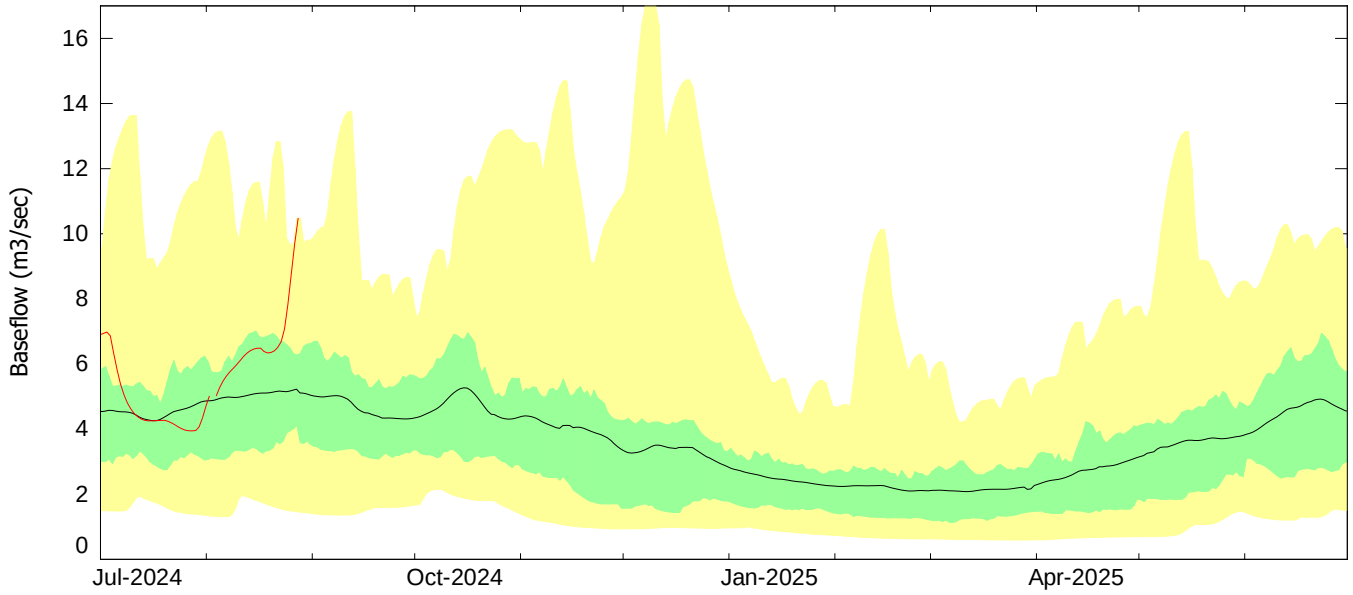

Figure 8. Rai River at Rai Falls baseflow, from 1 July 2024 to 30 June 2025. The black line is average baseflow and the red line is the 2024/25 baseflow. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

A full summary of river flows for June, July and August 2024 can be found in the appendix.

Soil Moisture

June started with Blenheim soil moisture in the lower 10th percentile (below 30%) until rain in the second week of June saw soil moisture rise to above field capacity (see Figure 9 below). Soil moisture stayed near average until late July, when a dry period saw soil moisture again fall into the lower 10th percentile.

Soil moisture was generally below average until the 18th of August, when 19 mm of rain fell, raising soil moisture above field capacity to a maximum of 43%. From there soil moisture stayed near average to the end of August. 27.5 mm of rain was recorded on the 31st of August, causing soil moisture to rise into the 90th percentile by midday on the 1st of September.

