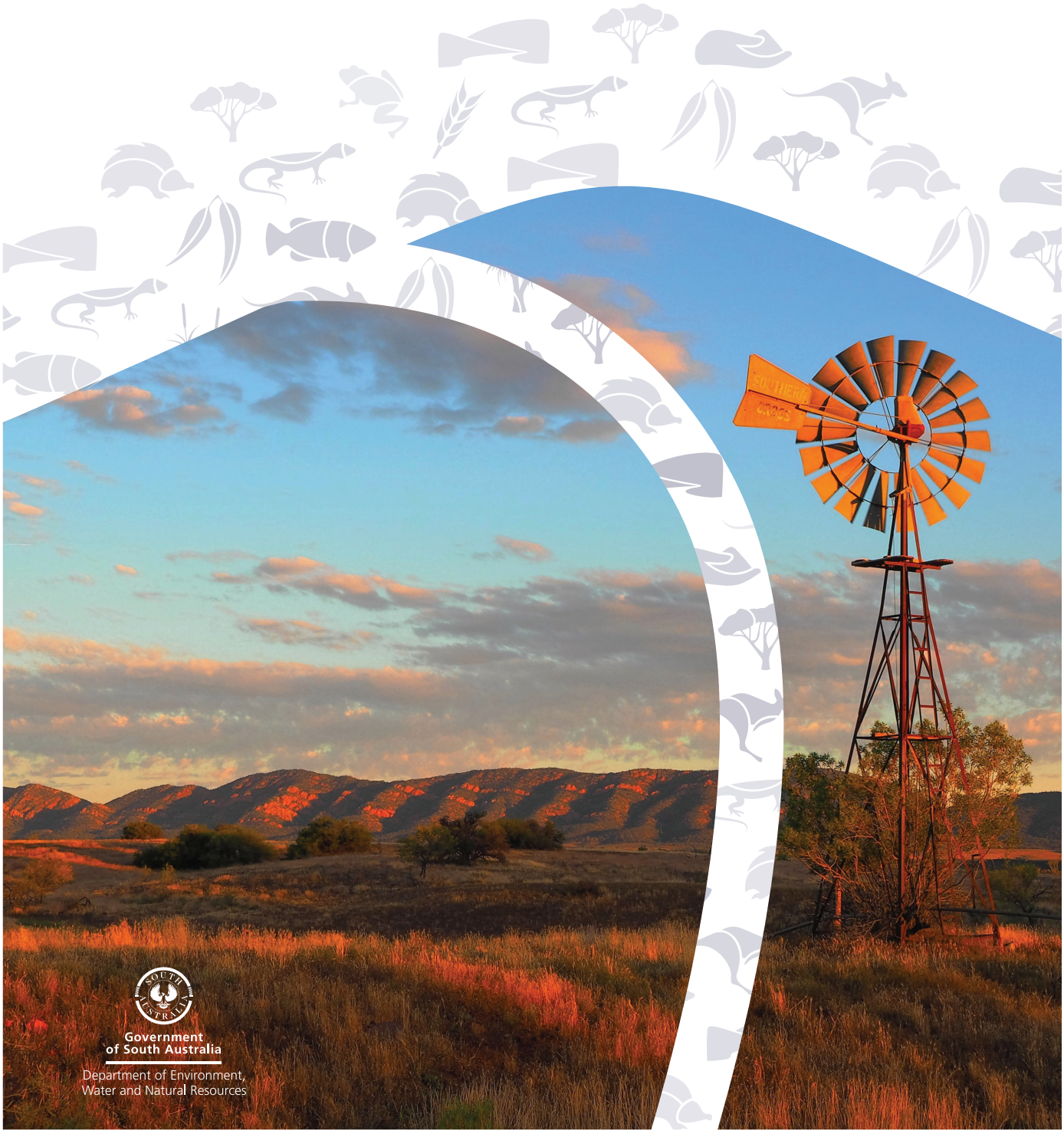
Kangaroo Flat region of the Northern Adelaide Plains PWA T2 aquifer

2016 Groundwater level and salinity status report



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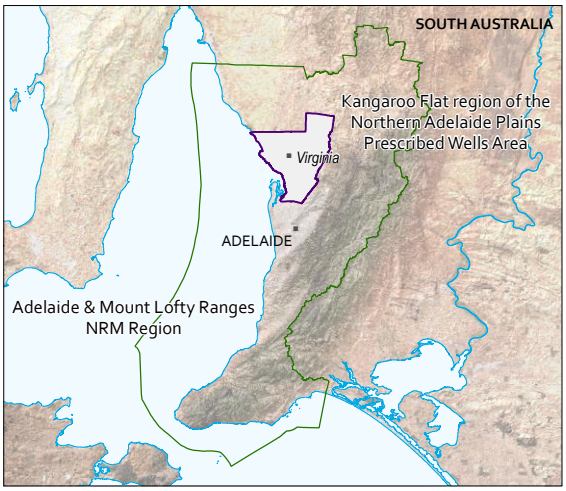
Regional setting



The Kangaroo Flat region encompasses an area of around 80 km^2 situated towards the north-eastern corner of the Northern Adelaide Plains Prescribed Wells Area (PWA). It is located within the Adelaide and Mount Lofty Ranges Natural Resources Management (NRM) Region, approximately 40 km north-east of Adelaide. Groundwater use in the Kangaroo Flat region was restricted in 2000 and the area was prescribed in 2004 — as an addition to the Northern Adelaide Plains PWA — under the *Natural Resources Management Act 2004*. The current water allocation plan is being amended to provide for the sustainable management of the water resources.

