Lower Limestone Coast PWA

Unconfined aquifer

2015 Groundwater level and salinity status report

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

Department of Environment, Water and Natural Resources
GPO Box 1047, Adelaide SA 5001

Telephone	National	(08) 8463 6946
	International	+61 8 8463 6946
Fax	National	(08) 8463 6999
	International	+61 8 8463 6999
Website	www.environment.sa.gov.au	

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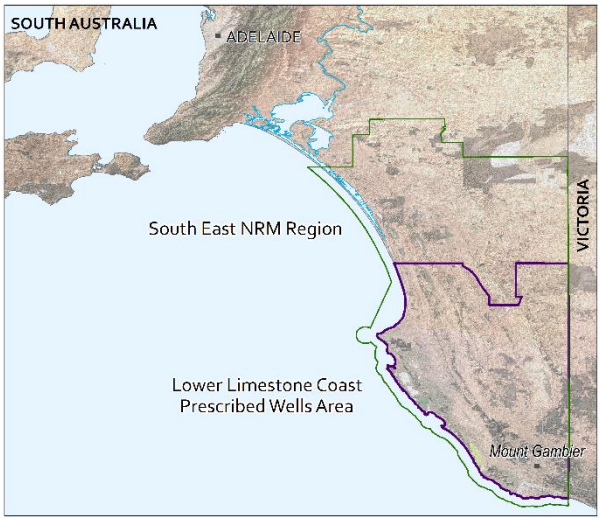
2015 Summary



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*. A water allocation plan provides for the sustainable use of the groundwater resource.

The Lower Limestone Coast PWA is predominantly underlain by Tertiary and Quaternary 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 sand and 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. Changes in land use, such as the clearing of deep-rooted native vegetation and replacing it with shallow-rooted pasture and crops, and tree plantations has also affected groundwater level and salinity trends, and the recycling of irrigation drainage water has been shown to cause rising salinity.

The Mount Gambier Aerodrome rainfall station (BoM Station 26021) located about 8 km north of Mount Gambier, recorded 506 mm of rain in the 2014–15 water-use year, more than 200 mm less than the long-term average of 712 mm (1900–2015), and the sixth lowest rainfall total on record for that station (Figs. 1 and 2). The five-year average annual rainfall of 755 mm (2010–11 to 2014–15) is higher than the long-term average, though a trend of declining rainfall over the past five years is evident despite the high rainfall in 2013–14 (Fig. 2). Long-term seasonal rainfall patterns show generally higher rainfall during the winter months and lower rainfall over summer. Notable seasonal variations over the past five years include the unusually wet spring and summer of 2010–11, the dry spring–summer of 2012–13, and the wet summer and autumn–winter of 2013–14. The 2014–15 water-use year has been particularly dry, with five months recording less than half their long-term monthly-average rainfall, although May recorded almost twice its average.

Groundwater extractions (excluding stock and domestic use) for the unconfined aquifer in the Lower Limestone Coast PWA totalled 268 230 ML[1] for 2014–15, an increase of 64% from the previous water-use year and 36% more than the five-year average annual extraction (Fig. 3). Extractions have increased over the past five years, with the exception of 2013–14 and a correlation can be seen between extractions and annual rainfall (Figs. 2 and 3).

[1] The licensed groundwater use for the 2014–15 water-use year is based on the best data available as of March 2016 and may be subject to change, as approximately three per cent of South East annual water use reports had not been submitted at the time. As such, the total licensed groundwater use may be higher than the volume presented in this report.

Below-average rainfall coupled with intensive groundwater extraction and commercial forest plantations has contributed to a consistent decline in groundwater levels on the coastal plain since 1993. Long-term monitoring data reveal relatively stable groundwater levels on the inter-dunal flats, with the maximum recovered groundwater levels displaying a broad relationship with rainfall trends. Wetter conditions from 2009 to 2011 led to rises in groundwater levels across the coastal plain 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 monitoring wells display a declining trend after the year 2000. 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 the five years to 2015, just over half of monitoring wells (54%) across the Lower Limestone Coast PWA recorded a declining groundwater level trend, with 15% recording their lowest groundwater level on record in 2015 (Fig. 4). Declines ranged from 0.02 to 0.82 m/y with a median of 0.08 m/y and are located across the PWA, but particularly in the higlands, inter-dunal flats and between Penola and Mount Gambier. Wells recording their lowest level are located mainly between Lucindale and Mount Gambier. Rising groundwater level trends were recorded in 30% of monitoring wells and range between 0.02 and 2.06 m/y, with a median of 0.09 m/y. These wells are located primarily in and around Mount Gambier and Tantanoola, where rises of more than one metre per year were recorded (Fig. 4). The remaining 16% of wells recorded a trend of stable groundwater levels and are primarily on the coastal plain and between Penola and the coast.

