

Kangaroo Flat region of the Northern Adelaide Plains PWA

T2 aquifer

2015 Groundwater level and salinity status report



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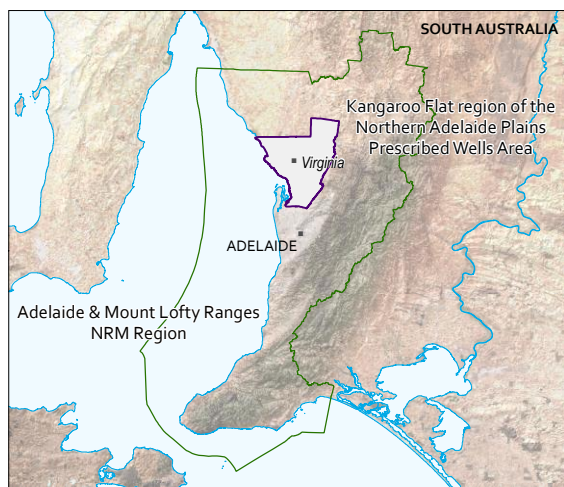
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2015 Summary



The Kangaroo Flat region encompasses an area of around 80 km² 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 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 South Australian *Natural Resources Management Act 2004*. The Kangaroo Flat region will be included in the upcoming *Water Allocation Plan for the Adelaide Plains*.

An assessment of the capacity of the groundwater resource in the Kangaroo Flat region was recently undertaken to help determine an acceptable extraction volume for the issuing of licensed allocations. Consequently, the status of this region's groundwater resources is reported

independent of the assessment undertaken across the Northern Adelaide Plains PWA.

The Kangaroo Flat region contains Quaternary and Tertiary sediments that extend to a depth of about 100 m below the 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 confined nature of the T2 aquifer, which does not receive direct recharge from incident 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 experienced above-average rainfall, this could result in less groundwater being extracted from the T2 aquifer for irrigation purposes, with resultant rises in groundwater pressure levels and reductions in salinities.

The Gawler rainfall station (BoM Station 23078) was selected as representative of rainfall across the Kangaroo Flat region (Fig. 1); 293 mm of rainfall fell in the 2014–15 water-use year, 158 mm less than the long-term average of 451 mm (1900–2015) and the lowest in the past 50 years. Despite the five-year average annual rainfall of 465 mm (2010–11 to 2014–15), which is higher than the long-term average, rainfall data show a declining trend over the past five years (Fig. 2).

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 1108 ML in 2014–15, representing a 4% increase from the previous water-use year and 2.5% less than the five-year average annual extraction (Fig. 3).

A localised cone of depression in the groundwater pressure level, 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). Marked seasonal drawdowns of up to 20 m can be seen in monitoring wells MUW029 and MUW030. In contrast, well MUW031, which is located around 5 km to the north of these two wells, shows little seasonal variation.

During the period 2000–10, MUW029 shows a slight rising trend and MUW030 and MUW031 show declining trends. In the past five years (2011–15), all three wells recorded a declining trend at the rate of 0.16, 0.13 and 0.08 m/y, respectively. The 2015 groundwater pressure level for MUW031 is the lowest on record (Fig. 5).

Rising 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 aquifers are strongly connected in this location and consequently, pumping from the T2 aquifer is likely to induce downward leakage from the Q4 aquifer.

Interpretation of long-term groundwater salinity trends is difficult due to a lack of salinity data prior to 2008. However, irrigation wells with multiple salinity readings over the past 30 years generally show a rising trend in salinity. Furthermore, an increase in salinity was recorded between 2008 and 2010, corresponding to a period of increased rates of extraction and a change in the pumping regime. From 2008, there were eight wells with salinities of less than 1500 mg/L and at times, three of these wells have fluctuated above 1500 mg/L, which is the salinity threshold for most crop types. Since 2010, salinities have stabilised or shown a decreasing trend, in response to reductions in the rate of extraction and the likely subsequent reduction in downward leakage from the Q4 aquifer. The most recent salinity data show MUW100, MUW104, and MUW113 are again above 1500 mg/L (Fig. 6).

