Lower Limestone Coast PWA

Unconfined aquifer

2014 Groundwater level and salinity status report

Government of South Australia
Department of Environment, Water and Natural Resources

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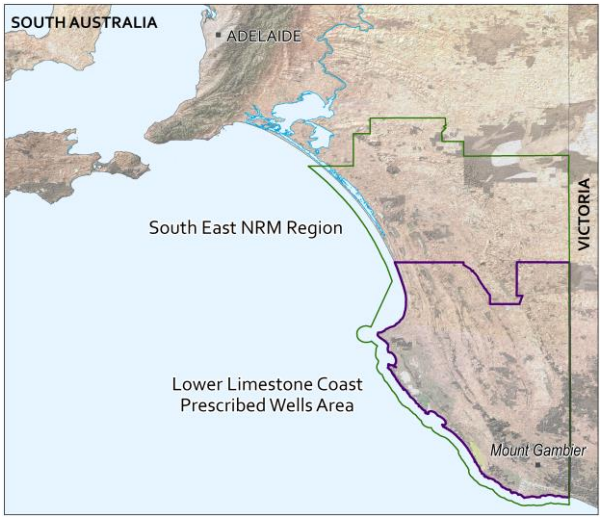
ISBN 978-1-922255-63-1

This document is available online at www.waterconnect.sa.gov.au/Systems/GSR/Pages.

2014 Summary



The Lower Limestone Coast Prescribed Wells Area (PWA) is located in the South East NRM Region, the northern boundary being approximately 300 km south-east of Adelaide. It is a regional-scale resource for which groundwater is prescribed under South Australia's *Natural Resources Management Act 2004*. Three water allocation plans—Comaum–Caroline, Lacepede Kongorong and Naracoorte Ranges—provided for the sustainable use of the groundwater resources and were replaced with a single *Water Allocation Plan for the Lower Limestone Coast Prescribed Wells Area* in November 2013.

The Lower Limestone Coast PWA is predominantly underlain by Tertiary sediments of the Gambier Basin, with a continuous transition to similar sediments of the Murray Basin in the northern portion of the PWA. Most of the region is characterised by a low-lying coastal plain that gently rises to 70 m above sea level in the eastern and north-eastern parts of the PWA. The northern and central parts of the Lower Limestone Coast PWA are characterised by north-west trending remnants of old coastal dunes separated by inter-dunal flats.

There are two aquifer systems located in the region—an unconfined aquifer comprising Quaternary and Tertiary limestone (the focus of this report)—and an underlying confined Tertiary sand aquifer. The Quaternary-aged Padthaway, Coomandook and Bridgewater Formations form the unconfined aquifer in the northern and central parts of the PWA. In the south of the PWA, the Tertiary-aged Gambier Limestone forms the unconfined aquifer. Beneath the highlands, the unconfined aquifer is contained within the Tertiary-aged Murray Group limestone aquifer, which is in the Murray Basin and is equivalent to the Gambier Limestone of the Gambier Basin. The main source of recharge to the unconfined aquifer is the direct infiltration of rainfall, and groundwater flow occurs from the topographic high of the Dundas Plateau located in western Victoria. From there, groundwater flows through the PWA in a radial direction westward and southward to the coast.

Trends in groundwater levels and salinity in the Lower Limestone Coast PWA are primarily climate driven: below-average rainfall results in a reduction in recharge to the aquifers. 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 results in increases in recharge, decreases in irrigation extractions and groundwater levels may rise and salinity stabilise or decline.

Analysis of climatic trends in the South East has revealed a general drying trend since the early 1950s. This is reflected in most groundwater hydrographs and a strong relationship has been demonstrated between decreases in average annual rainfall and declining water levels measured in observation wells for both the confined and unconfined aquifers over the last 40 years. Trends identified at the Mount Gambier Aero rainfall station (number 26021), located about 8 km north of Mount Gambier, are indicative of changes in rainfall patterns across the PWA. This station recorded 635 mm of rain in 2014, which is 87 mm below the long-term average (1889–2014) annual rainfall and nearly 190 mm less than 2013. The months of May and June received rainfall significantly above its long-term monthly average, January to April recorded close to average monthly rainfall and the last six months of the year recorded below-average rainfall (Fig. 1).

