

Kangaroo Flat region of the Northern Adelaide Plains PWA

T2 aquifer

2014 Groundwater level and salinity status report



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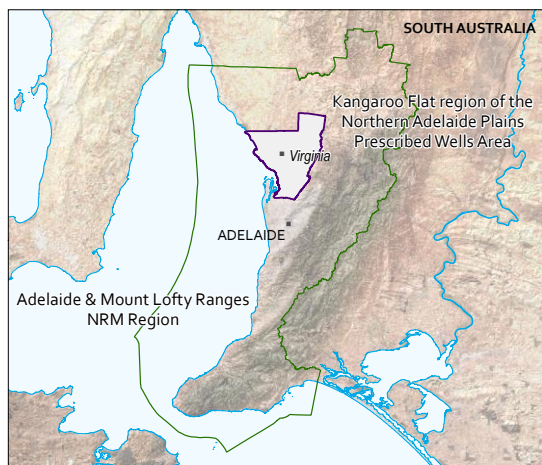
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2014 Summary



The Kangaroo Flat region encompasses an area of about 80 km² within the north-eastern corner of the Northern Adelaide Plains Prescribed Wells Area (PWA). It is located in 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 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* to provide for the sustainable management of the groundwater resources.

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 licensed allocations. Consequently, the status of the region is reported on separately from 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 hydrogeologic units: Hindmarsh Clay, the Carisbrooke Sand (Q4) aquifer, a semi-confining layer consisting of weathered Quaternary and Tertiary sediments and the confined T2 aquifer. The T2 aquifer consists of limestone and sand from the lower Port Willunga Formation and is directly overlain by the Q4 aquifer and the Hindmarsh Clay aquitard. Groundwater is extracted from only the T2 aquifer in the Kangaroo Flat region, which is the focus of this report.

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

Despite being a confined aquifer that does not receive direct recharge from rainfall, the intensity and timing of rainfall and subsequent extraction practices can have an effect on groundwater levels and salinity in the T2 aquifer. 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 and therefore smaller declines in groundwater levels and stable or improving salinity.

Data from the Gawler rainfall station (number 23078) were chosen for the analysis of rainfall in 2014. In 2014, the total annual rainfall was 458 mm, only 2 mm more than the long-term average annual rainfall (1889–2014) of 456 mm and 13 mm more than 2013. The monthly data for 2014 indicates that the region experienced significantly above-average rainfall in February, whereas rainfall was well below average from August to October and in December (Fig. 1).

Licensed groundwater extractions from the T2 aquifer have been metered since 1999. The irrigation season in the Kangaroo Flat region starts earlier than the rest of the Adelaide Plains area, with maximum drawdowns due to extractions reached in December rather than March. Extraction volumes have varied since metering commenced, with a general increase in extraction from the 2005–06 to 2008–09 irrigation seasons. Since 2008–09, extraction steadily decreased until the 2011–12 season when extraction increased by 23% from the previous year. Metered groundwater extractions totalled 1063 ML¹ in 2013–14, a decrease of 11% from the previous water-use year (Fig. 2).

There is a localised depression in groundwater elevation centred in the south-eastern corner of the Kangaroo Flat region that occurs on a seasonal basis and can be seen through the analysis of December 2014 groundwater elevation data (Fig. 3). This is most likely the result of the intensive extraction regime that typically occurs in this region during spring/early summer. Between 2013 and 2014 there was an increase in drawdown between Kangaroo Flat and Ward Belt, which may increase downward leakage of saline water from the overlying Q4 aquifer.

There are three observation wells that monitor water levels of the T2 aquifer in the Kangaroo Flat region (Fig. 4). Wells MUW029 and MUW030 indicate significant seasonal drawdowns due to irrigation, however, water levels generally recover after the irrigation

¹ The licensed groundwater use and managed aquifer recharge volumes for the 2013–14 water-use year are based on the best data available as of February 2014 and may be subject to change, as some extraction volumes are in the process of being verified.

season, indicating fairly stable long-term trends. In contrast, well MUW031, which is located to the north of the other two observation wells, does not display significant seasonal variations and has recorded a long-term decline in the maximum recovered water level of approximately one metre between 2002 and 2009, but the level appears to have stabilised since 2009.