Over the past five years, MUW108, MUW113, and MUW114 show stable salinities, while the remaining wells show a decreasing trend (Fig. 7). However, there is an ever-present risk of increasing salinity over the short term, resulting from higher rates of extraction that are likely to exacerbate the downward leakage of higher-salinity groundwater from the overlying Q4 aquifer.

To determine the status of the T2 groundwater resource in the Kangaroo Flat region for 2015, the trends in groundwater pressure level and salinity over the past five years (2011 to 2015, inclusive) were analysed. This is a new approach, 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.

The T2 aquifer of the Kangaroo Flat region of the Northern Adelaide Plains PWA has been assigned an orange status for 2015:

2015 Status



Moderate adverse trends have been observed over the past five years

The 2015 status for the T2 aquifer is based on:

- the ever-present risk of increasing salinity over the short to medium term from higher rates of extraction that are likely to exacerbate the downward leakage of higher-salinity groundwater from the overlying Q4 aquifer
- all monitoring wells recorded a five-year trend of declining groundwater pressure level and one well recorded its lowest pressure level on record in 2015.

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 Kangaroo Flat region of 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](#).

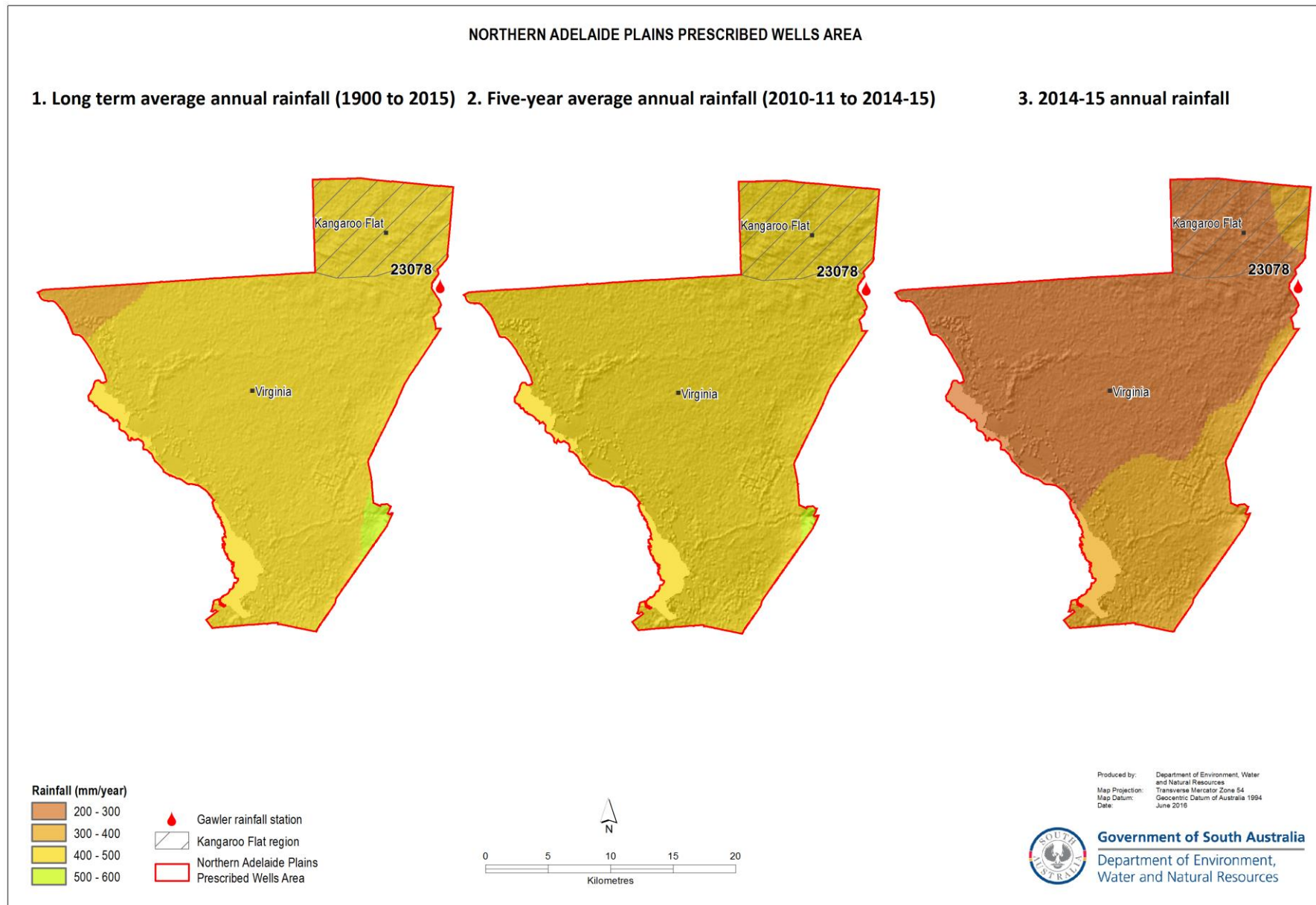


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2014–15 water-use year in the Northern Adelaide Plains Prescribed Wells Area¹

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.