Groundwater extractions (excluding stock and domestic use) for the Tertiary Limestone aquifer in the Lower Limestone Coast PWA for 2013–14 totalled 163 377 ML[1], which represents a decrease of 66 730 ML (34%) from the previous water-use year (Fig. 2).

Long-term observations of the unconfined aquifer reveal relatively stable groundwater level trends on the inter-dunal flats, with the maximum recovered groundwater levels displaying a broad relationship with rainfall trends. Below-average rainfall coupled with intensive, licensed groundwater extraction and commercial forest plantations has contributed to a consistent decline in groundwater

[1] The licensed groundwater use for the 2013–14 water-use year is based on the best data available as of June 2015 and will be subject to change, as approximately ten percent of South East annual water use reports had not been submitted at the time of printing and groundwater extracted for forestry is not included. As such, the total licensed groundwater use will be higher than the volume presented in this report.

levels on the coastal plain since 1993. Wetter conditions from 2009 to 2013 have led to increases in groundwater levels across the coastal plains and inter-dunal flats.

In the highlands to the north, long-term observations show rising groundwater levels due to increased recharge caused by the widespread clearance of native vegetation. This rising trend persisted for several years after the prolonged period of below-average rainfall that commenced in 1993—however, the majority of observation wells display a declining trend after the year 2000 or later. This is likely caused by the lag time for recharge to the aquifer by rainfall infiltration as the water table is deep in this area.

In 2014, 13% of the 455 groundwater-level observation wells with available data recorded a rise in the maximum recovered groundwater level when compared to 2013 water level data (Fig. 3). These ranged between 0.1 and 0.49 m, with a median of 0.2 m. A decline in the maximum recovered groundwater level was observed in 58% of wells with available data, ranging from 0.1 to 1.15 m, with a median of 0.32 m. The largest decline was recorded by observation well BLA071, which is located in a commercial forested area where the water table is about 37 m below ground surface.

Negligible change in the groundwater level was recorded in about 29% of the observation wells, where the change in maximum recovered water level between 2013 and 2014 was less than 0.1 m (increase or decline). The median rate of change across the entire monitoring network was a decline of 0.15 m. Increases in groundwater levels occurred primarily on the coastal plain in the Lower South East (south of Mount Gambier where the water table is shallowest and the rate of rainfall is higher). Declines in groundwater levels occurred across the whole PWA. The decline in water level may be due to reduced recharge from below-average rainfall that was also much less than the previous year.

The Donovans Management Area shows a mix of rising and declining water levels in shallow observation wells, with most of the wells showing negligible change in water level (less than 0.1 m). The risk of seawater intrusion caused by declining water levels in the deeper units of the aquifer close to the coast continues to be monitored. These declines can be exacerbated by intensive inland extraction from the deeper units of the aquifer. Since 2013, water levels in these wells appear to be stable, however, they are at levels that are likely to cause a gradual inland migration of the sea water interface, and thus represent an ongoing risk to the resource in the near-coast region.

Over large areas of the PWA, where stresses on the unconfined aquifer such as intensive irrigation or land use change are absent, long-term salinity trends are reasonably stable. However, trends of increasing salinity have been observed locally in areas of flood irrigation, through the recycling of salt by irrigation drainage water, and areas of intensive groundwater extraction and native vegetation clearance.

Generally, the water in the unconfined aquifer is of good quality, with 84% of monitored wells recording groundwater salinity of less than 1500 mg/L in 2014 (Fig. 4). Salinity above 1500 mg/L is predominantly found across the northern half of the PWA. About 41% of the 183 observation wells with sufficient data recorded an increase in salinity when compared to 2013 salinity data. However, most wells (72%) recorded a change in salinity (increase or decrease) of less than 5%. Wells that recorded an increase in salinity are found predominantly in the highlands or in areas of high-density irrigation, and those that recorded a decrease are located primarily on the inter-dunal flats.

