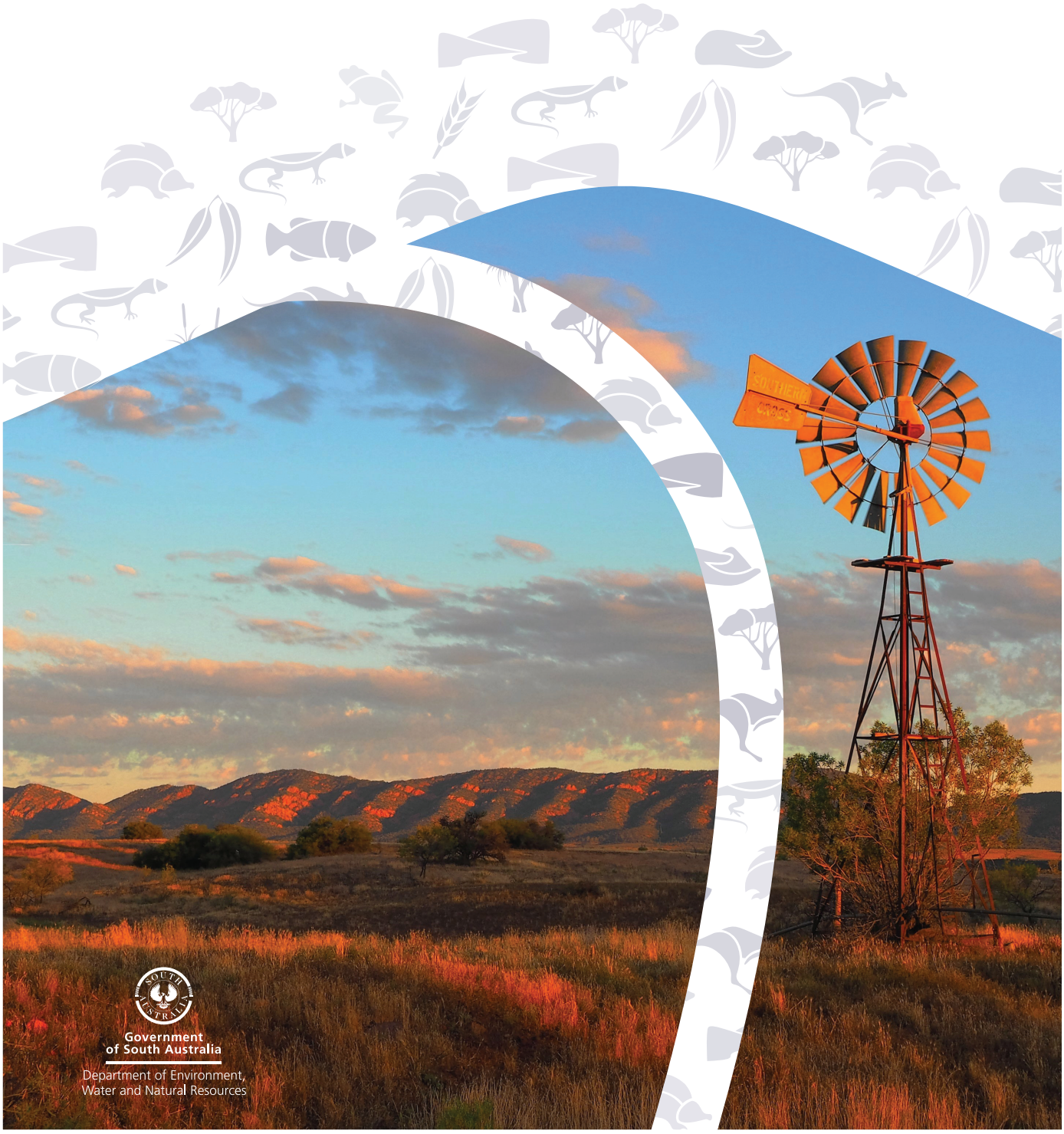
Marne Saunders PWRA
Fractured rock aquifer