In 2014, well MUW029 recorded a rise in the maximum recovered groundwater level of 0.24 m. Negligible change in water level was recorded in wells MUW030 and MUW031, where the change in maximum recovered water level between 2013 and 2014 was less than 0.1 m.

Rising salinity resulting from irrigation extraction is identified as the greatest risk to sustainability in the Kangaroo Flat region. Salinity increases due to lateral inflows of more saline groundwater from the north-east are a potential problem over the long term, but due to the generally slow rate of groundwater movement, the salinity risk from downward leakage of saline groundwater from the overlying Q4 aquifer is considered greater and more immediate. For example, the water levels measured in two observation wells in the Q4 aquifer continue to closely mirror the levels in the T2 aquifer (e.g. MUW035 in Figure 4). This indicates that the aquifers are closely connected in these locations, such that pumping from the T2 aquifer is likely to induce some leakage from the Q4 aquifer.

Irrigation wells with multiple salinity readings over the past 30 years indicate an overall increase in salinity. However, a lack of salinity monitoring before 2008 makes interpretation of any historical groundwater salinity trends difficult. A notable increase in salinity was recorded between 2008 and 2010, corresponding to a period of heightened extraction and a change in the pumping regime to an earlier and more prolonged irrigation season. At the start of 2008, there were 8 monitored wells with salinity levels below 1500 mg/L and at times in recent years, three of these wells have seen levels fluctuate above 1500 mg/L, the maximum salinity concentration recommended for most crop types. Since 2010, salinity trends have stabilised or decreased in response to the decrease in extraction and the accompanying likely reduction in downward leakage from the overlying, more saline Q4 aquifer.

Salinity monitoring of the T2 aquifer was undertaken for eight licensed extraction wells in early 2014, providing an indication of salinity levels at the end of the 2013–14 irrigation season. The salinity of the T2 aquifer ranged from 1016 to 1815 mg/L, with three wells recording a salinity of more than 1500 mg/L (Fig. 5).

The T2 aquifer of the Kangaroo Flat region of the Northern Adelaide Plains PWA has been assigned an orange status for 2014:

2014 Status



“Significant adverse changes, indicating high risk to the resource in the short to medium term”

This means that significant adverse changes in resource status have been observed over the 12-month reporting period. If these conditions were to continue, it is likely to lead to negative impacts on the beneficial use of the resource within 5 to 10 years.

The 2014 status for the T2 aquifer in the Kangaroo Flat region is supported by:

- an increase in the seasonal drawdown when compared to 2013 data, which may increase downward leakage of saline water from the overlying Q4 aquifer. There is an ever-present risk of salinisation of the resource over the course of a few years from higher rates of extraction that exacerbate the downward leakage of more saline groundwater from the overlying Q4 aquifer.

To view descriptions for all status symbols, please visit [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 observation 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](#).