Due the vast area, the different land uses and the geomorphology of the Lower Limestone Coast PWA, the unconfined aquifer has been divided into three resource groups, with a status assigned to each for 2014.

Coastal plain and inter-dunal flats

On the coastal plain and inter-dunal flats, the unconfined aquifer of the Lower Limestone Coast PWA has been assigned a yellow status for 2014:

2014 Status

"Gradual adverse changes indicating a low risk to the resource in the medium term"

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

The 2014 status for the unconfined aquifer on the coastal plain and inter-dunal flats of the Lower Limestone Coast PWA is supported by:

- the widespread decline in the maximum recovered groundwater level in 2014 when compared to 2013 water level data.

The highlands area

In the highlands area along the eastern border of the PWA, the unconfined aquifer of the Lower Limestone Coast PWA has been assigned a yellow status for 2014:

2014 Status

"Gradual adverse changes indicating low risk to the resource in the medium term"

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

The 2014 status for the unconfined aquifer in the highlands area of the Lower Limestone Coast PWA is supported by:

- an overall decline in the maximum recovered groundwater level in 2014 when compared to 2013 water level data
- an overall increase in groundwater salinity in 2014 when compared to 2013 salinity data.

The Donovans Management Area

In the Donovans Management Area, the unconfined aquifer of the Lower Limestone Coast PWA has been assigned a yellow status for 2014:

2014 Status

"Gradual adverse changes indicating low risk to the resource in the medium term"

This means that minor adverse changes in the resource 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 (such as drinking water, irrigation or stock watering) for at least 15 years.

The 2014 status for the unconfined aquifer in the Donovans Management Area of the Lower Limestone Coast PWA is supported by:

- groundwater water levels observed in coastal wells are low enough to potentially cause the gradual inland movement of seawater in the lower part of the aquifer.

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

To view the *Lower Limestone Coast PWA groundwater level and salinity status report 2011*, which includes background information on hydrogeology, rainfall and relevant groundwater-dependent ecosystems, visit WaterConnect.

To view or download groundwater level and salinity data from observation wells within the Lower Limestone Coast PWA, please visit Groundwater Data on WaterConnect.

For further details about the Lower Limestone Coast PWA, please see the *Lower Limestone Coast Water Allocation Plan* on the Natural Resources South East website.