2016 Groundwater level and salinity status report



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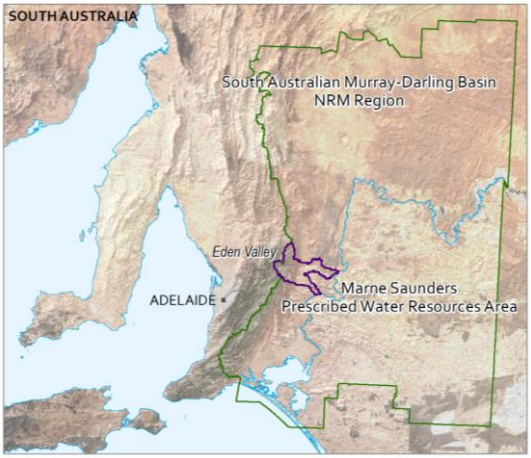
Regional setting



The Marne Saunders Prescribed Water Resources Area (PWRA) is located within the South Australian Murray-Darling Basin Natural Resources Management Region and lies on the eastern side of the Mount Lofty Ranges (MLR), approximately 60 km north-east of Adelaide. It is a regional-scale resource for which groundwater, surface water and watercourse water are prescribed under South Australia's *Natural Resources Management Act 2004*. A water allocation plan provides for sustainable use of the water resources.

The Marne Saunders PWRA consists of two tributary catchments of the River Murray and can be divided into two distinct groundwater regions: the 'hills zone' to the west (the focus of this report) and the 'plains zone' in the east. The hills zone comprises the consolidated basement rock of the MLR, which is comprised of micaceous and feldspathic sandstones and siltstones of the Cambrian-aged Kanmantoo Group. The metamorphic rocks form a fractured rock aquifer that is generally tight and impermeable with few fractures and joints, within which groundwater is stored and transmitted; consequently, wells are typically low yielding (around 2 L/s).

The movement of groundwater within the catchment generally follows topographic contours, generally recharging at high elevation before discharging to streams that are situated lower in the landscape. Also, groundwater flows eastward from recharge zones in the MLR before discharging to the lower-lying sedimentary aquifers of the plains zone. Recharge to the elevated fractured rock aquifer of the hills zone occurs by rainfall percolation through the soil profile or exposed bedrock.

Trends in groundwater levels and salinity in the fractured rock aquifer of the Marne Saunders PWRA are primarily climate driven: below-average rainfall results in a reduction in recharge to the aquifer. Below-average summer rainfall can also result in increasing irrigation extractions, and these two elements can cause the groundwater levels to fall and salinity to increase. Conversely, increases in rainfall may result in increases in recharge, decreases in irrigation extractions and groundwater levels may rise and salinity may stabilise or decrease.

2016 Status

The fractured rock aquifer of the Marne Saunders PWRA has been assigned a green status for 2016:

2016 Status  Positive trends have been observed over the past five years

The 2016 status for the fractured rock aquifer is based on:

- most monitoring wells (64%) show a five-year trend of rising groundwater levels.

Rainfall

Within the Marne Saunders PWRA, rainfall is highest in the hills zone at the western edge of the area, with a sharp gradient of declining rainfall towards the east due to the rain-shadow effect of the Mount Lofty Ranges (Fig. 1). In the 2015–16 water-use year, the Mount Pleasant rainfall station (BoM station 23737) recorded 535 mm of rainfall. This is 20% below the long-term annual average of 665 mm (1900–2016), and 11% below the five-year average annual rainfall of 602 mm (2011–16). In the 2015–16 water use year, eight months recorded below their respective long-term monthly average (median of 53%), while March and May recorded rainfall which is markedly greater than their respective long-term monthly average (Fig. 2). A trend of declining rainfall is evident over the long term (1900–2016) (Fig. 1).

Water use

Licensed groundwater extractions totalled 504 ML[1] for the 2015–16 water-use year. This is 106 ML (27%) more than the volume extracted in the previous water-use year[2] and 109 ML (28%) above the five-year average annual extraction (Fig. 3). Rates of extraction show an inverse relationship with average annual rainfall (Figs 2 and 3).

Groundwater levels

Due to the variable nature of the unconfined FRA, groundwater level responses to changing stressors can be unpredictable and irregular. In the five years to 2016, most monitoring wells (64%) recorded a rising trend in groundwater level, at rates ranging from 0.05 to 1.65 m/y with a median of 0.35 m/y (Fig. 4), and these wells are located toward the western boundary of the PWRA. A declining trend is shown by the remaining wells (36%), with one observation well showing its lowest level on record. Rates of decline in water levels range between 0.02 and 0.53 m/y, with a median of 0.25 m/y. These wells are concentrated toward the north-western extent of the PWRA.