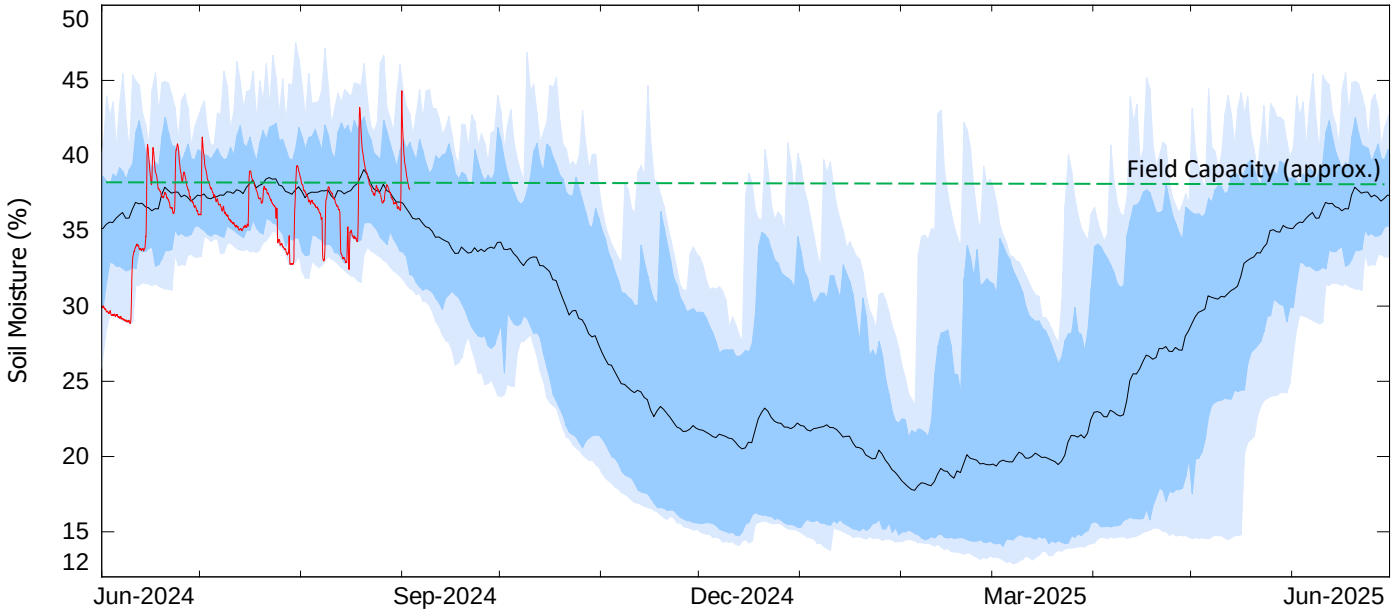

Figure 9. Shallow soil moisture at the Marlborough Research Centre (Blenheim) from the 1st of June 2024 to the 30th of June 2025. The red line shows this year's soil moisture, while the black line shows average soil moisture from 19 years of data. The light blue shows the upper and lower 10% of the data and the darker blue shows the middle 80% of data.

The current soil moisture deficit map from NIWA (the far right map in Figure 10 below) shows that at the end of August, soils in Marlborough are generally at or near field capacity. In comparison to the same time last year, soil moisture is slightly higher this year.

The soil moisture anomaly map (Figure 11) shows how current soil moisture compares to the historic average. The map shows soil moisture is average to slightly above average across the region. Soils in the lower Awatere Valley and further east appear to be between 10-20% wetter than average for this time of year.

