

Marne Saunders PWRA

Murray Group Limestone aquifer

2014 Groundwater level and salinity status report



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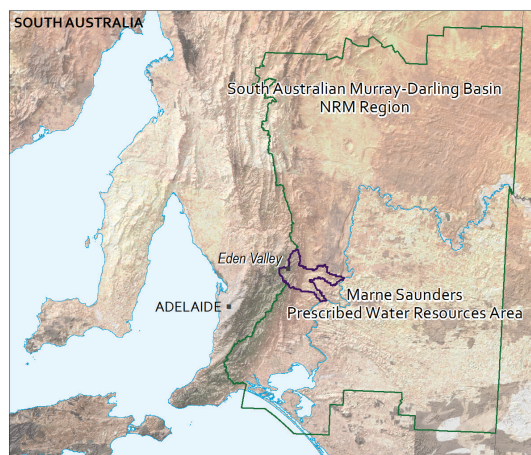
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2014 Summary



The Marne Saunders Prescribed Water Resources Area (PWRA) is located on the eastern side of the Mount Lofty Ranges, about 60 km north-east of Adelaide in the South Australian Murray-Darling Basin NRM Region. It is a regional-scale resource for which surface water and groundwater are prescribed under South Australia's *Natural Resources Management Act 2004*. A water allocation plan provides for sustainable management 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 and the Plains Zone in the east. The Plains Zone is underlain by unconsolidated sediments of the Murray Basin consisting of limestone, sand and clay layers up to 80 m thick that overlie basement rocks exposed in

the Hills Zone to the west. The Murray Basin sediments in the Marne Saunders PWRA consist of four units: Quaternary sediments, the Murray Group Limestone (MGL), the Ettrick Formation and the Renmark Group. The MGL is highly fossiliferous and sandy with solution cavities present and forms the main aquifer in the Plains Zone. This aquifer (the focus of this report) is confined in the west where it is overlain by the Quaternary-aged Pooraka Formation next to the Hills Zone, and becomes unconfined east of Cambrai where the Pooraka Formation pinches out. In general, the MGL is overlain by Quaternary sediments and underlain by the Ettrick Formation and the Renmark Group. Recharge to the MGL aquifer comes from throughflow from the adjacent basement rocks in the Hills Zone and from streamflow during flood periods where it is unconfined.

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 MGL aquifer. For example, if the region experienced above-average rainfall during typically dry summer months, this could result in less groundwater being extracted from the MGL aquifer for irrigation purposes and therefore smaller declines in groundwater levels and stable or improving salinity.

Rainfall is highest in the Hills Zone at the western edge of the PWRA, declining rapidly towards the east in the rain shadow of the Mount Lofty Ranges. Data from the Kongolia rainfall station (number 24513) were chosen for the analysis of rainfall trends in the Plains Zone. In 2014, the total annual rainfall was 339 mm, which is 48 mm above the long-term (1889–2014) annual average of 291 mm. A notable feature of the rainfall chart for 2014 is the February rainfall, which was more than five times higher than the long-term average for February (Fig. 1). Rainfall between April and June was also above average, however, rainfall was well below average from August to the end of the year.

Irrigation supplies in the Plains Zone are sourced from the MGL aquifer, predominantly along the Marne River valley. Metered extractions from the MGL aquifer have declined steadily since peaking during the drought in 2008–09, in response to increased rainfall and, therefore, lower demand for groundwater resources. Extractions increased again in 2011–12 and 2012–13. Metered extractions for 2013–14 totalled 1106 ML¹, which represents a decrease of 19% from the previous water-use year (Fig. 2) and accounts for 77% of the total groundwater extracted from the Marne Saunders PWRA.

Long-term groundwater level monitoring in the MGL aquifer shows a strong relationship with rainfall and river flow². Periods of below-average rainfall in the Hills Zone results in little stream flow and consequently only minor recharge to the limestone aquifer where it is unconfined downstream of Cambrai, as described in the water allocation plan. Conversely, above-average rainfall in the Hills Zone results in more significant stream flows, which contributes to groundwater recharge to the MGL. Gradual water level declines in the areas where the aquifer is unconfined are not necessarily a cause for concern, as levels respond rapidly to occasional floods in the Marne River.

Groundwater levels in monitoring wells around Cambrai were declining until around 2009–10, and many have stabilised or risen since this period. However, further east along the Marne River, groundwater levels have generally continued to decline.

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 March 2015 and may be subject to change, as some extraction volumes are in the process of being verified.