Six of the 21 monitoring wells in the Donovans Management Area with sufficient data show a five-year declining groundwater level trend, including three of the deeper monitoring wells (100–180 m). These declines were minor, ranging from 0.03 to 0.14 m/y, but can be exacerbated by intensive inland extraction from the deeper units of the aquifer, and represent an ongoing risk of seawater intrusion to the resource in the near-coast region. The remaining wells recorded a trend of stable or rising levels.

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 levels 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 also areas of intensive groundwater extraction and native vegetation clearance.

Generally, groundwater in the unconfined aquifer is of good quality. In 2015, salinity typically ranged between 180 and 6800 mg/L. One of the deeper monitoring wells near the coast in the Donovans Management Area recorded a salinity of 33 000 mg/L, but such high salinity concentration is typical of this well. Eighty-three per cent of monitoring wells with data recorded a salinity of less than 1500 mg/L (Fig. 5). These wells are predominantly found across the southern half of the PWA. In the five years to 2015, most monitoring wells (72%) recorded a trend of stable salinity and are found across the PWA (Fig. 6). Eighteen per cent of wells recorded a rising salinity trend and are primarily spread across the southern half of the PWA. The remaining 10% of wells recorded a decreasing salinity trend and are also mainly found in the southern half of the PWA. In the Donovans Management Area, seven wells recorded a trend of stable salinity and three wells recorded a rising trend in salinity, including one of the deeper monitoring wells (180 m). However, another deep monitoring well (106 m) recorded a much larger decrease in salinity over the past five years.

To determine the status of the unconfined aquifer for 2015, the trends in groundwater levels 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.

Due to the vast area, different land uses and geomorphology of the Lower Limestone Coast PWA, the unconfined aquifer has been divided into three resource groups, with a status assigned to each one for 2015.

Coastal plain

The coastal plain (including Mount Gambier) has been assigned a green status for 2015:

2015 Status

Positive trends have been observed over the past five years

The 2015 status for the unconfined aquifer in this area is based on:

- most wells show a five-year trend of stable or rising groundwater level
- most wells show a five-year trend of stable or decreasing salinity.

Inter-dunal flats, highlands and Donovans Management Area

The inter-dunal flats, highlands and Donovans Management Area have been assigned a yellow status for 2015:

2015 Status

Minor adverse trends have been observed over the past five years

The 2015 status for the unconfined aquifer in these areas is based on:

- most wells show a five-year trend of declining groundwater levels and a number of wells recorded their lowest level on record in 2015.

To view descriptions for 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, please visit the *Water Resource Assessments* page on WaterConnect.

To view or download groundwater level and salinity data from monitoring 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.