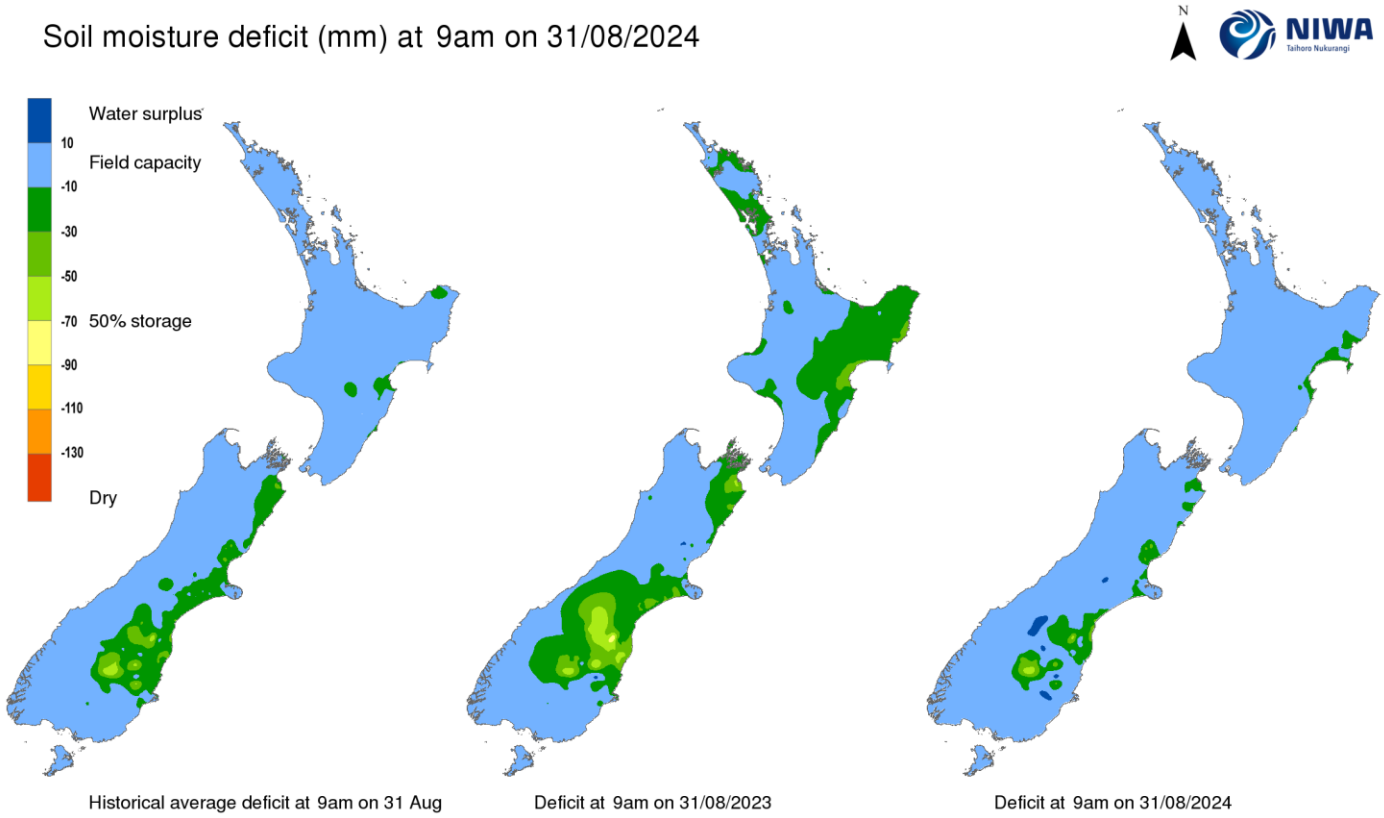

Figure 10. Soil moisture deficit maps of New Zealand, retrieved from NIWA on the 2nd of September 2024.

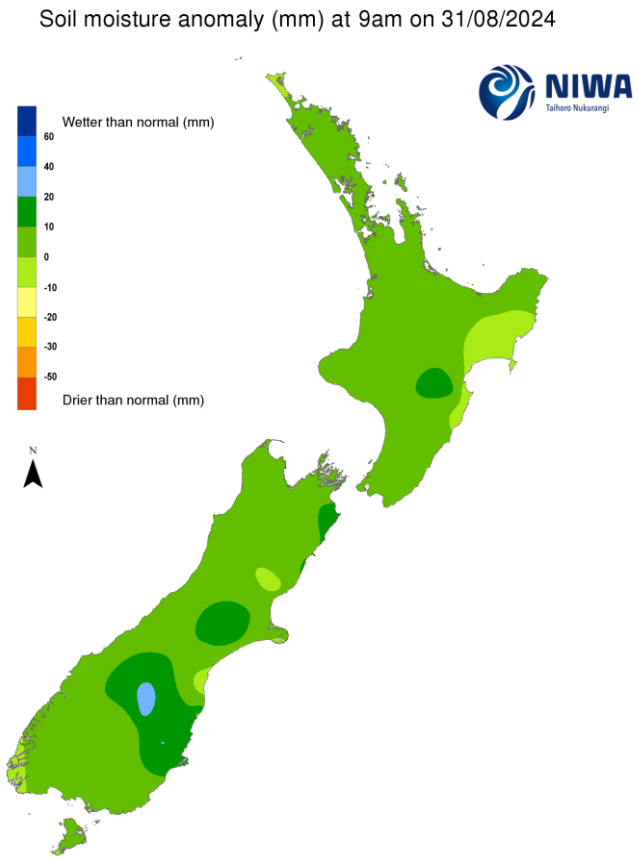

Figure 11. Soil moisture anomaly map of New Zealand, retrieved from NIWA on the 2nd of September 2024.