² Surface Water Data for South Australia can be found online at WaterConnect <https://www.waterconnect.sa.gov.au/Systems/SWD/SitePages/Home.aspx>.

In 2014, above-average rainfall and reduced extraction have seen an overall increase in groundwater levels in the Plains Zone; 9 out of 15 observation wells with 2013 and 2014 data available for comparison show an increase of between 0.26 to 0.75 m, with a median of 0.38 m. Six wells recorded negligible change, where the change in maximum recorded water level was less than 0.1 m. Overall, there was a median 0.33 m rise in groundwater levels in 2014.

Increases in salinity represent a significant risk to the resource. During the past 10 years, there has been a gradual increase in salinity (Fig. 4).

Irrigators in the Marne Saunders PWRA are required to submit a water sample from their wells to DEWNR for salinity analysis every year. In 2014, a range of salinities from 1143 to 3742 mg/L were recorded, with 98% of the 44 monitored wells recording salinity of less than 3000 mg/L and 34% recording levels less than 1500 mg/L (Fig. 4). Of the 37 wells with data from both 2013 and 2014 available for comparison, 16 wells (43%) showed stable salinity, where the rise or fall in salinity was less than 5%. Ten wells (27%) showed decreasing salinity and 11 wells (30%) showed an increase in salinity. However, it should be noted that for nearly all of these wells, the 2013 and 2014 salinity data are the only recent measurements.

The Water Allocation Plan (WAP) for the Marne Saunders PWRA region has identified resource condition indicators which apply to the MGL aquifer in the Confined Zone A Management Zone (located immediately west of Cambrai) and the Unconfined Zone 1 Management Zone (located immediately east of Cambrai). These limits are designed to give early warning of unfavourable trends in water levels and salinity that may affect other users of the resource.

Confined Zone A: The water level trigger is a reversal of the pressure gradient between pumping seasons that would result in more saline groundwater flowing into the area. During the non-irrigation season in the 2013–14 water use year, the pressure gradient maintained throughflow and as such the resource conditions limit have not been exceeded. The salinity trigger is an increase in salinity of greater than 2% per year, averaged over 5 years, in more than 50% of monitoring wells. This has not been observed within the management zone, therefore the resource conditions limits have not been exceeded for this zone during 2013–14.

Unconfined Zone 1: The water level trigger is a decline below the minimum water level experienced between 1998 and 2002, in any of the monitoring wells in the management zone. Since the WAP was adopted in 2010, water levels in four of the five monitoring wells have consistently shown water levels below these minimum levels, breaching the resource condition limits. The salinity trigger is a long-term increase in salinity in the monitoring wells within the zone. Since the WAP was adopted in 2010, salinity in four of the five monitoring wells has increased in salinity by up to 10%, while one has decreased in salinity by 13%. Overall, there was a median 6% increase in salinity since 2010, which may be considered a breach of the resource condition limits.

Investigations have shown that in Unconfined Zone 1, groundwater levels and salinity are strongly controlled by high flow events down the Marne River, with a reduction in allocations unlikely to significantly change the trends. Groundwater levels in the MGL aquifer declined during the dry period over 2006–08, and the opportunity for levels to recover has been limited, with only one year receiving above-average streamflow since then, in 2010. Use of groundwater allocations on the plains has been below the combined allocation limit for the MGL aquifer of 2156 ML. There have been no significant impacts observed on groundwater-dependent ecosystems in Unconfined Zone 1 as a result of these trends.

The MGL aquifer in the Marne Saunders Prescribed Water Resources Area has been assigned a yellow status for 2014:

2014 Status



“Gradual adverse change, indicating low risk to the resource in the medium term”

This means that minor adverse changes in the resource status have been observed over the 12-month reporting period. If these conditions were to continue, they are unlikely to negatively impact the beneficial uses of the resource (e.g. drinking water, irrigation or stock watering) for at least 15 years.

The 2014 status for the Murray Group Limestone aquifer is supported by:

- an overall increase in groundwater salinity when compared to 2013 salinity data
- water level and salinity resource-condition limits exceeded in Unconfined Zone 1.

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

To view the *Marne Saunders PWRA Groundwater Level and Salinity Status Report 2011*, which includes background information on hydrogeology, location of rainfall stations and relevant groundwater dependent ecosystems, and to view descriptions for all status symbols, 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 Murry-Darling Basin [website](#).