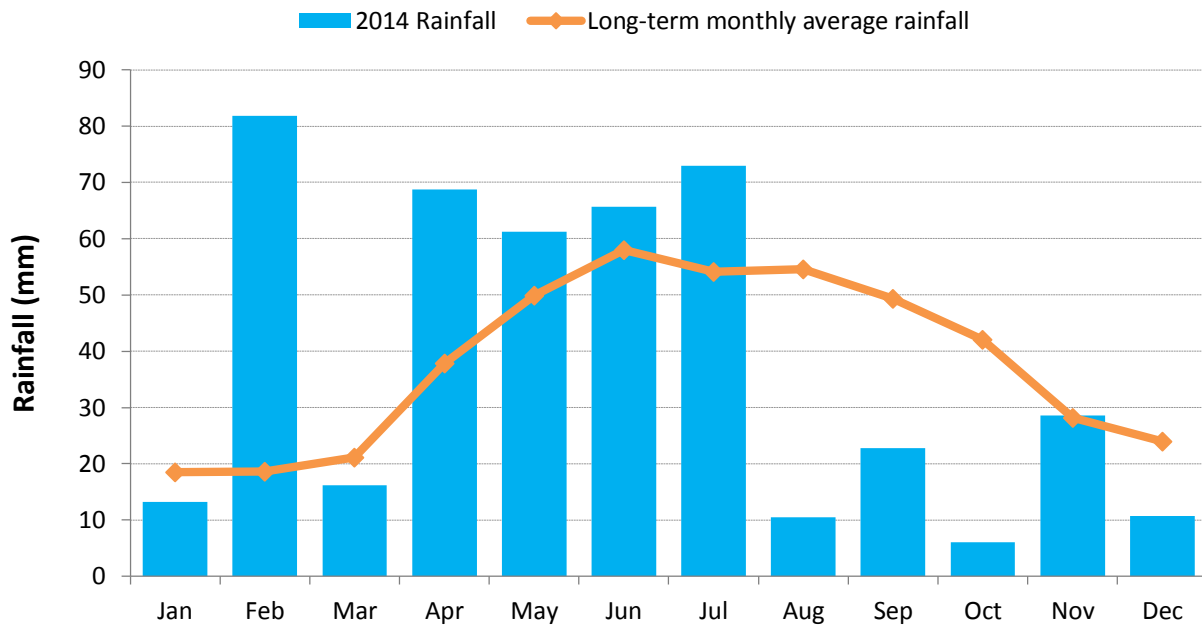


Figure 1. Monthly rainfall (mm) for 2014 and the long-term average monthly rainfall (mm) at the Gawler rainfall station (number 23078)² in the Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area

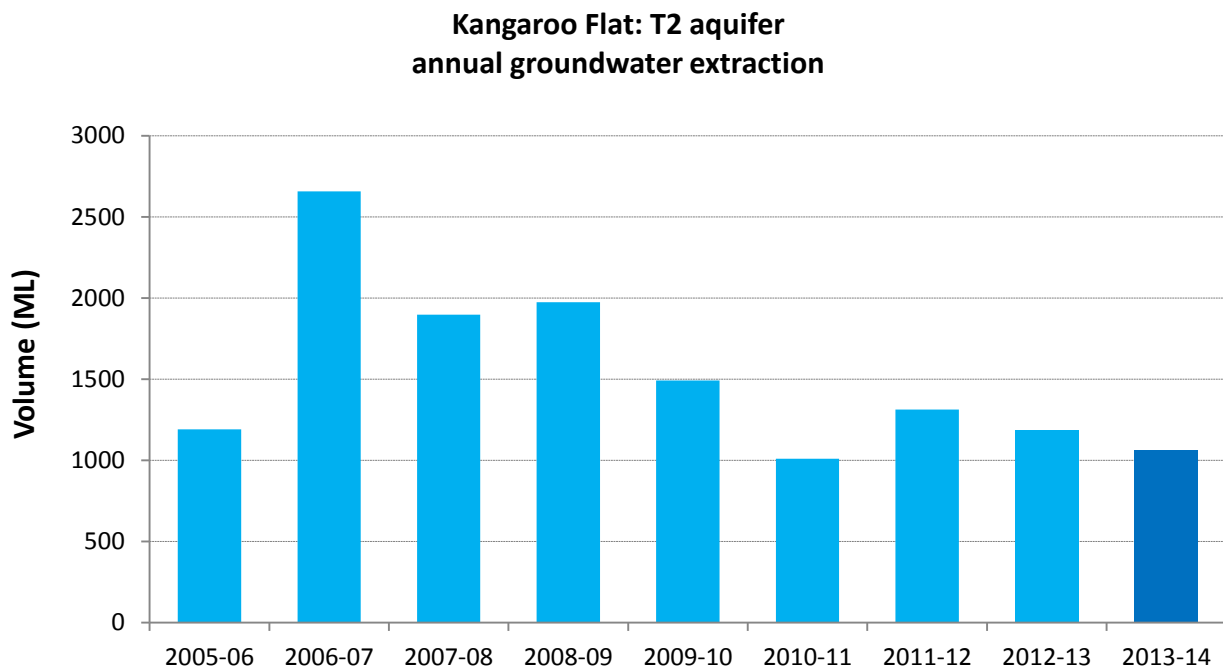


Figure 2. Historical groundwater use for the confined T2 aquifer in the Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area

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.