In 2013, an assessment of the capacity of the groundwater resource in the Kangaroo Flat region was undertaken to estimate sustainable extraction volumes for future licensed groundwater allocations. Consequently, the status of the Kangaroo Flat region's groundwater resources is reported independent of the *Northern Adelaide Plains PWA T2 aquifer 2016 Groundwater level and salinity status report*.

The Kangaroo Flat region contains Quaternary and Tertiary sediments that extend to a depth of around 100 m below ground surface. These sediments can be broadly divided into four regional hydrogeological units: the Hindmarsh Clay aquitard; the Carisbrooke Sand (Q4) aquifer; a semi-confining layer consisting of weathered Quaternary and Tertiary sediments; and the confined T2 aquifer. The T2 aquifer comprises limestones and sands of the lower Port Willunga Formation and is directly overlain by the Q4 aquifer and the Hindmarsh Clay aquitard. In the Kangaroo Flat region, groundwater is extracted from only the T2 aquifer, which is the focus of this report.

Groundwater recharge to the T2 aquifer is thought to occur by lateral inflow from the adjacent fractured rock aquifers of the Mount Lofty Ranges, which are located along the eastern boundary of the PWA. Outflows from the groundwater system occur through extraction from irrigation and domestic wells, and discharge to Gulf St Vincent.

Despite the generally confined nature of the T2 aquifer, which does not receive direct recharge from local rainfall, the intensity and timing of rainfall (and related variations in rates of groundwater extraction) can have an effect on groundwater pressure levels and salinities. For example, if the Kangaroo Flat region experiences above-average rainfall, this could result in less groundwater being extracted from the T2 aquifer for irrigation, and rises in groundwater pressure levels might result.

2016 Status

The T2 aquifer of the Kangaroo Flat region of the Northern Adelaide Plains PWA has been assigned an orange status for 2016:

2016 Status  Moderate adverse trends have been observed over the past five years

The 2016 status for the T2 aquifer is based on:

- most monitoring wells (75%) show a five-year trend of falling groundwater pressure levels
- one of two monitoring wells (50%) shows a five-year trend of increasing salinity.

Rainfall

In 2015–16, the Gawler rainfall station (BoM Station 23078), which is located near the Kangaroo Flat region, recorded 410 mm of rainfall. This is 43 mm below the long-term average of 453 mm (1900–2016) and almost identical to the five-year average of 412 mm (Figs 1 and 2). Monthly rainfall data show January, March, May and June were above-average monthly rainfall compared with long–term monthly averages, while the remaining months are below their long-term average (median of 9 mm/month). Notably, October recorded rainfall 85% below the long-term monthly average. A trend of declining rainfall is evident over the long term (1900–2016) (Fig. 1) and more recently, three of the past five years show annual rainfall totals below the long-term average (Fig. 2).

Water use

The irrigation season in the Kangaroo Flat region starts earlier than across most of the Adelaide Plains area. Maximum (extraction-related) drawdowns across the Adelaide Plains are generally recorded in March each year, but in the Kangaroo Flat region they occur around December due to a very early pumping regime from some wells. Metered groundwater extractions totalled 1241 ML in 2015–16, representing a 12% increase from the previous water-use year and 5% greater than the five-year average annual extraction (Fig. 3).

Groundwater pressure levels

A localised cone of depression in T2 groundwater pressure levels, centred in the south-western corner of the Kangaroo Flat region, forms on a seasonal basis as the result of the intensive spring/early-summer extraction regime (Fig. 4). Due to a paucity of water level data available for the T2 aquifer in December 2016, a potentiometric surface map was created using December 2015 water level data.

In the five years to 2016, three out of four monitoring wells (75%) have shown a five-year trend of declining groundwater pressure levels (Fig. 4). Declines ranged between 0.08 and 0.33 m/y, with a median of 0.14 m/y. A single well shows a rising trend in groundwater pressure level, at a rate of 0.16 m/y.