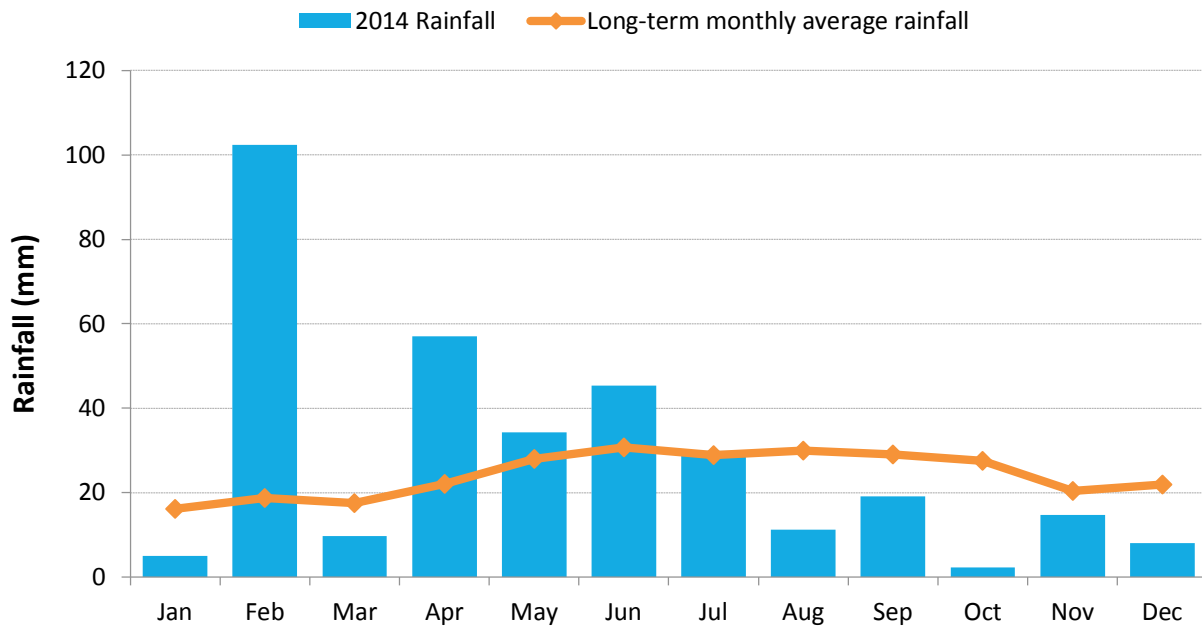


Figure 2. Monthly rainfall (mm) for 2014 and the long-term average monthly rainfall (mm) at the Kongolia rainfall station³ (number 24513) in the Plains Zone of the Marne Saunders Prescribed Water Resources Area

Marne Saunders Prescribed Water Resources Area: Murray Group Limestone aquifer groundwater extraction