Groundwater salinity

Each year since 2015, irrigators in the Marne Saunders PWRA have submitted groundwater samples from their irrigation wells to the Department of Environment, Water and Natural Resources for salinity testing. The increasing coverage of salinity measurements in the area will greatly assist in assessing long-term changes in groundwater salinity and its spatial distribution. To ensure these salinity data meet Quality Assurance standards, annual measurements over four to five years will be required from each well. Once validated, salinity data will be reported in groundwater level and salinity status reports[3].

Groundwater salinity can be highly variable in fractured rock aquifers. In 2016, salinities in the Marne Saunders FRA range from 1058 to 5700 mg/L. Most salinity wells (76%) show salinities between 1500 and 3000 mg/L, 18% are less than 1500 mg/L and 6% greater than 3000 mg/L. Groundwater salinity was not regularly measured in the past for the fractured rock aquifer of Marne Saunders PWRA and as such, due to the paucity of salinity data for completing a five-year trend analysis, salinity has not been used when assessing the status of the resource in this report.

[1] The licensed groundwater extraction volume for the 2015–16 water-use year is based on the best data available as of March 2017 and may be subject to change, as some extraction volumes are in the process of being verified.
[2] As part of the ongoing process of updating DEWNR's monitoring network database, well construction details (e.g. screen interval and production zones) have been reviewed and some monitoring wells have been re-assigned to different aquifers. Consequently, 2014–15 licensed groundwater extraction volumes for the fractured rock aquifer have been re-calculated based on the updated aquifer assignments.
[3] The salinity data collected from irrigation wells can be viewed at Groundwater Data or via WaterConnect.

More information

To determine the status of the fractured rock aquifer of Marne Saunders PWRA for 2016, the trend in groundwater levels 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 *Marne Saunders PWRA Groundwater Level and Salinity Status Report 2011*, which includes background information on hydrogeology, rainfall and relevant groundwater-dependent ecosystems, please visit the *Water Resource Assessments* page on WaterConnect.

To view or download groundwater level and salinity data from observation wells within the Marne Saunders PWRA, please visit Groundwater Data on WaterConnect.

For further information about the Marne Saunders PWRA, please see *The Water Allocation Plan for the Marne Saunders Prescribed Water Resources Area* on the Natural Resources SA Murray-Darling Basin website.