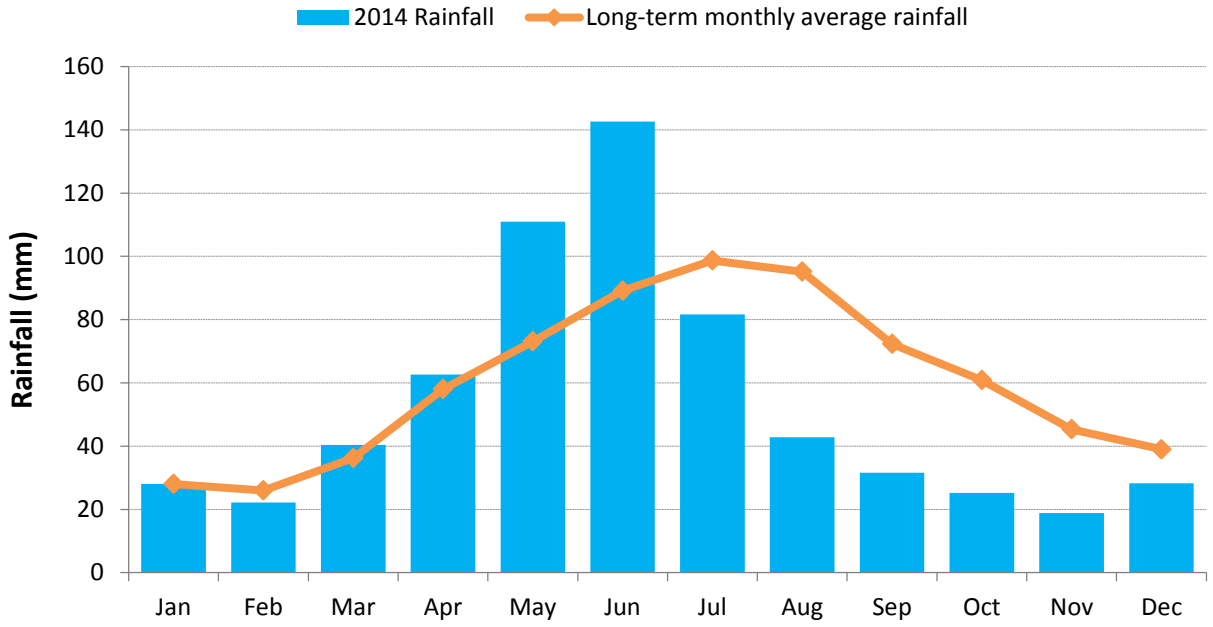


Figure 1. Monthly rainfall (mm) for 2014 and the long-term average monthly rainfall (mm) at the Mount Gambier Aero rainfall station[2] (number 26021) in the Lower Limestone Coast Prescribed Wells Area

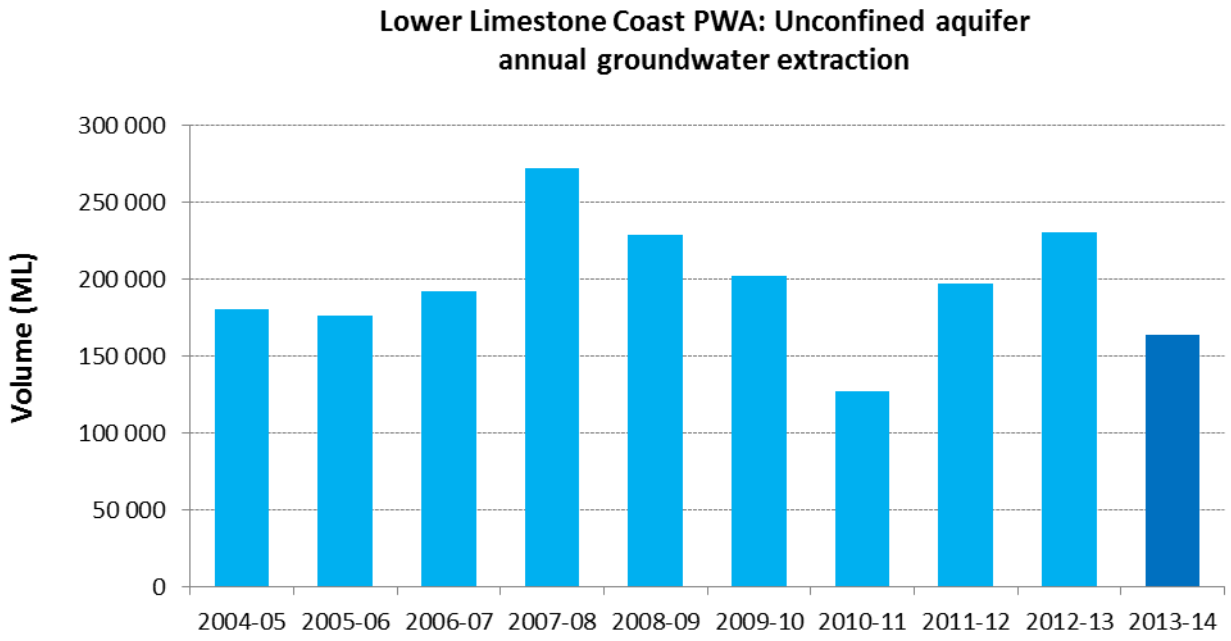


Figure 2. Historical licensed groundwater use[3] for the Lower Limestone Coast Prescribed Wells Area

[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.

[3] Groundwater extracted for forestry not included.