Groundwater salinity

Increasing salinity resulting from irrigation extraction is the greatest risk to T2 aquifer sustainability in the Kangaroo Flat region. Salinity increases due to lateral inflows of more-saline groundwater from the north–east are a potential long-term problem but, due to the slow rate of lateral groundwater flow in the T2 aquifer, the risk of increasing salinity from downward leakage of saline groundwater from the overlying Q4 aquifer is a greater and more-immediate threat. For example, the Q4 aquifer groundwater levels shown by well MUW035 closely match the water levels in the T2 aquifer. This suggests that the T2 and Q4 aquifers have a strong hydraulic connection in this location and consequently, pumping large volumes from the T2 aquifer is likely to induce downward leakage of high-salinity groundwater from the overlying Q4 aquifer.

In 2016, the T2 aquifer salinity ranges from 965 to 4782 mg/L with six out of 12 monitoring wells recording salinities of greater than 1500 mg/L (Fig. 5), which is the salinity threshold for most crop types. Over the past five years, MUW029 shows stable salinity, while MUW038 shows an increasing trend (Fig. 7).

More information

To determine the status of the T2 aquifer in the Kangaroo Flat region for 2016, the trends in groundwater pressure levels and salinities over the past five years (2012 to 2016, inclusive) were analysed, in contrast to the year-to-year assessments that have been used in past *Groundwater level and salinity status reports*. Please visit the Frequently Asked Questions on the *Water Resource Assessments* page on WaterConnect for more detail on the current method of evaluating the status of groundwater resources.

To view descriptions for all status symbols, please visit the *Water Resource Assessments* page on WaterConnect.

To view the *Kangaroo Flat region of the Northern Adelaide Plains PWA Groundwater Level and Salinity Status Report 2011*, which includes background information on hydrogeology, rainfall and relevant groundwater-dependent ecosystems, please visit WaterConnect.

To view or download groundwater level and salinity data from monitoring wells within the Kangaroo Flat region of the Northern Adelaide Plains PWA, please visit Groundwater Data on WaterConnect.

For further details about the Northern Adelaide Plains PWA, please see the *Water Allocation Plan for the Northern Adelaide Plains Prescribed Wells Area* on the Natural Resources Adelaide and Mount Lofty Ranges website.