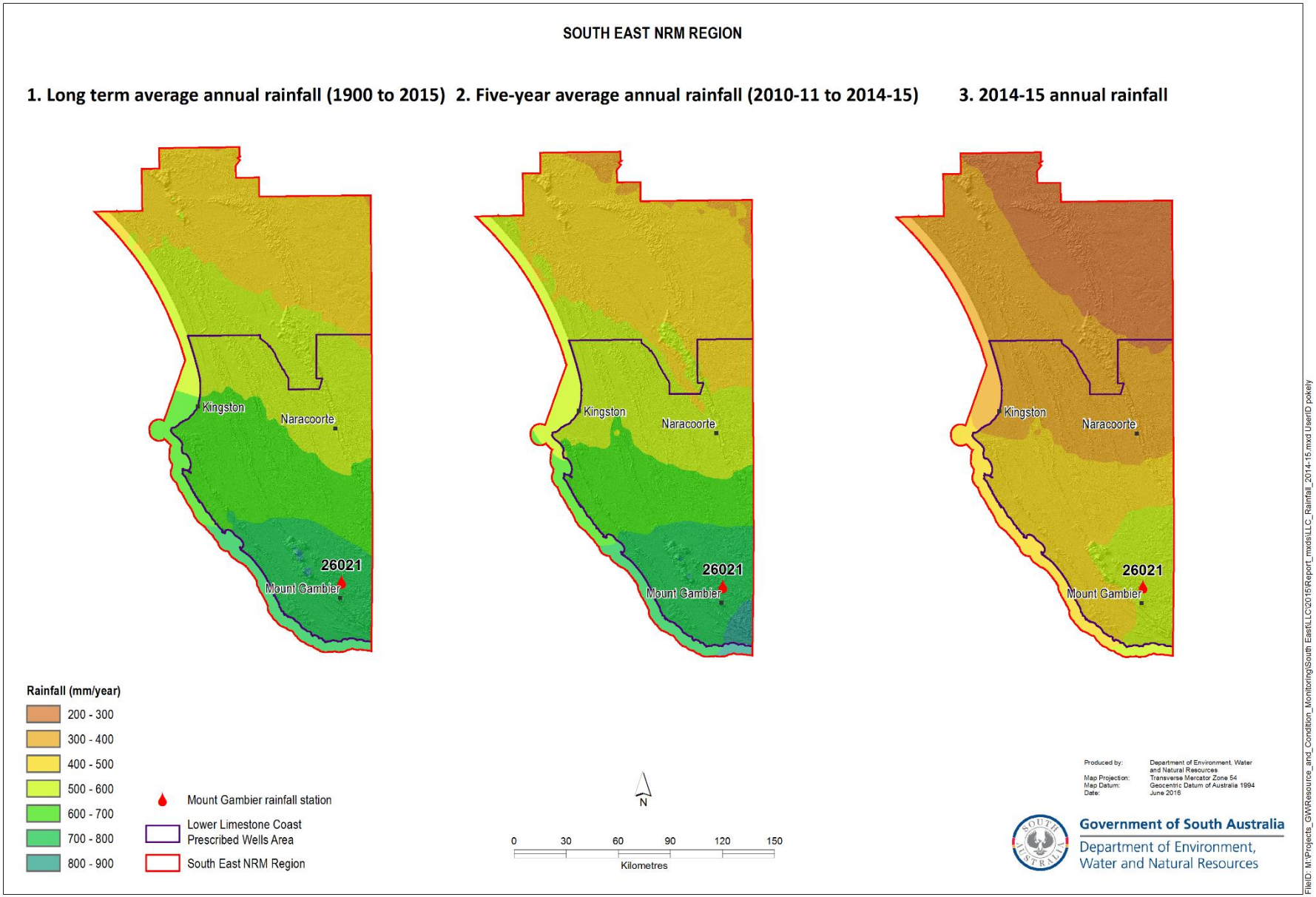


Figure 1. (1) Long-term and (2) five-year average annual rainfall and (3) annual rainfall for the 2014–15 water-use year in the South East NRM region[2]

[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.