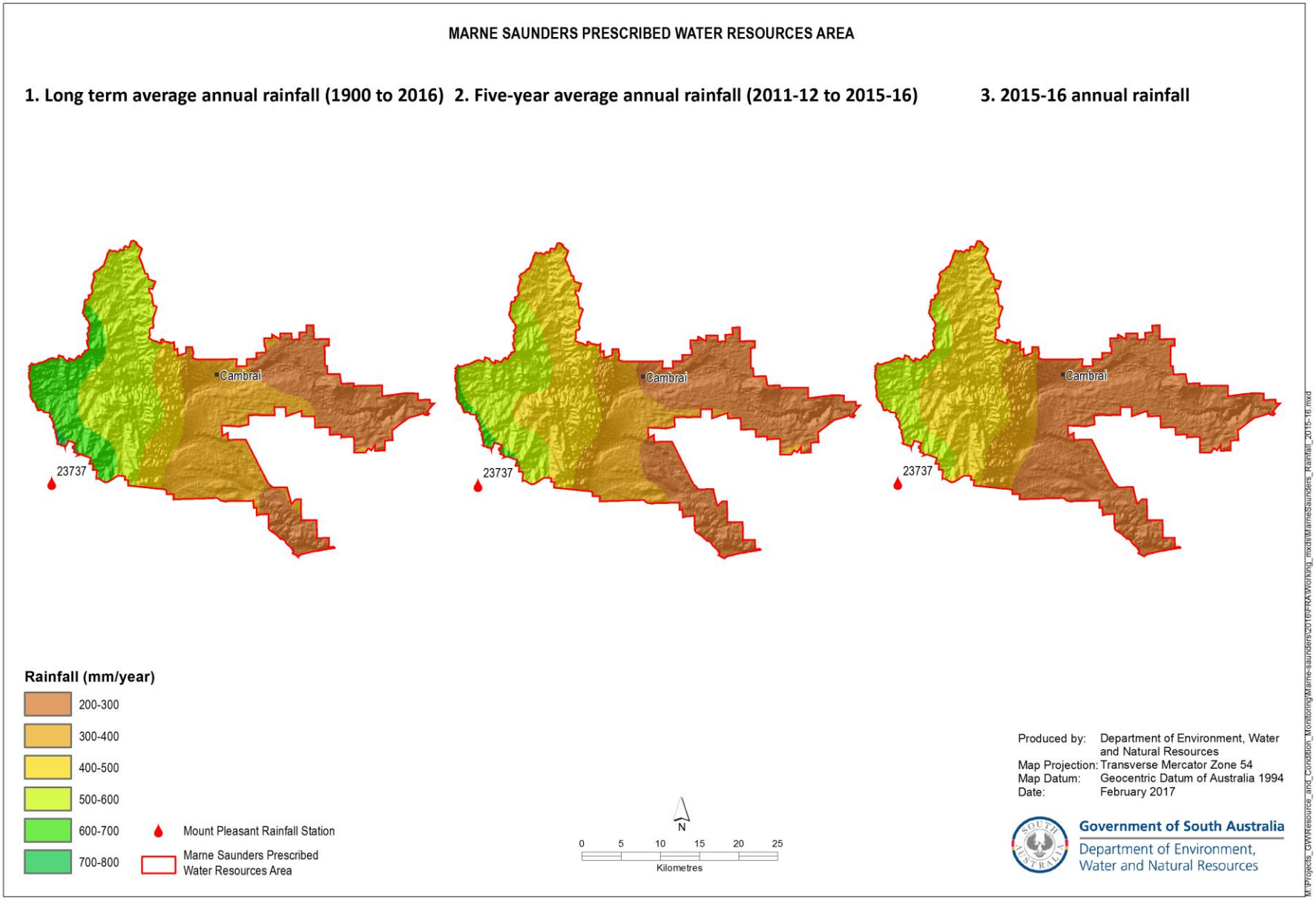


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2015–16 water-use year in the Marne Saunders PWRA[4]

[4] 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.