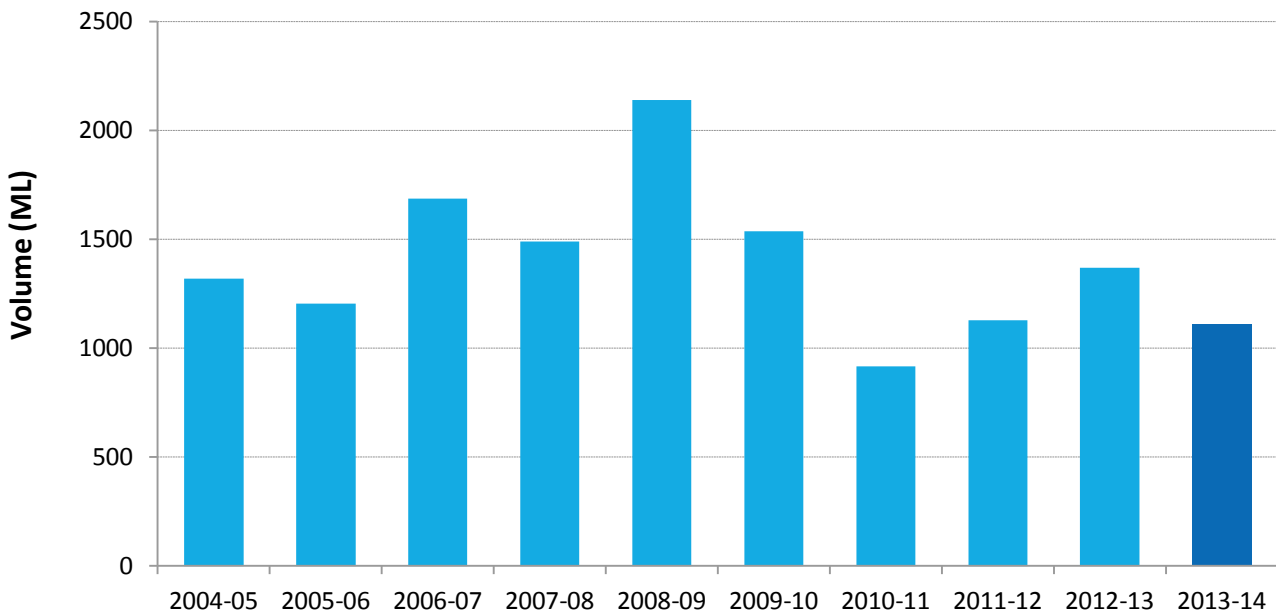


Figure 1. Historical licensed groundwater use from the Murray Group Limestone aquifer in the Marne Saunders Prescribed Water Resources Area

³ 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.

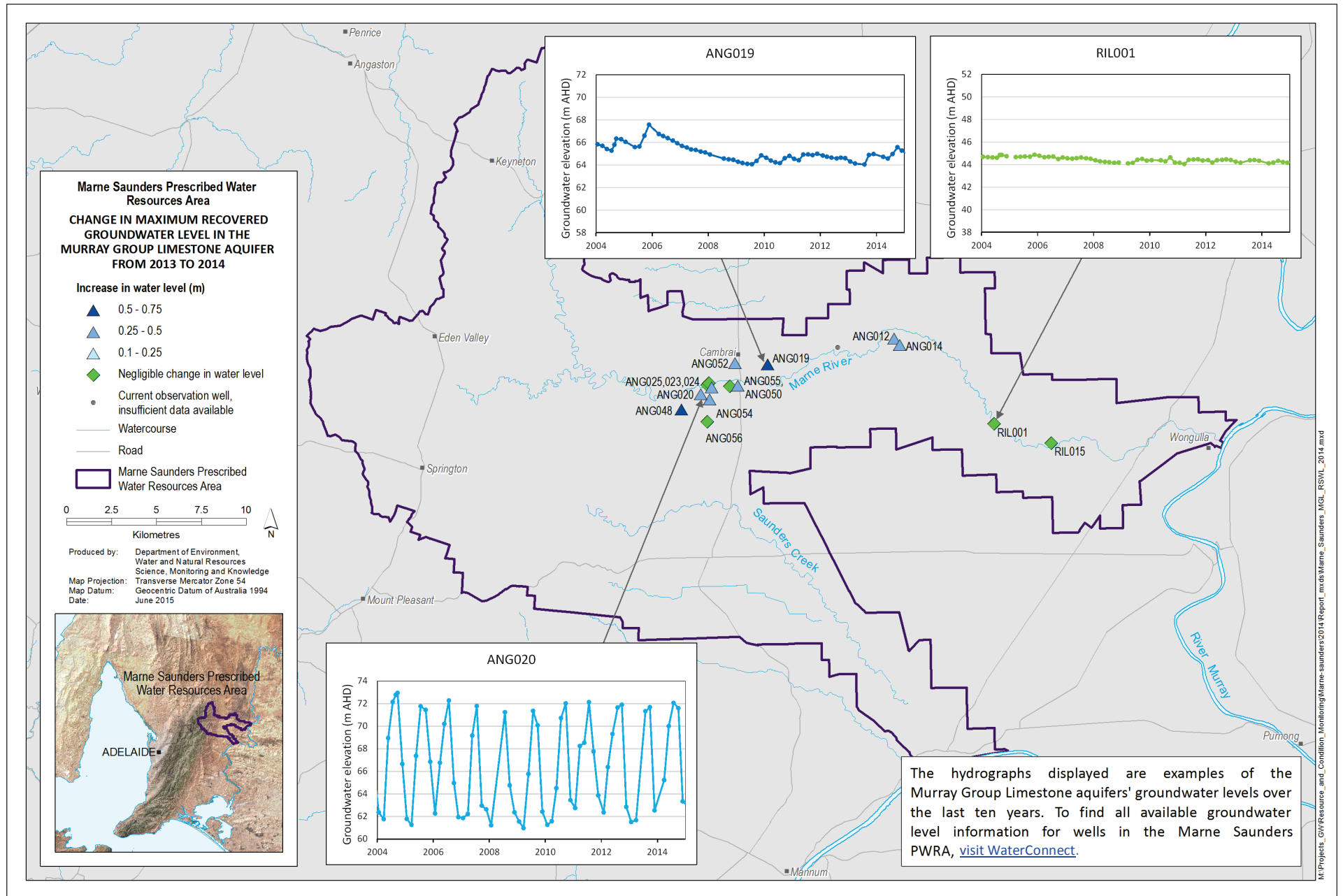


Figure 3. Overall changes in maximum groundwater levels of the Murray Group Limestone aquifer in the Marne Saunders Prescribed Water Resources Area from 2013 to 2014