Groundwater

The Wairau Aquifer water level remained within the lower quartile throughout July and much of August. Groundwater recharge is highly correlated with Wairau River baseflow, which was also fairly low throughout July. As baseflow was replenished through a series of small-moderate flow peaks in the river from mid-August onwards, aquifer levels rose by approximately 460 mm to just below average by early September, as seen in Figure 12 below. The long-term declining trend in the aquifer means the groundwater level is less likely to rise above average now and into the future. Sustained river flow throughout spring will be important to maintain aquifer levels for the irrigation season, as mean transit time through the aquifer is approximately 3 months and requires ongoing inputs to maintain water levels.

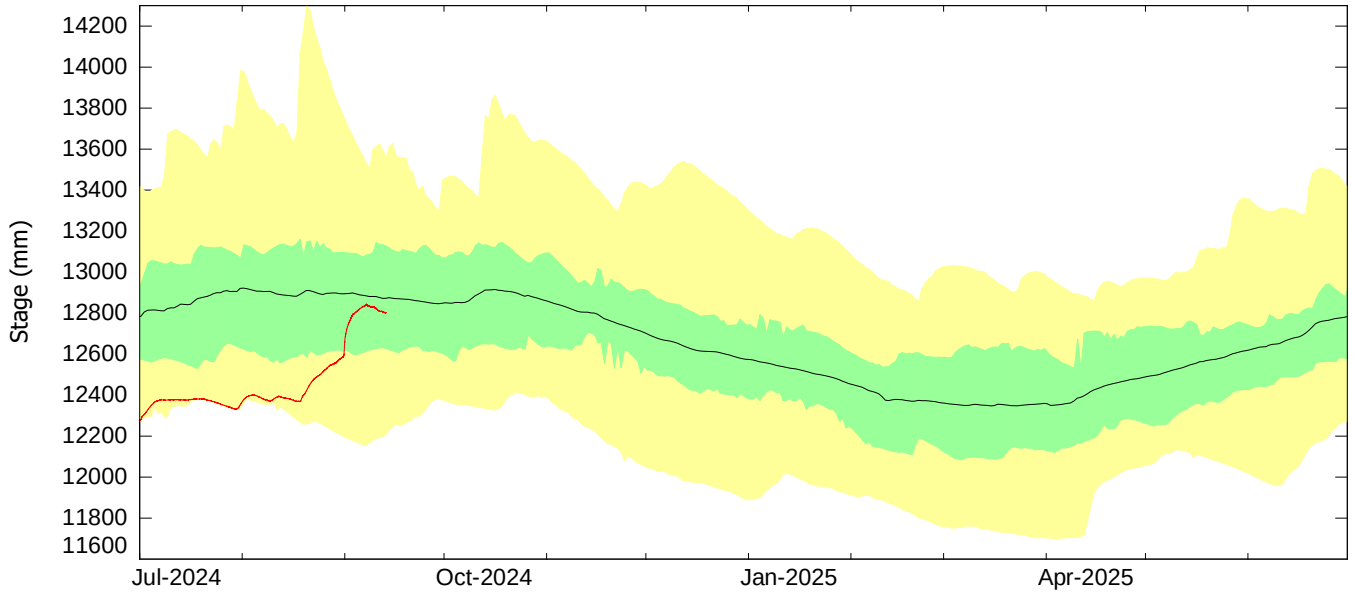

Figure 12. Wairau Aquifer at Wratts Road well water level, from 1 July 2024 to 30 June 2025. The black line is average groundwater level, and the red line is the 2024/25 groundwater level. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

Water level in the Riverlands Aquifer has been in the lower quartile throughout much of winter, but as of early September is around average. Some pumping takes place over winter for domestic and industrial processes which will affect water level in the aquifer. Without the effects of pumping, aquifer levels would show much less seasonal variation and be higher year-round. As irrigation begins from October, the aquifer level will decline due to the increased pumping demand, as can be seen in Figure 13 below.