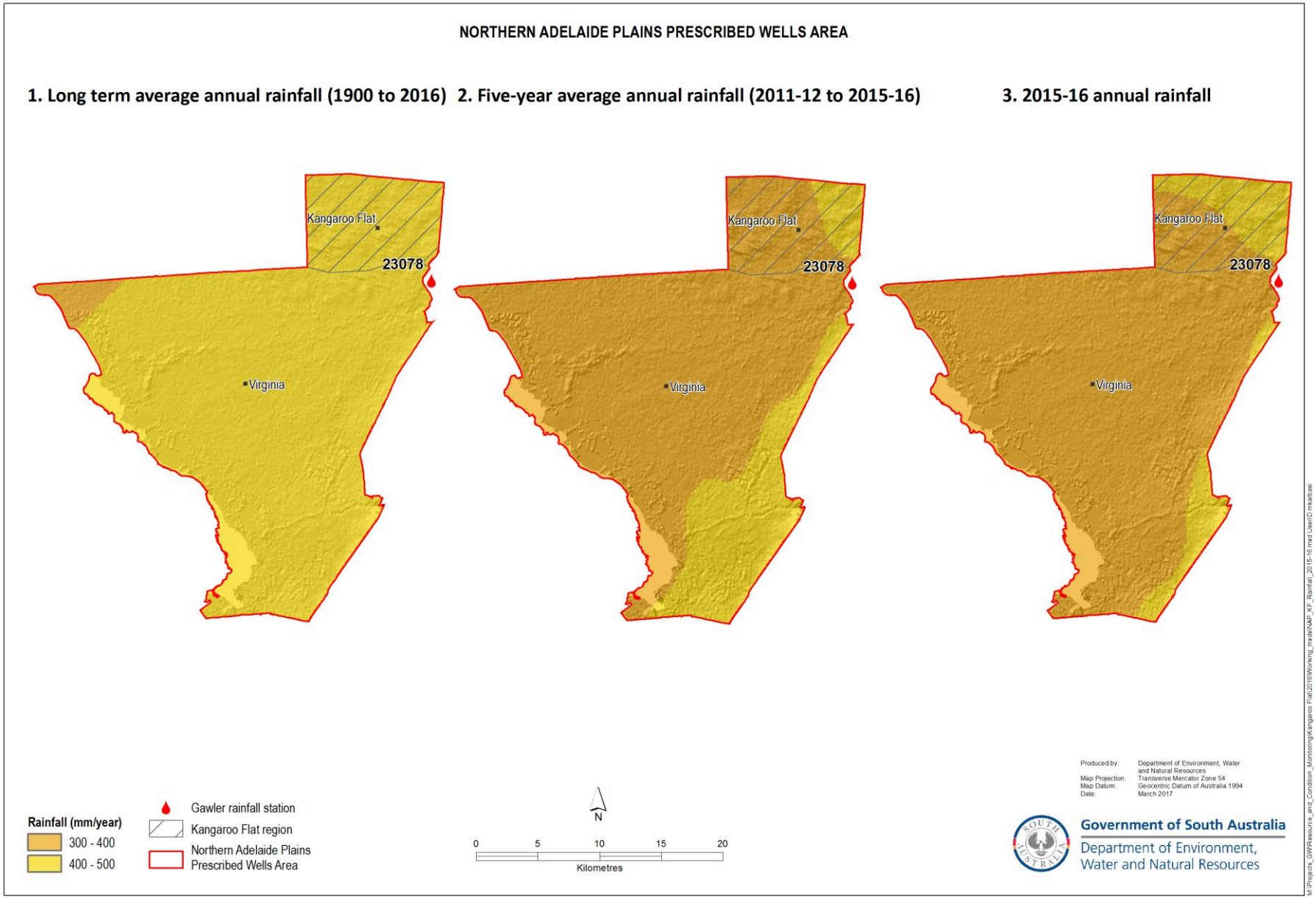


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2015–16 water-use year in the Northern Adelaide Plains PWA[1]

[1] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

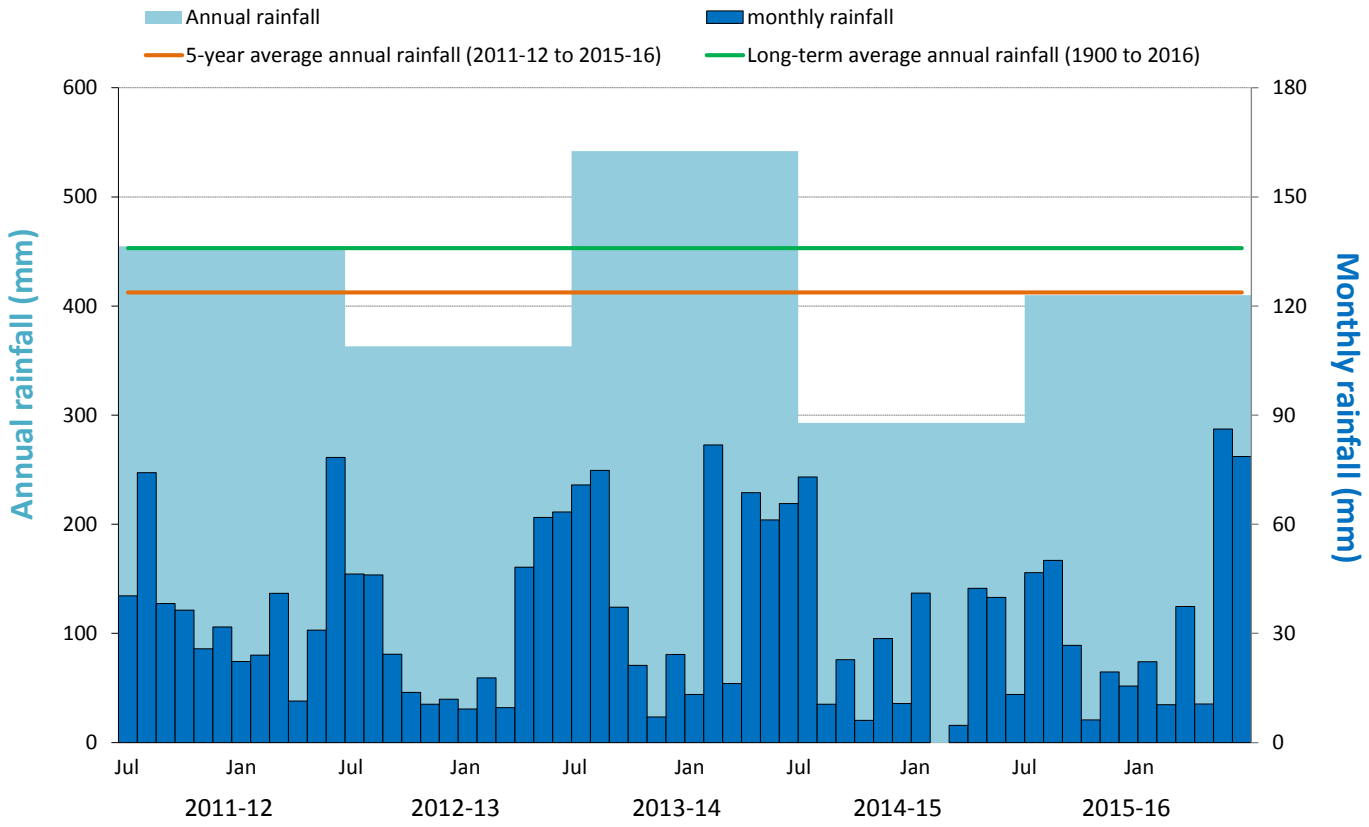


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Gawler (BoM Station 23078)[2]