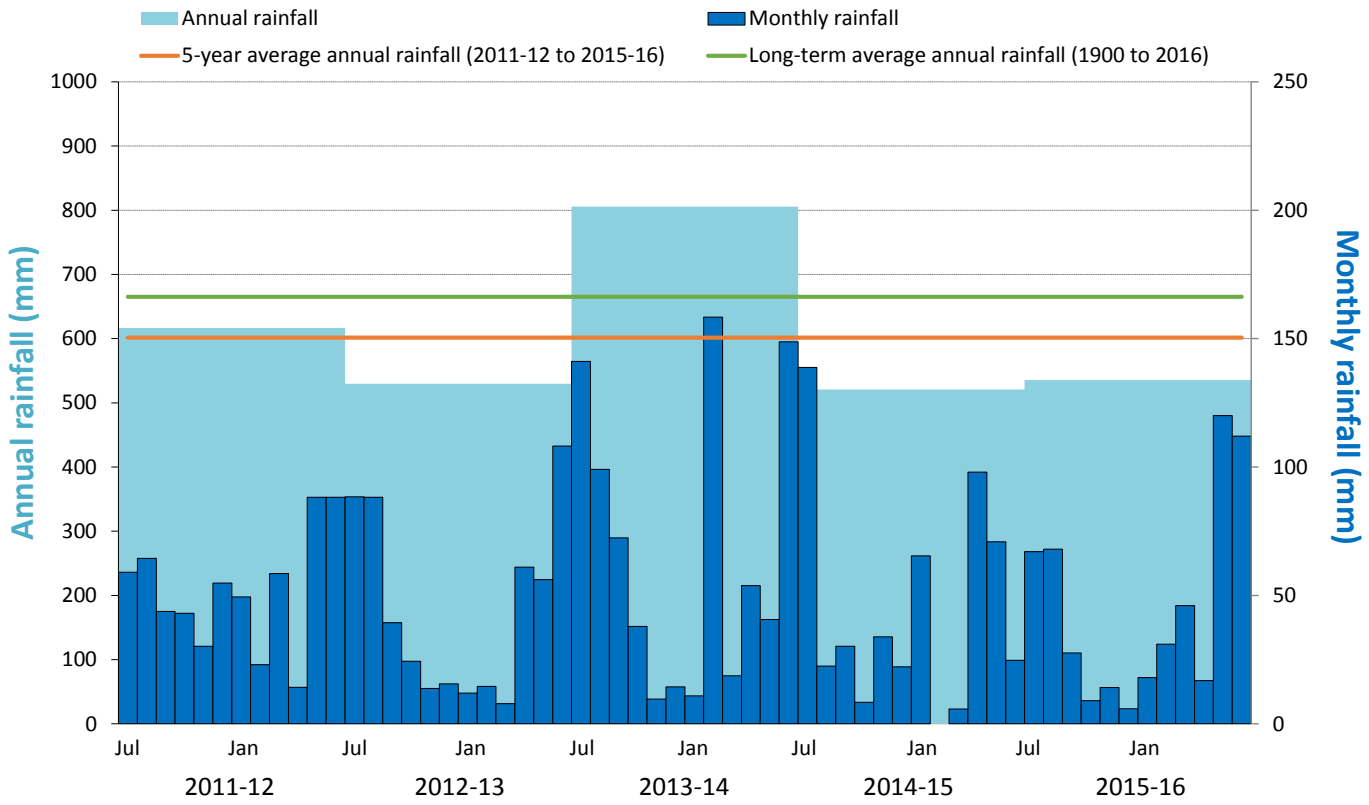


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Mount Pleasant (BoM Station 23737)[5]

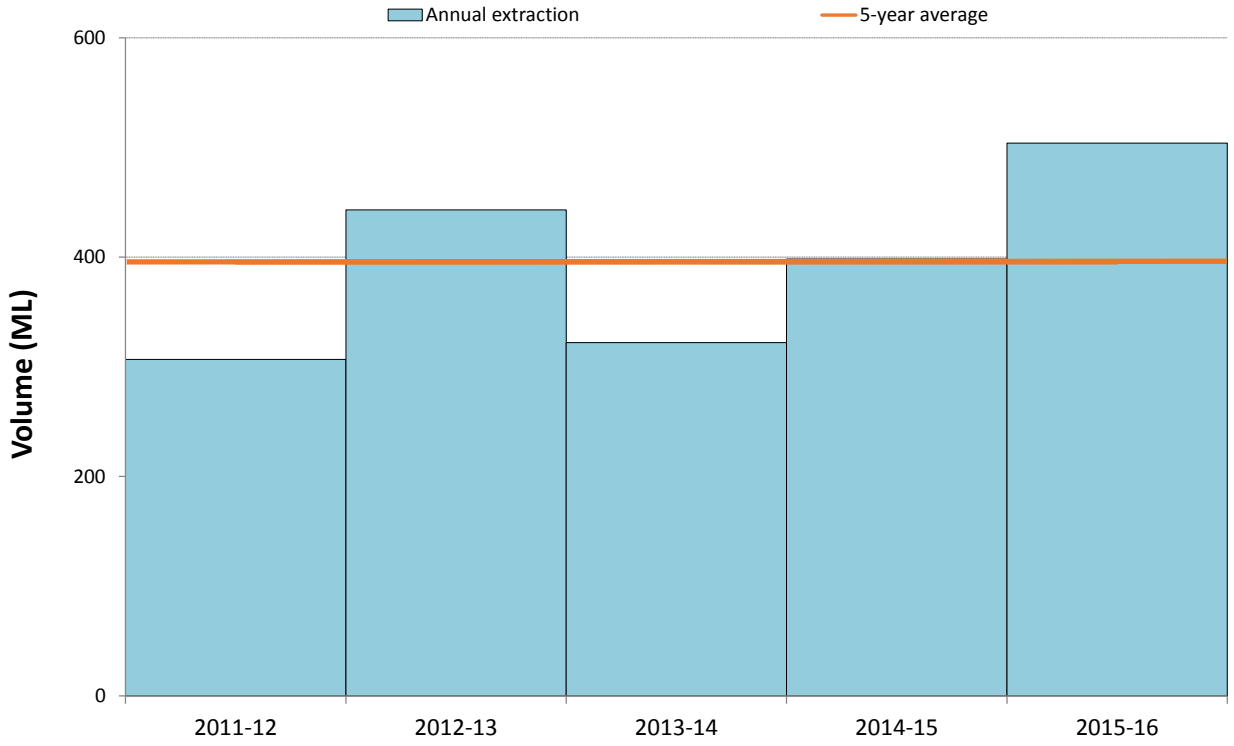


Figure 3. Licensed groundwater extraction volumes for the past five water-use years, for the fractured rock aquifer of the Marne Saunders PWRA[6]

[4] 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.