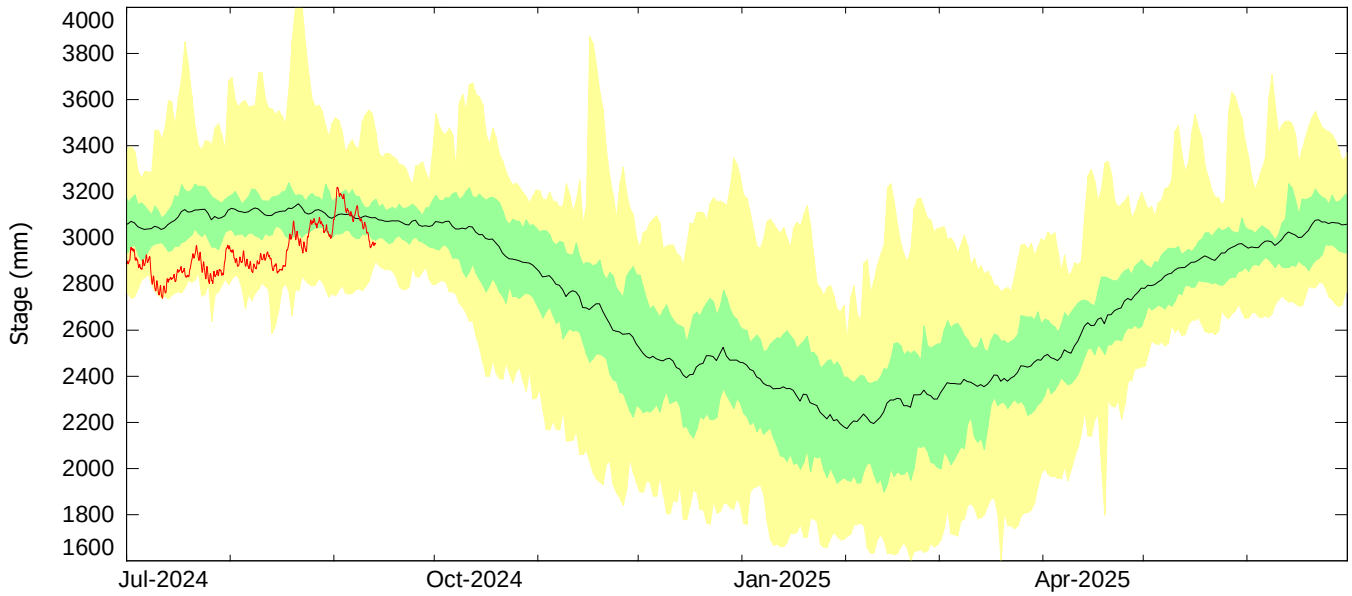

Figure 13. Riverlands Lagoon Well water level, from 1 July 2024 to 30 June 2025. The black line is average groundwater level, and the red line is the 2024/25 groundwater level. The green section is the middle 50% of data and the yellow sections show the upper and lower quartiles.

Climate Outlook September to November 2024

September is likely to be a month of two halves. The Sudden Stratospheric Warming (SSW) event over the South Pole is causing lower than normal air pressure to the south of New Zealand at the start of September. This will lead to an unsettled and windy start to spring. Strong westerlies in the first half of September will likely ease back in the second half of the month as the SSW wanes and high pressure builds.

The El Niño Southern Oscillation (ENSO) is starting to show signs of 'La Niña-like' conditions in the Pacific Ocean, with an official La Niña possible by the end of spring (50% chance). As our climate is changing, the effects of ENSO events are becoming less predictable. This was seen with the 2023/24 El Niño event, which was unusual compared to previous El Niño events.

The NIWA tropical cyclone outlook for the season will be available in late October/early November, but the early suggestion is this may not be a hugely active tropical cyclone season.

For Marlborough frequent fronts are expected throughout September, delivering regular rainfall. For spring as a whole rainfall is expected to be near or above average which will be important for soil moisture, river flows, and aquifer recharge.