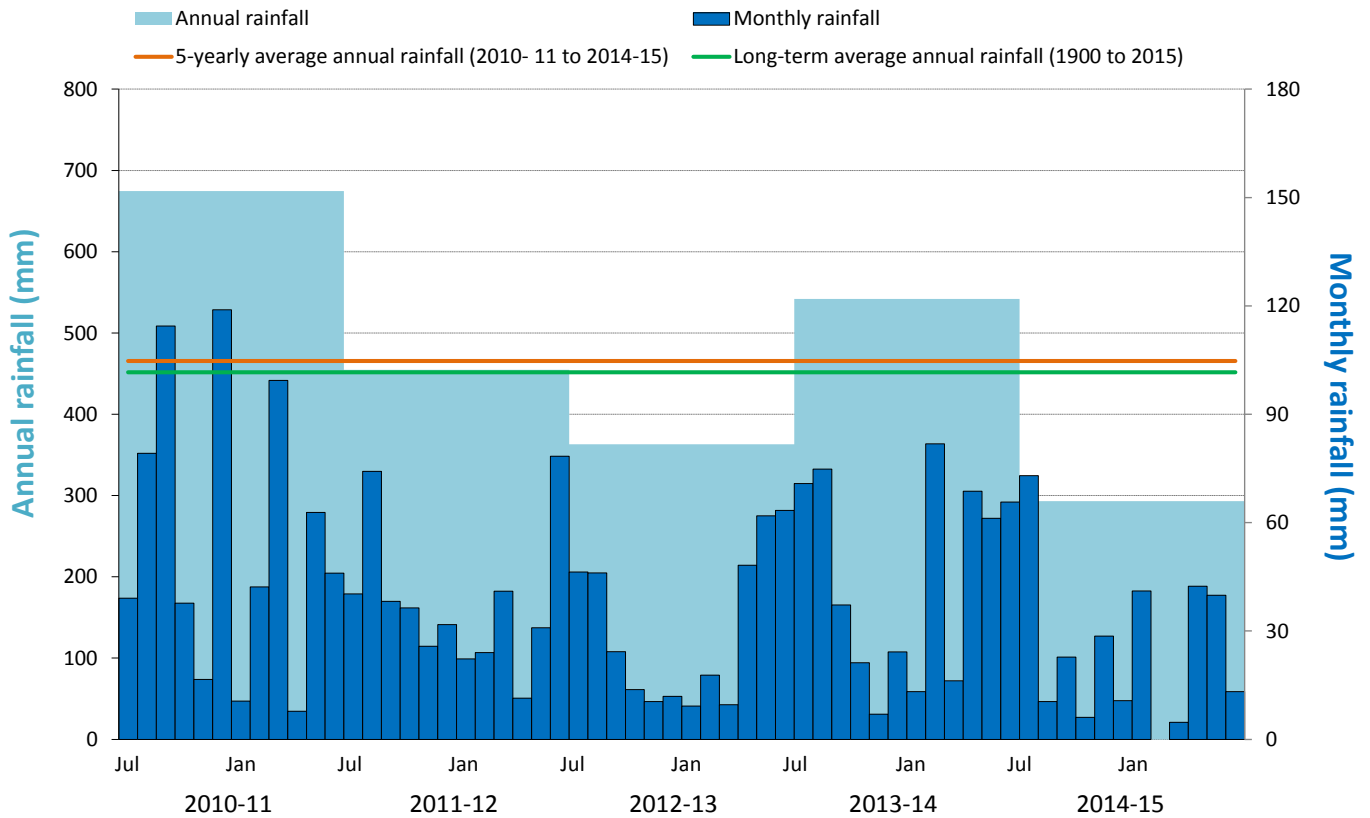


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Gawler (BoM Station 23078)²

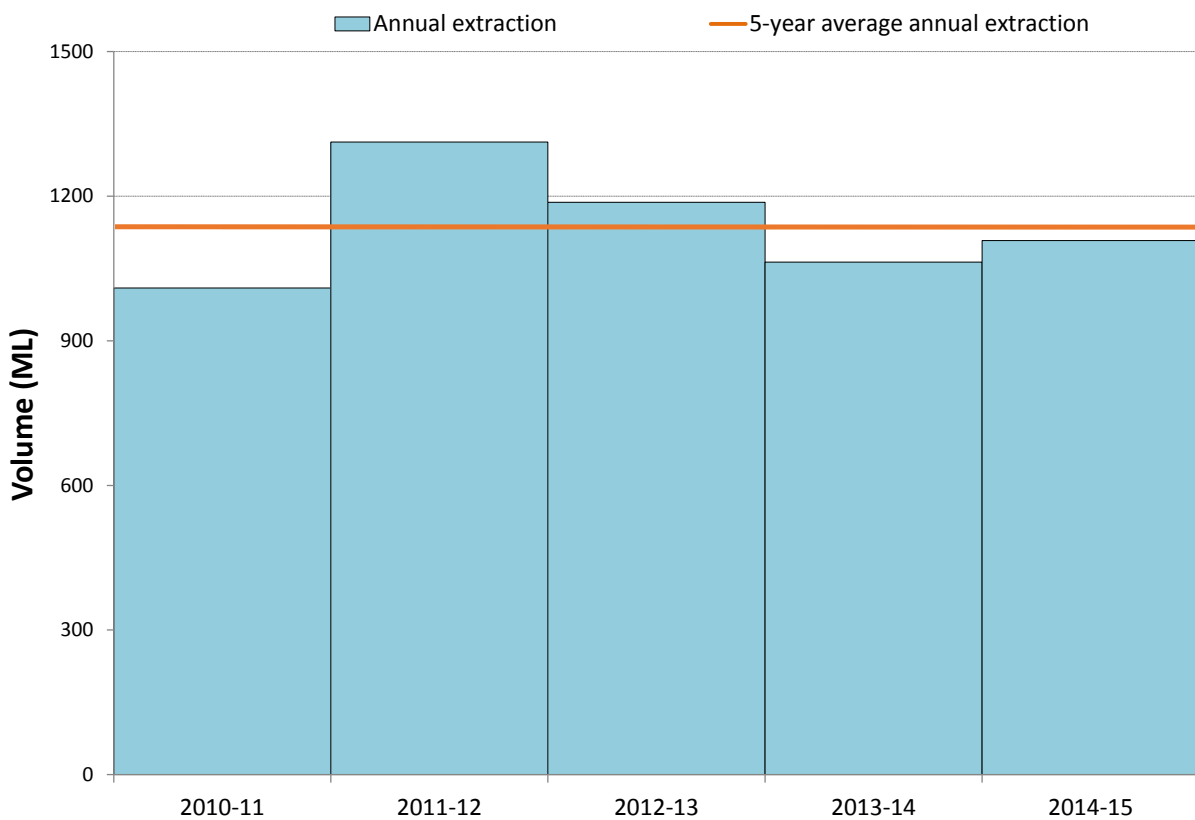


Figure 3. Metered groundwater extraction volumes for the past five water-use years, for the T2 aquifer in the Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area²

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.