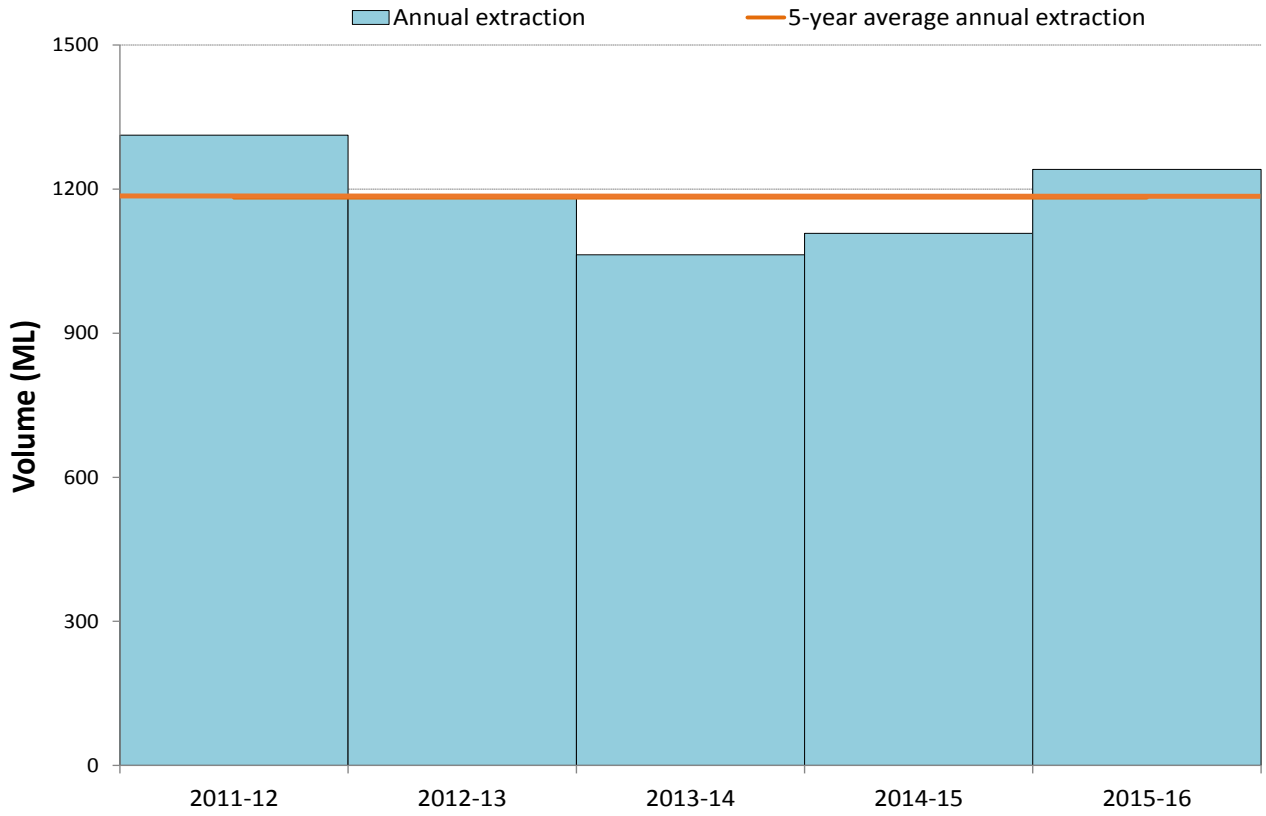


Figure 3. Metered groundwater extraction volumes for the past five water-use years, for the T2 aquifer in the Kangaroo Flat region of the Northern Adelaide Plains PWA[2]

[2] Rainfall data used in this report is sourced from the SILO Patched Point Dataset, which uses original Bureau of Meteorology daily rainfall measurements and is available online at www.longpaddock.qld.gov.au/silo.