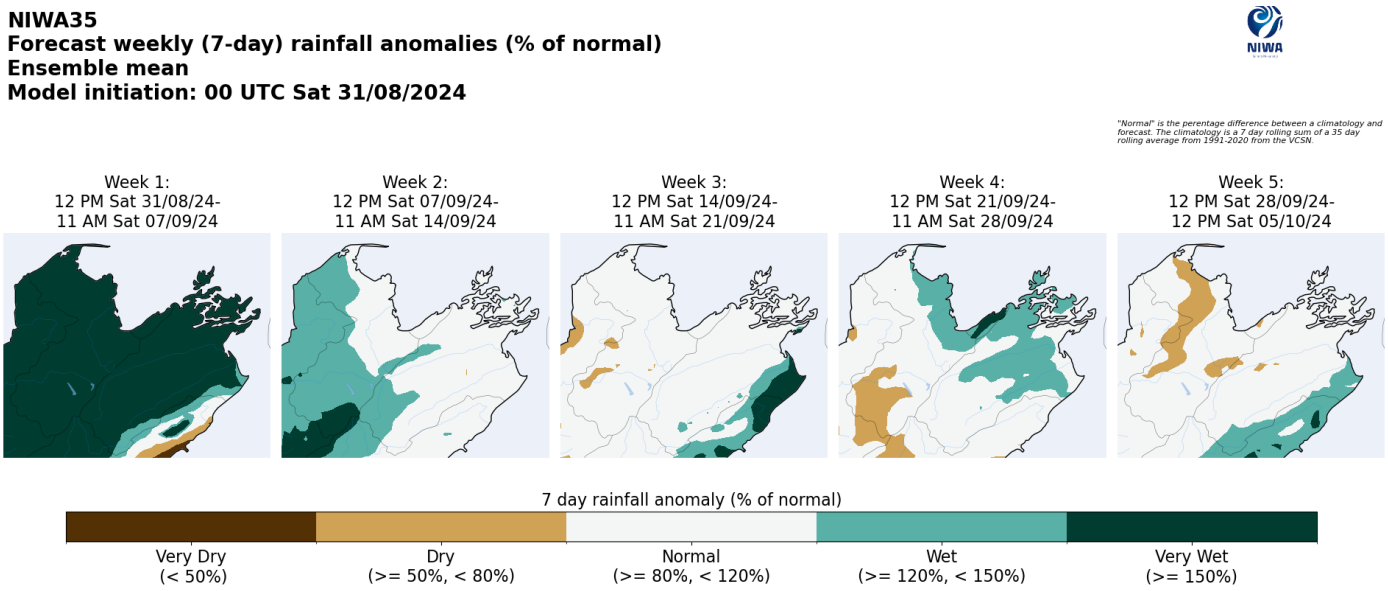

Figure 14. Weekly forecasted rainfall anomalies for Marlborough/Nelson/Tasman, from the 31st of August to the 5th of October. Retrieved from NIWA on the 2nd of September 2024.

The predictions for Marlborough/Tasman from September to November are:

- Temperature – above average (50% chance) or near average (45% chance)
- Rainfall – near average (40% chance) or above average (35% chance)
- Soil Moisture – near average
- River Flows – near average

Appendix

Table 1. Monthly rainfall totals (mm) for the 2024-25 hydrological year at monitoring sites in Marlborough (listed alphabetically).

Site	July	August
Awatere at Awapiri	65	93
Awatere Glenbrae NRFA	41	70
Beneagle at Farm Stream	54	81
Blenheim at MDC Office	38	67
Branch at Branch Recorder	92	132
Branch at Mt Morris	94	170
Flaxbourne at Corrie Downs	61	69
Kaituna Rainfall at Higgins Bridge	116	196
Kenepuru Head NRFA	188	295
Koromiko NRFA	132	214
Lake Elterwater Climate	71	69
Lansdowne NRFA	67	89
Malings	100	209
Mid Awatere Valley NRFA	55	64
Molesworth NRFA	34	86
Omaka at Ramshead Saddle	68	110
Onamalutu at Bartletts Creek Saddle	177	245
Onamalutu at Hilltop Road NRFA	154	273
Picton Climate at Waitohi Domain	110	164
Pudding Hill NRFA	36	85
Rai at Rai Falls	213	445

Site	July	August
Rai Valley NRFA	253	410
Rarangi at Driving Range	59	142
Red Hills	83	125
St Arnaud NRFA	62	184
Taylor at Taylor Pass Landfill	48	68
Taylor at Tinpot	76	114
Te Rapa	66	78
Top Valley at Staircase Ridge	144	168
Tor Darroch NRFA	82	91
Tunakino	268	441
Upper Clarence NRFA	41	58
Waihopai at Craiglochart	53	96
Waihopai at Spray Confluence	75	89
Waikakaho	74	136
Wairau Valley at Southwold	92	116
Wakamarina at Twin Falls	162	362
Ward NRFA	64	66
Wye at Charlies Rest	64	104

Table 2. A summary of river flows in Marlborough for June 2024.