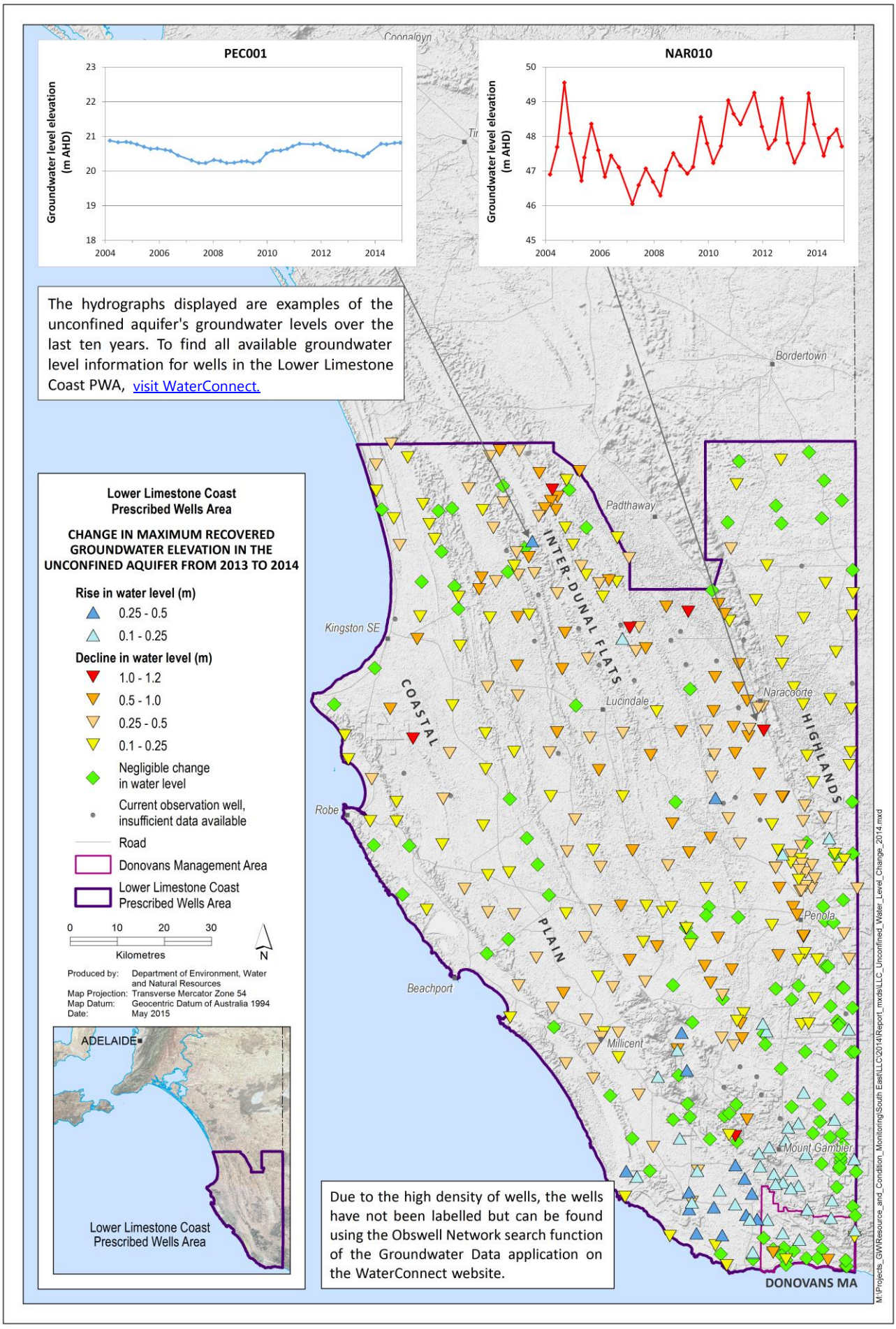


Figure 3. Overall changes in maximum groundwater levels in the unconfined aquifer of the Lower Limestone Coast Prescribed Wells Area from 2013 to 2014