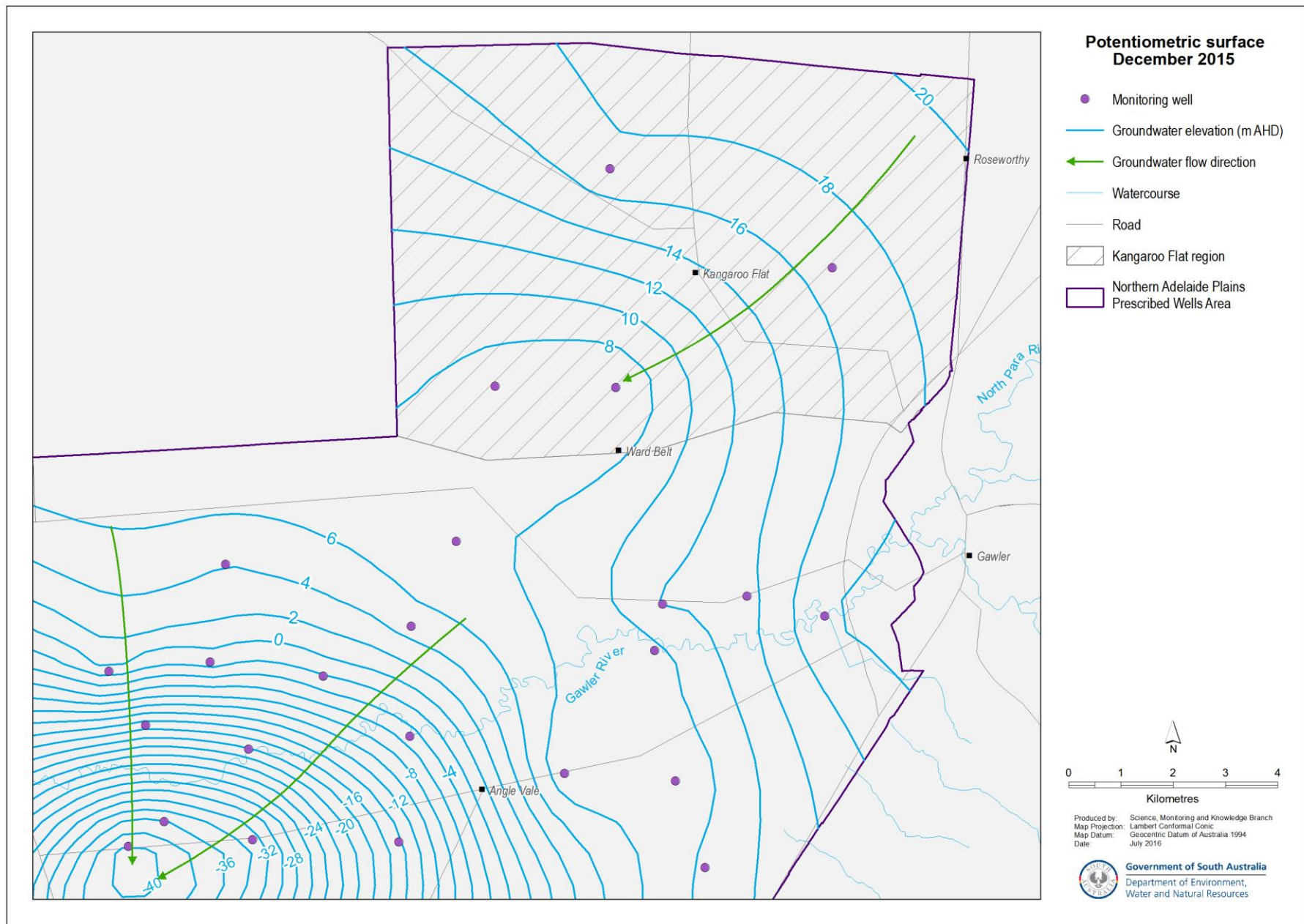


Figure 4. Potentiometric surface and direction of groundwater flow in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area) in December 2015