Site Name	June Mean Flow (m3/s)	June Long-Term Mean Flow (m3/s)	% of long-term mean	Flow Record Begins	Catchment Area (km2)
Rai River at Rai Falls	18.37	15.17	121	1979	211
Kaituna River at Higgins Bridge	4.06	6.38	64	1989	135
Branch River at Weir Intake	14.64	24.38	60	1958	551
Goulter River at Horseshoe Bend	10.19	11.38	90	2010	154
Waihopai River at Craiglochart	13.17	17.42	76	1960	745
Ohinemahuta River at Domain	1.86	1.75	106	2013	33
Are Are Creek at Kaituna Tuamarina Track	0.53	0.75	70	2007	32
Tuamarina River at Para Road	2.28	3.18	72	2024	100
Wairau River at Tuamarina	96.13	114.33	84	1960	3430
Omaka River at Gorge	1.34	1.63	82	1993	91
Taylor River at Borough Weir	1.06	0.93	114	1961	65
Flaxbourne River at Corrie Downs	1.37	0.89	155	2003	71
Awatere River at Awapiri	11.60	16.77	69	1977	983

Table 3. A summary of river flows in Marlborough for July 2024.

Site Name	July Mean Flow (m3/s)	July Long-Term Mean Flow (m3/s)	% of long-term mean	Flow Record Begins	Catchment Area (km2)
Rai River at Rai Falls	14.42	15.53	93	1979	211
Pelorus River at Bryants	22.08	22.66	97	1977	375
Kaituna River at Higgins Bridge	4.58	6.79	67	1989	135
Branch River at Weir Intake	12.19	22.91	53	1958	551
Goulter River at Horseshoe Bend	7.27	12.80	57	2010	154
Waihopai River at Craiglochart	10.28	20.17	51	1960	745
Ohinemahuta River at Domain	1.40	2.19	64	2013	33
Are Are Creek at Kaituna Tuamarina Track	0.57	1.07	53	2007	32
Tuamarina River at Para Road	1.62	3.61	45	2024	100
Wairau River at Tuamarina	65.13	125.59	52	1960	3430
Omaka River at Gorge	1.21	2.29	53	1993	91
Taylor River at Borough Weir	0.64	1.54	42	1961	65
Flaxbourne River at Corrie Downs	0.72	1.33	54	2003	71
Awatere River at Awapiri	9.99	18.65	54	1977	983

Table 4. A summary of river flows in Marlborough for August 2024.

Site Name	August Mean Flow (m3/s)	August Long-Term Mean Flow (m3/s)	% of long-term mean	Flow Record Begins	Catchment Area (km2)
Rai River at Rai Falls	26.26	15.55	169	1979	211
Pelorus River at Bryants	32.83	35.01	94	1977	375
Kaituna River at Higgins Bridge	7.37	7.78	95	1989	135
Branch River at Weir Intake	23.85	24.36	98	1958	551
Goulter River at Horseshoe Bend	8.95	10.34	87	2010	154
Waihopai River at Craiglochart	16.01	20.12	80	1960	745
Ohinemahuta River at Domain	1.99	1.76	113	2013	33
Are Are Creek at Kaituna Tuamarina Track	0.84	1.14	74	2007	32
Tuamarina River at Para Road	2.29	2.85	81	2024	100
Wairau River at Tuamarina	115.47	119.72	96	1960	3430
Omaka River at Gorge	1.60	2.17	74	1993	91
Taylor River at Borough Weir	0.70	1.40	50	1961	65
Flaxbourne River at Corrie Downs	0.92	1.31	70	2003	71
Awatere River at Awapiri	15.00	19.93	75	1977	983