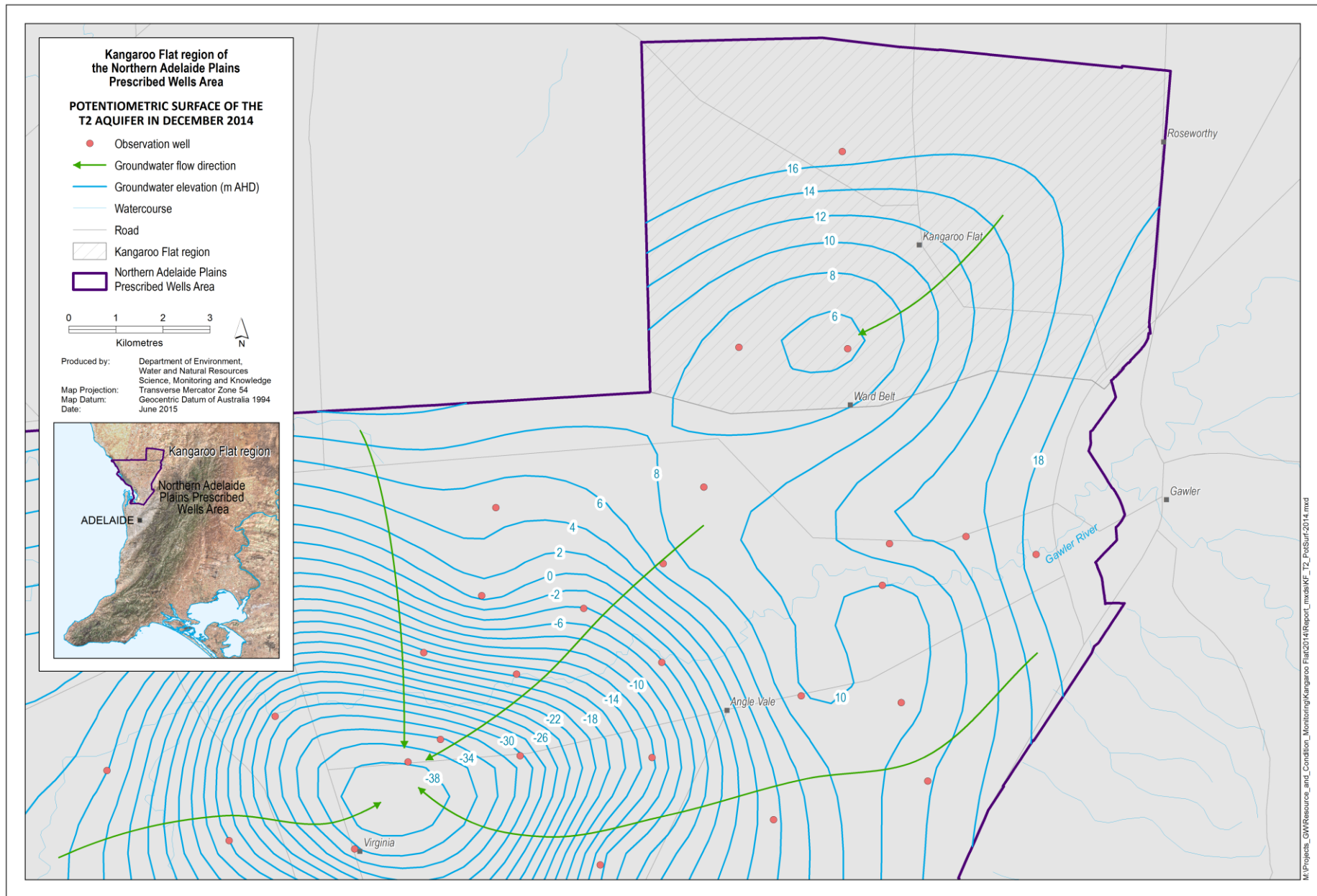


Figure 3. Potentiometric surface and direction of groundwater flow in T2 aquifer of the Kangaroo Flat region in the Northern Adelaide Plains Prescribed Wells Area