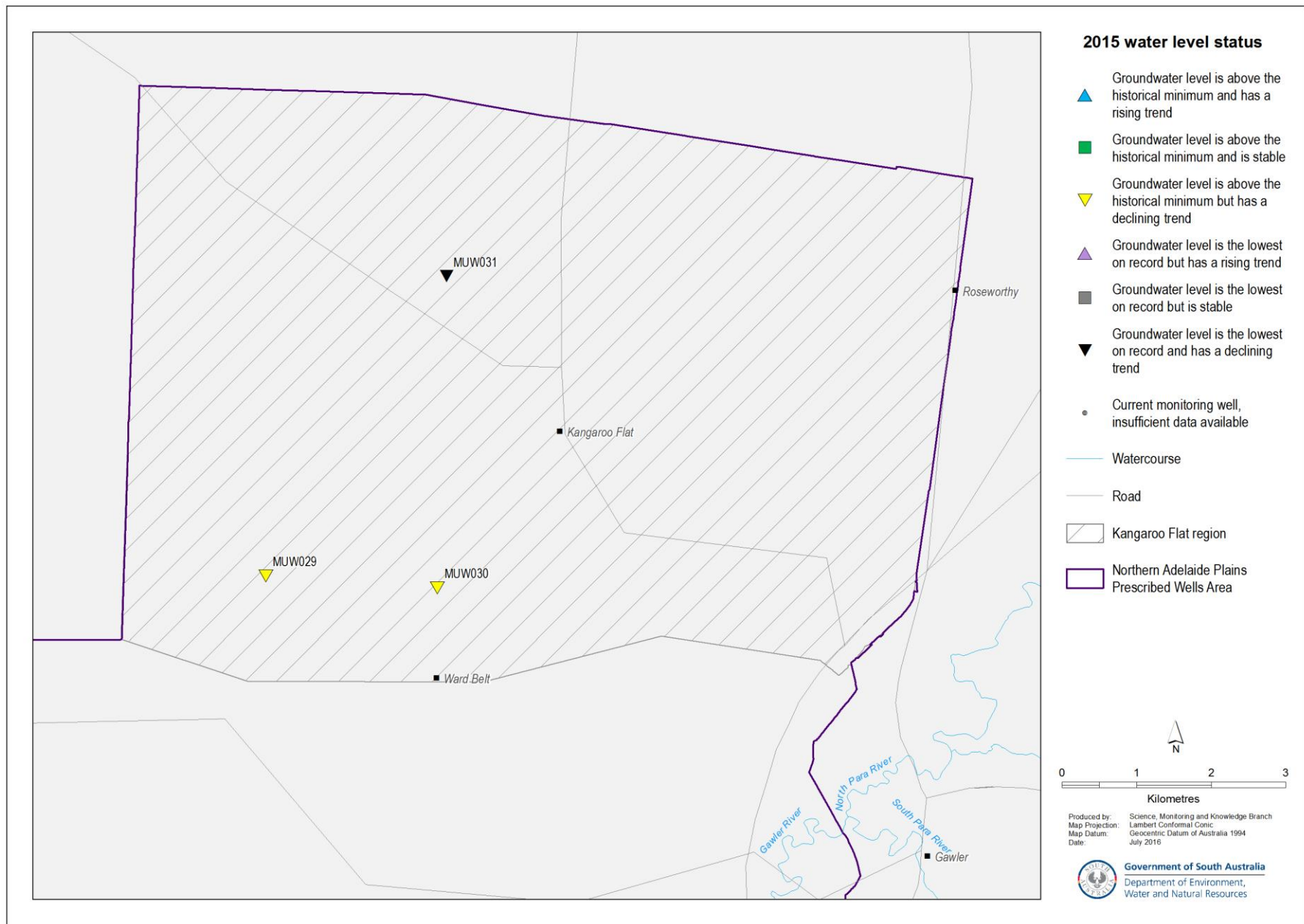


Figure 5. 2015 status of groundwater pressure level in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area) based on the five-year trend from 2011 to 2015