[5] The licensed groundwater extraction volume for the 2015–16 water-use year is based on the best data available as of March 2017 and may be subject to change, as some extraction volumes are in the process of being verified.

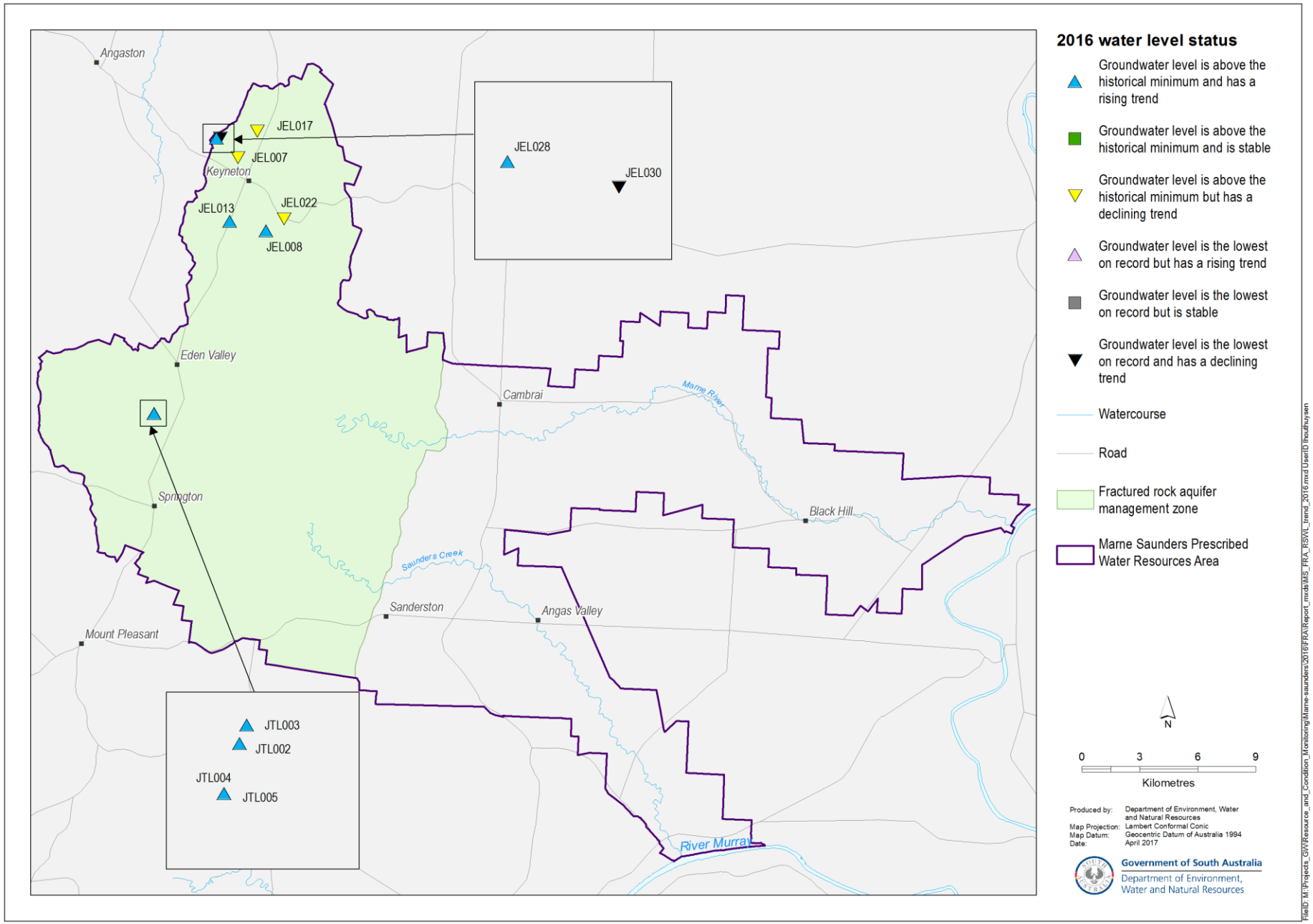


Figure 4. 2016 status of groundwater levels of the fractured rock aquifer (Marne Saunders PWRA), based on trends from 2012 to 2016