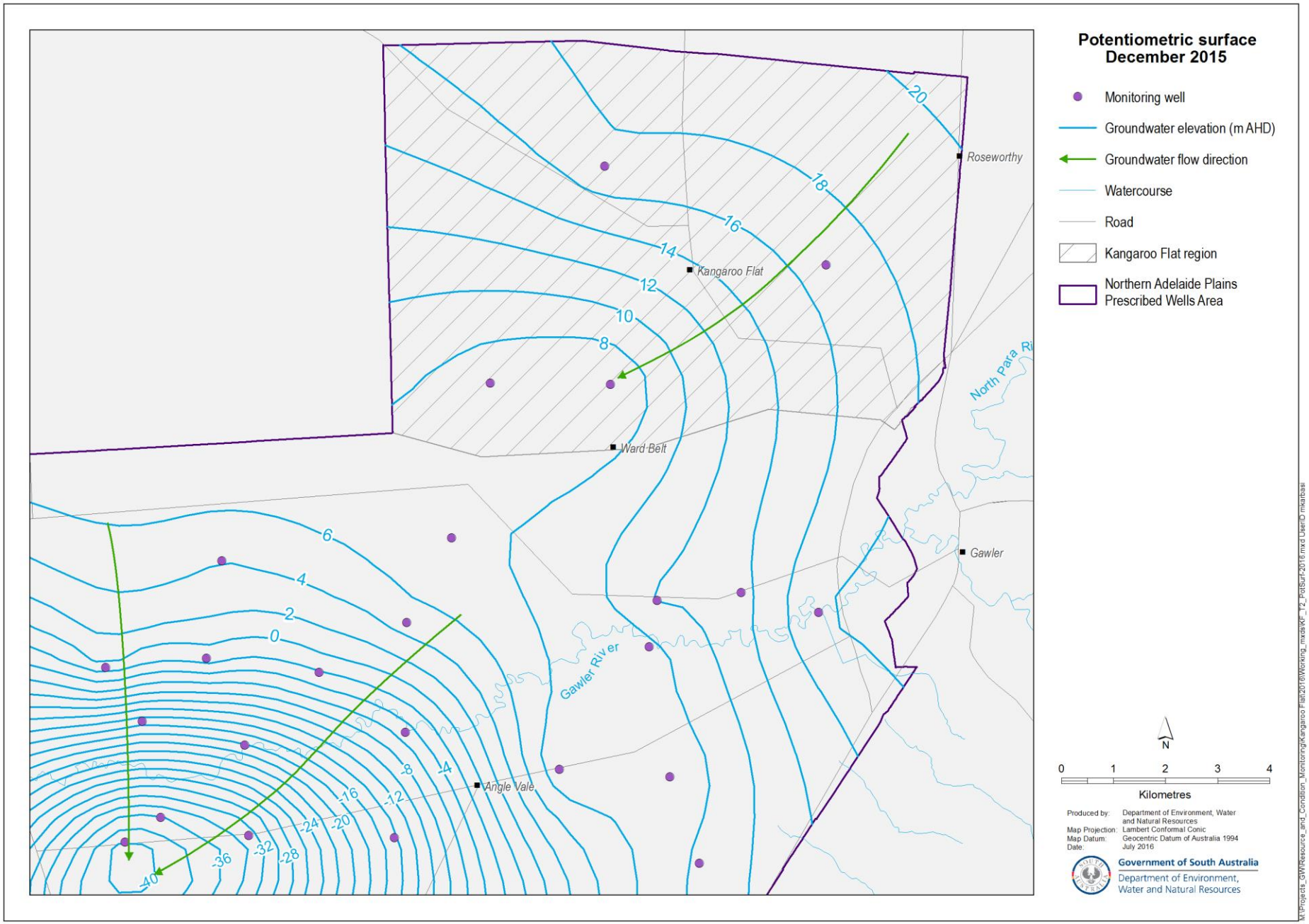


Figure 4. Potentiometric surface and direction of groundwater flow in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains PWA) in December 2015