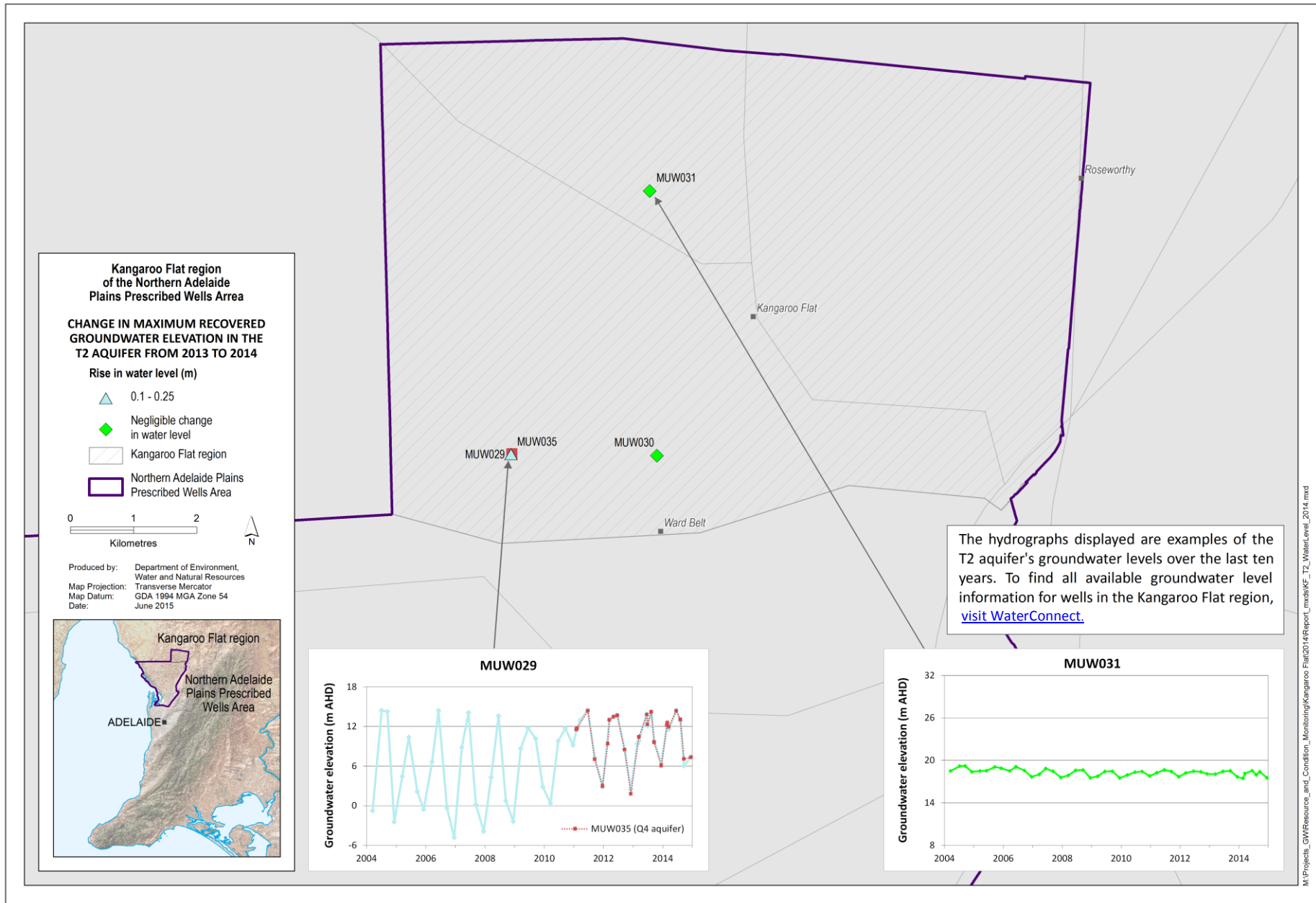


Figure 4. Overall changes in maximum groundwater levels in the T2 aquifer of the Kangaroo Flat region in the Northern Adelaide Plains Prescribed Wells Area