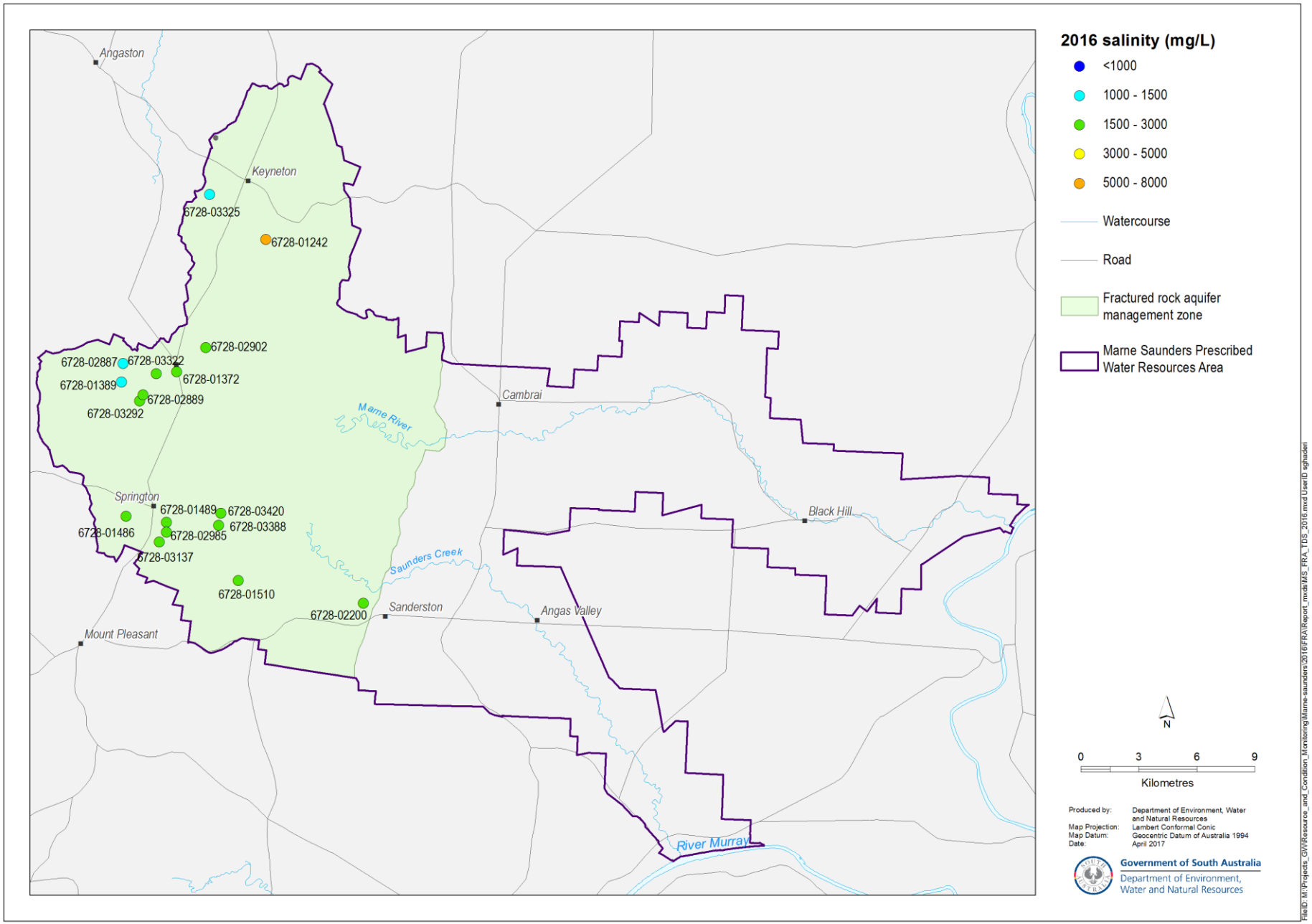


Figure 5. 2016 groundwater salinity of the fractured rock aquifer (Marne Saunders PWRA)

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