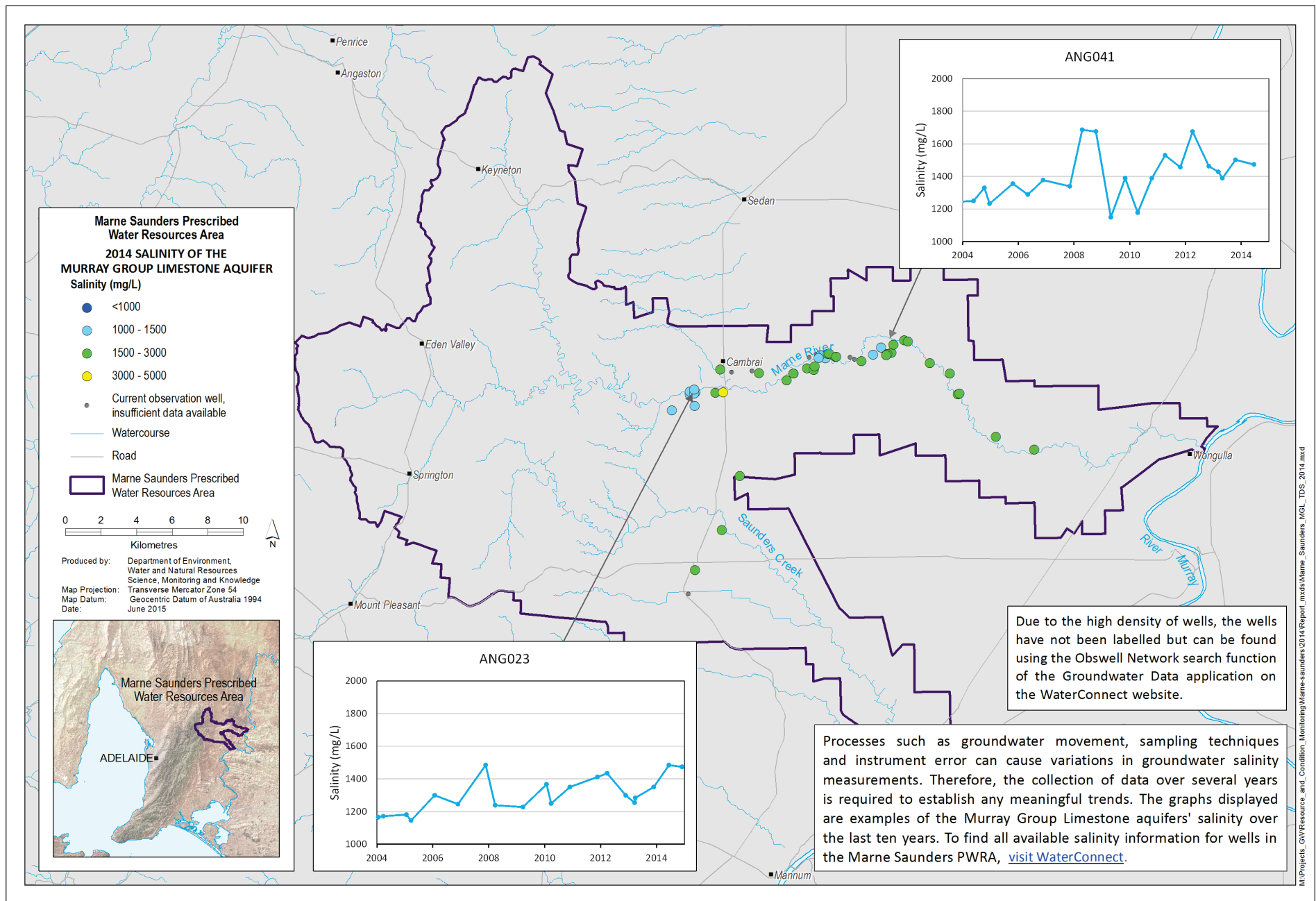


Figure 4. Groundwater salinity of the Murray Group Limestone aquifer in the Marne Saunders Prescribed Water Resources Area for 2014