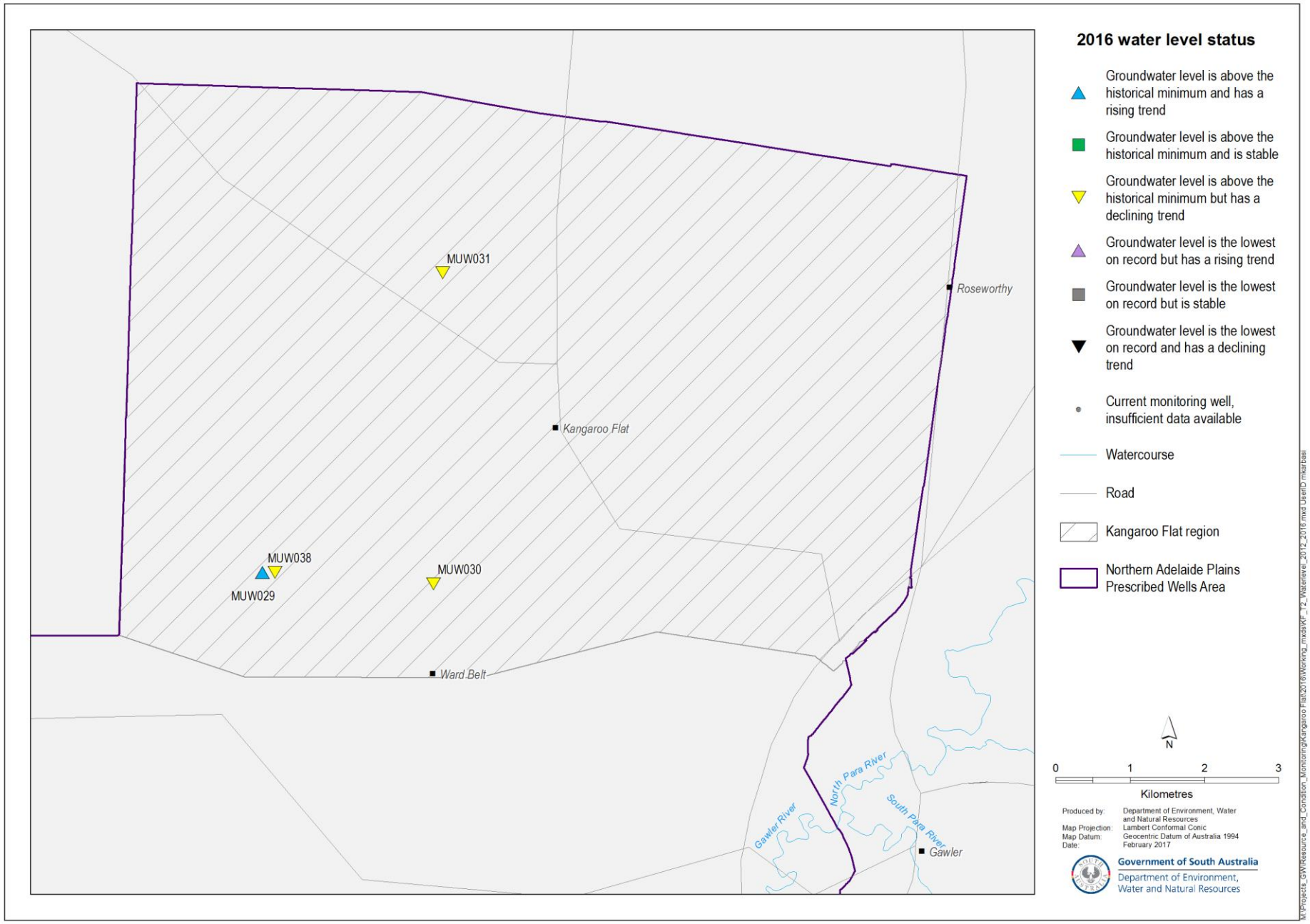


Figure 5. 2016 status of groundwater pressure levels in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains PWA), based on the five-year trend from 2012 to 2016