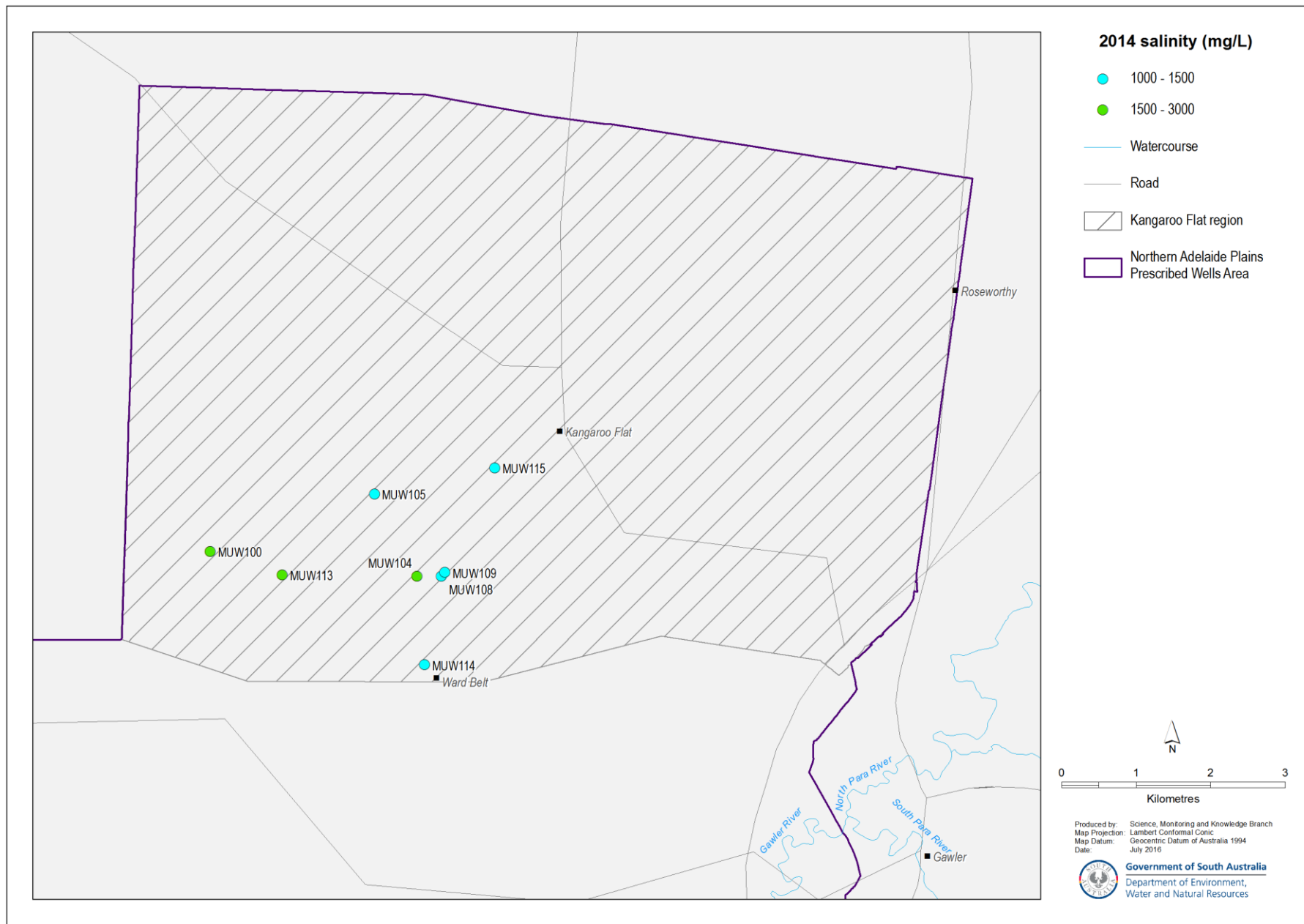


Figure 6. 2014 groundwater salinity of the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area)