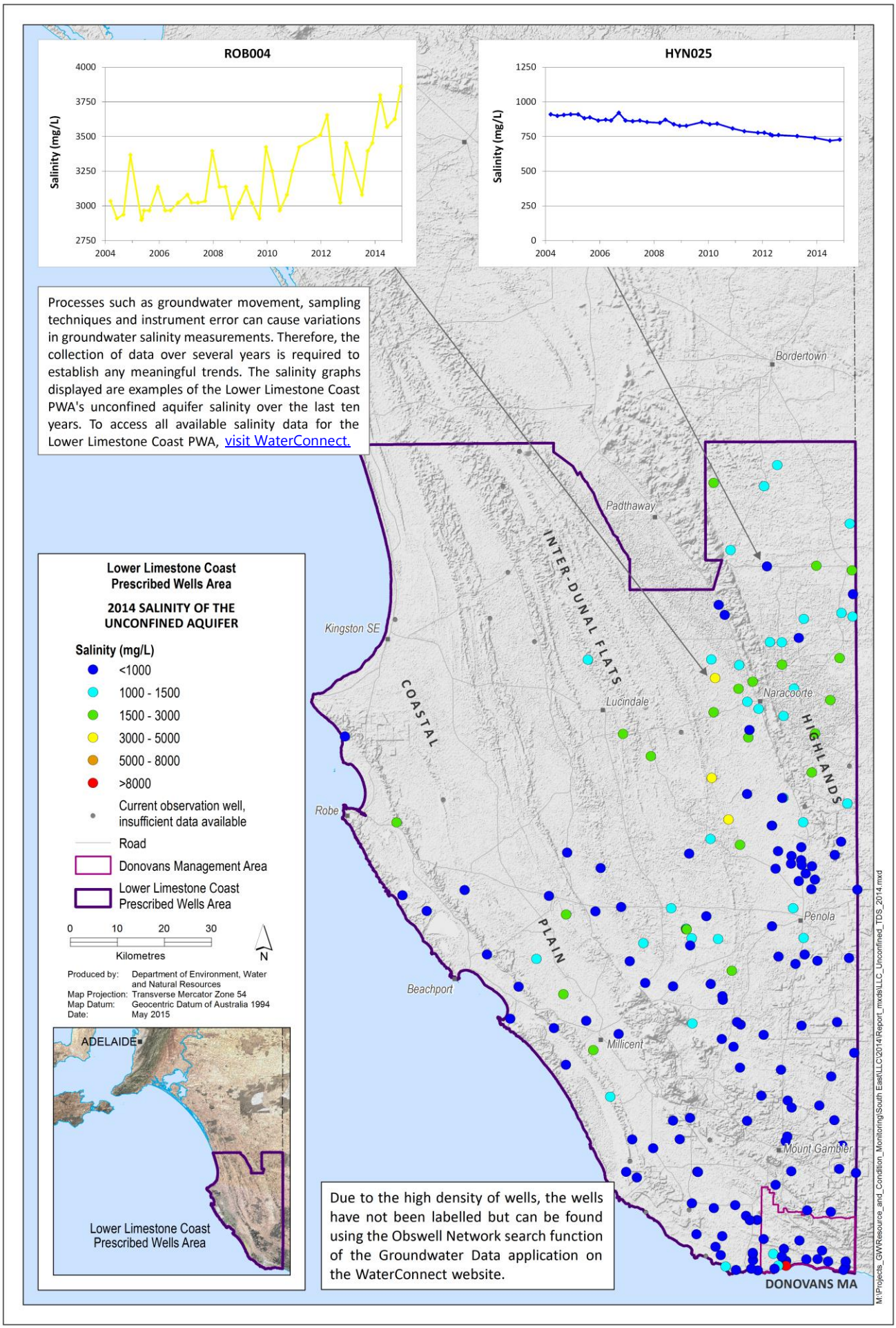


Figure 4. Groundwater salinity of the unconfined aquifer in the Lower Limestone Coast Prescribed Wells Area for 2014