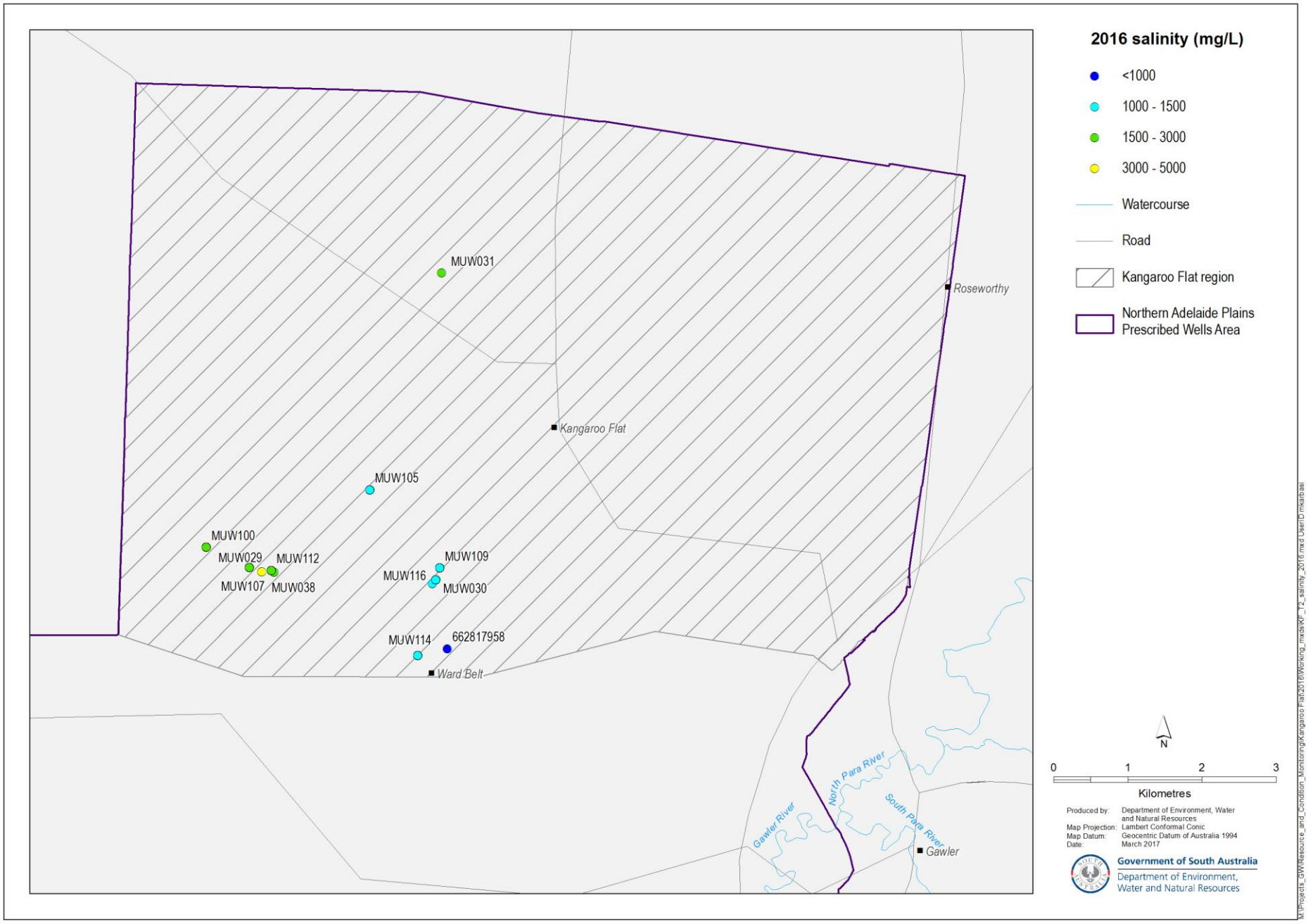


Figure 6. 2016 groundwater salinity of the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains PWA)

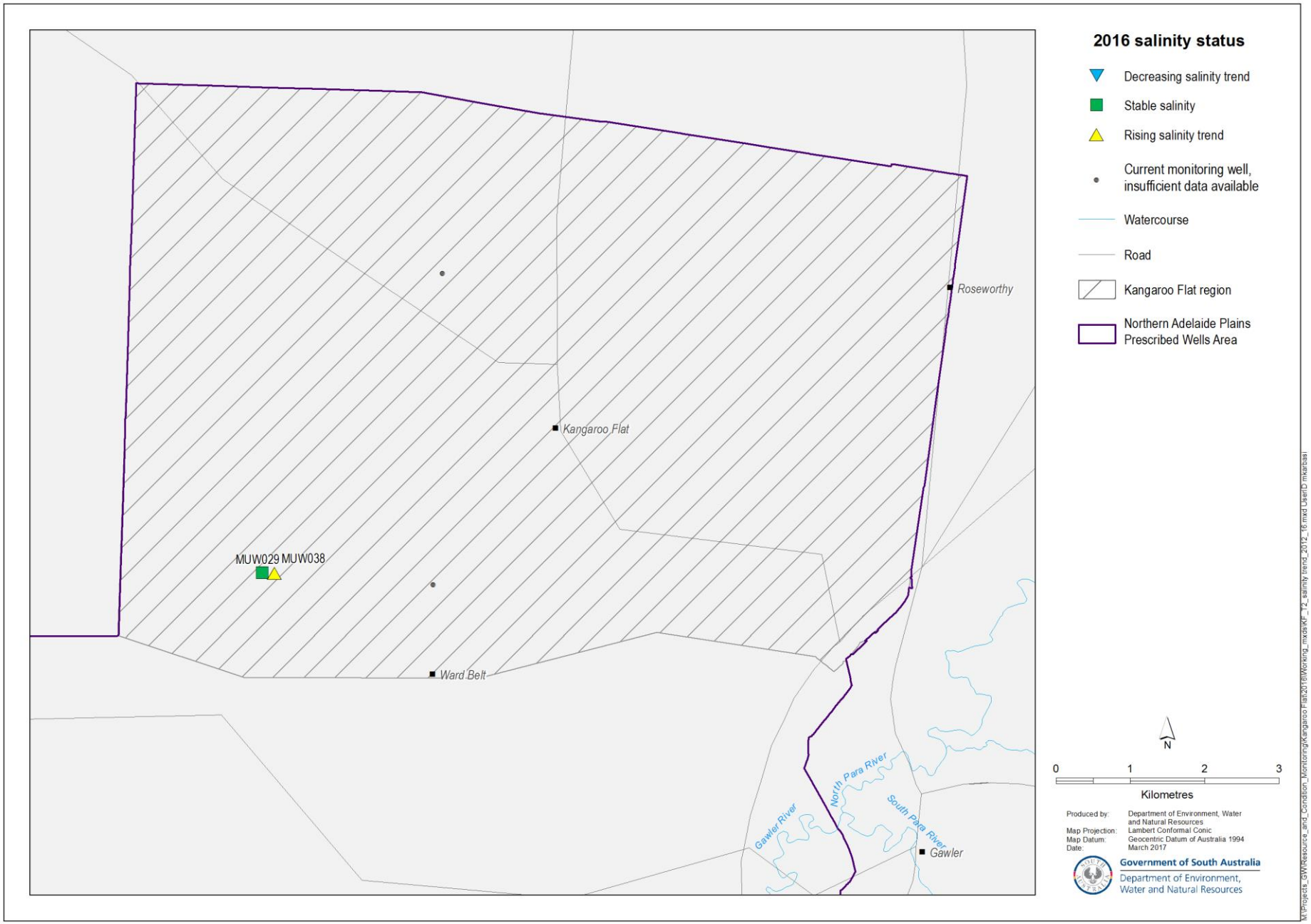


Figure 7. Status of groundwater salinities in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains PWA), based on five-year trends from 2012 to 2016

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