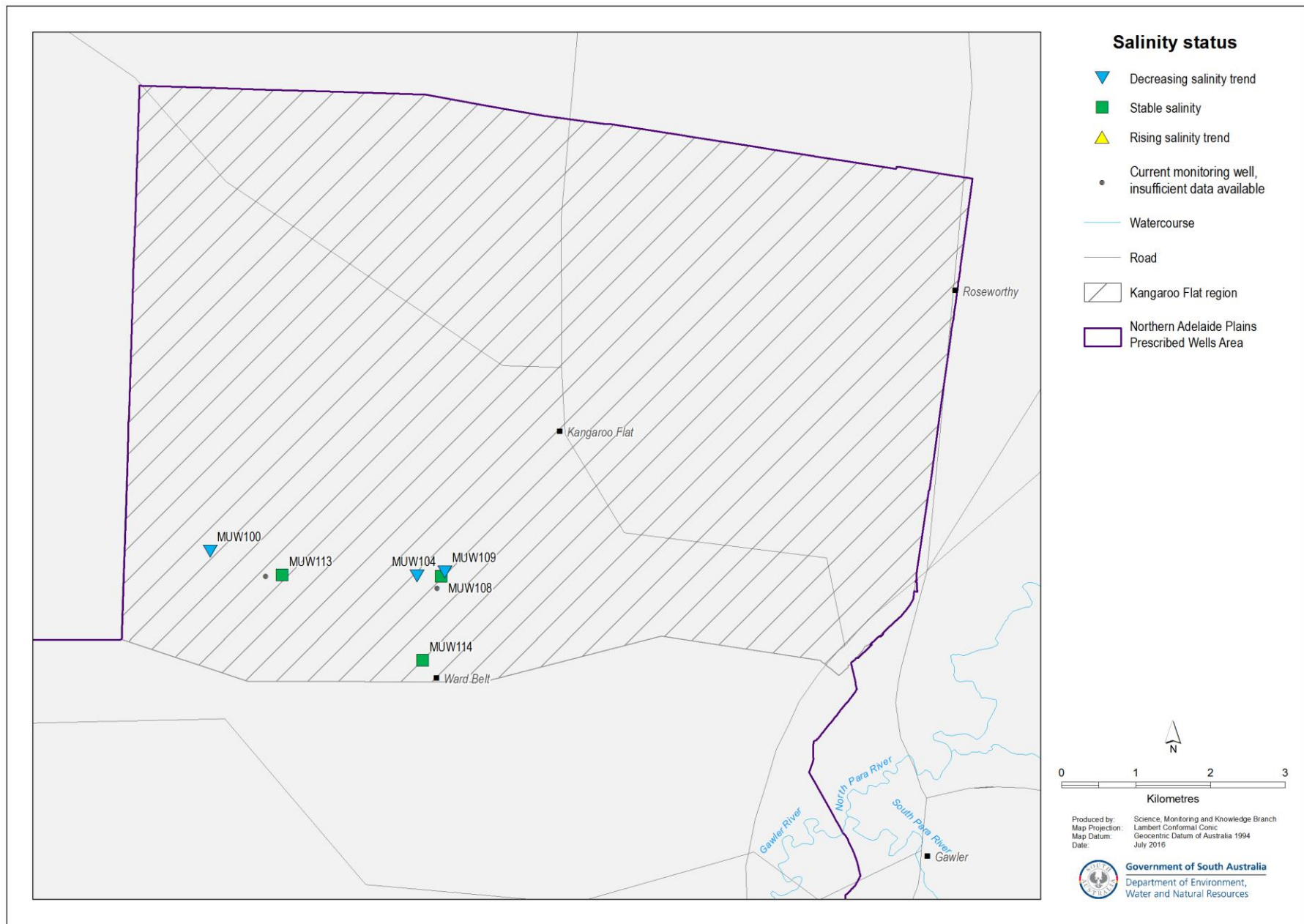


Figure 7. Status of groundwater salinities in the T2 aquifer (Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area) based on five-year trends from 2010 to 2014