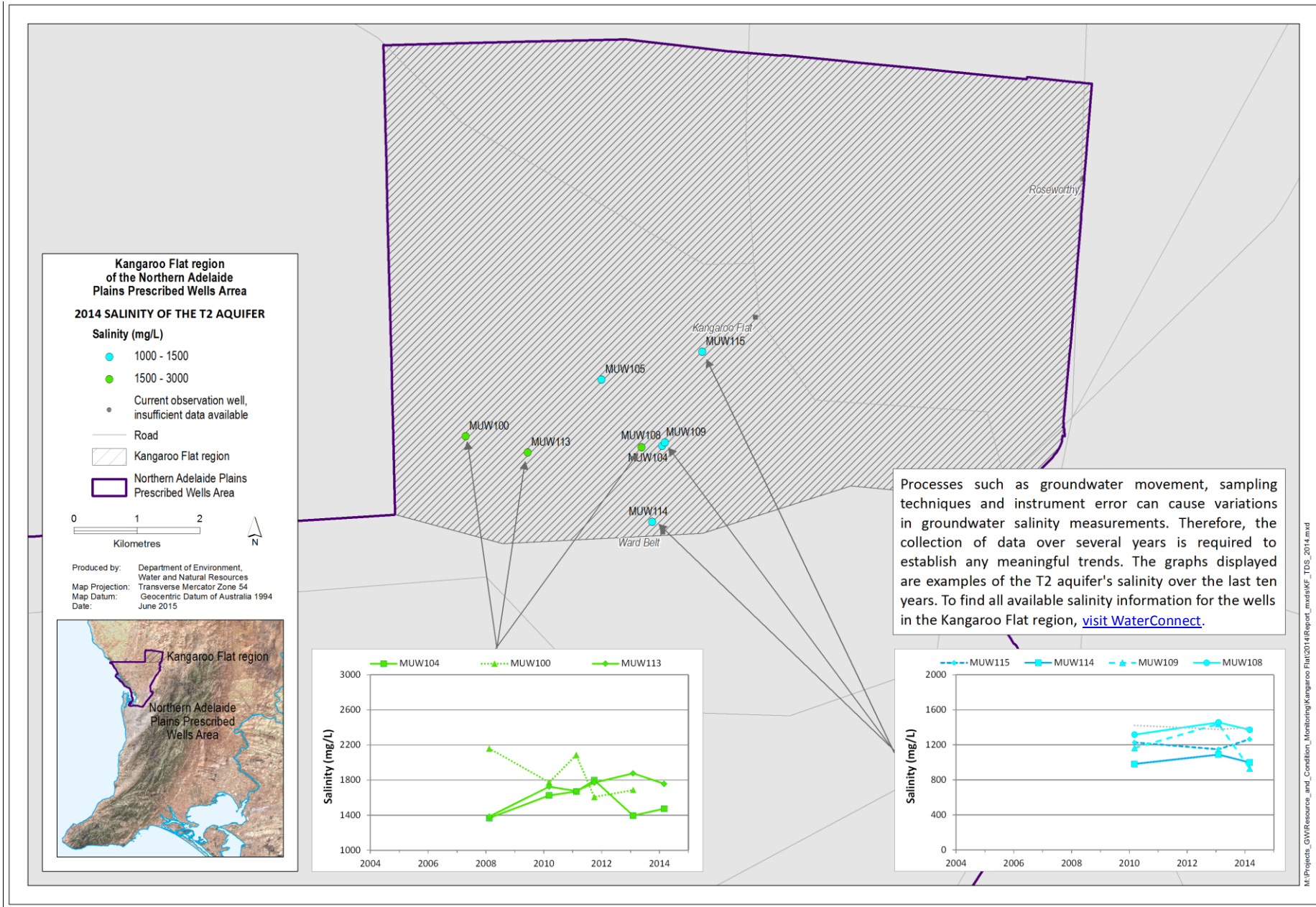


Figure 5. Groundwater salinity of the T2 aquifer of the Kangaroo Flat region of the Northern Adelaide Plains Prescribed Wells Area