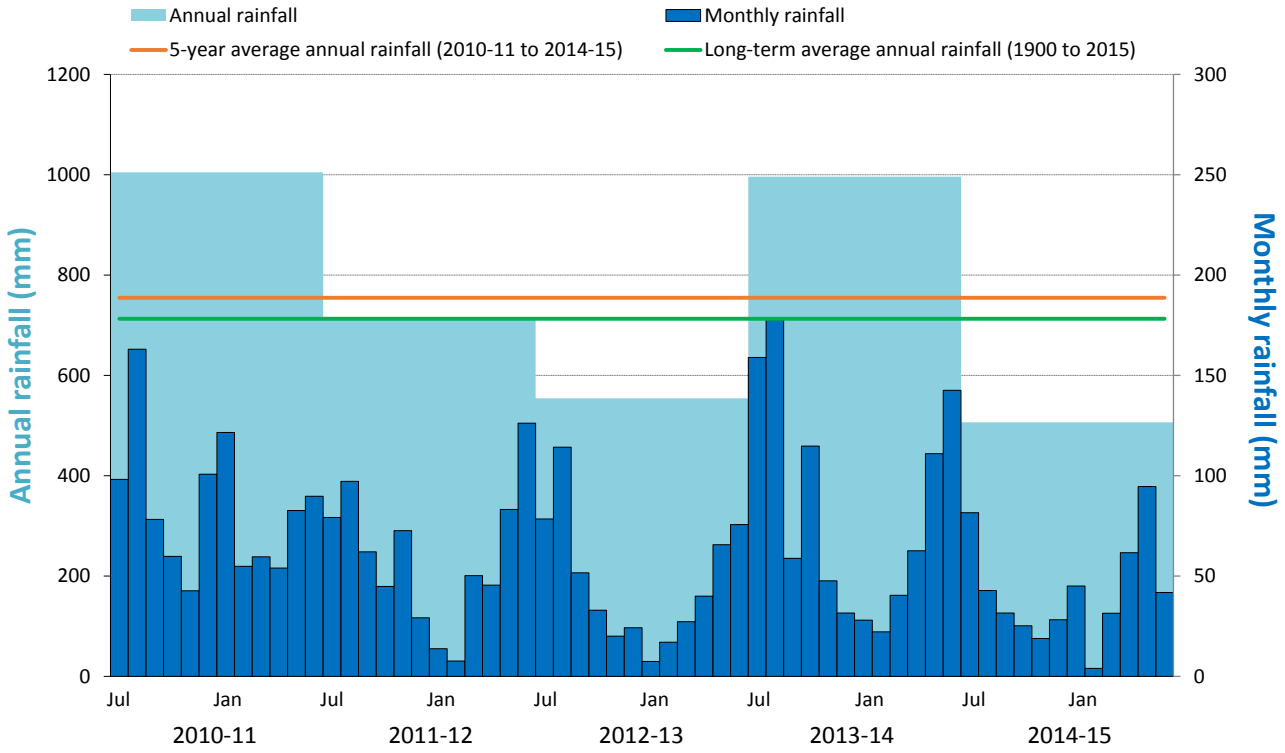


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Mount Gambier Aerodrome[3] (BoM 26021)

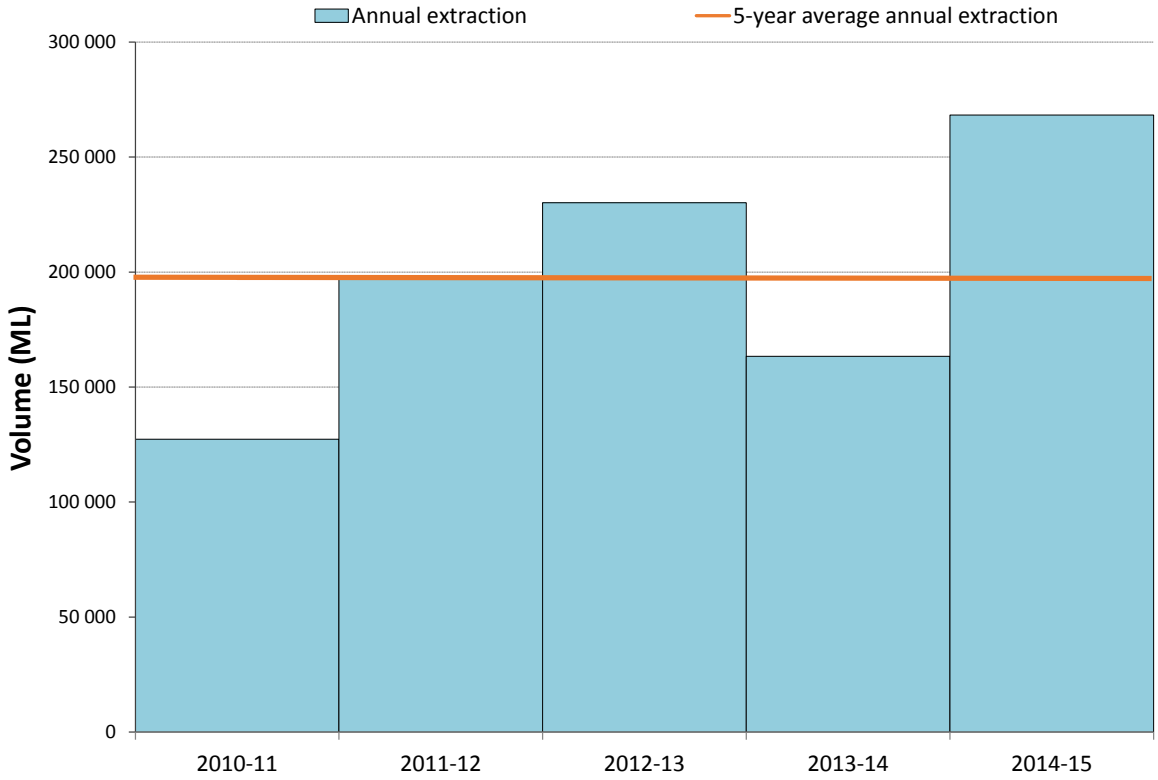


Figure 3. Licensed groundwater extraction volumes[4] for the past five water-use years, for the unconfined aquifer in the Lower Limestone Coast PWA

[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.

[4] The licensed groundwater use for the 2014–15 water-use year is based on the best data available as of March 2016 and may be subject to change, as approximately three per cent of South East annual water use reports had not been submitted at the time. As such, the total licensed groundwater use may be higher than the volume presented in this report.

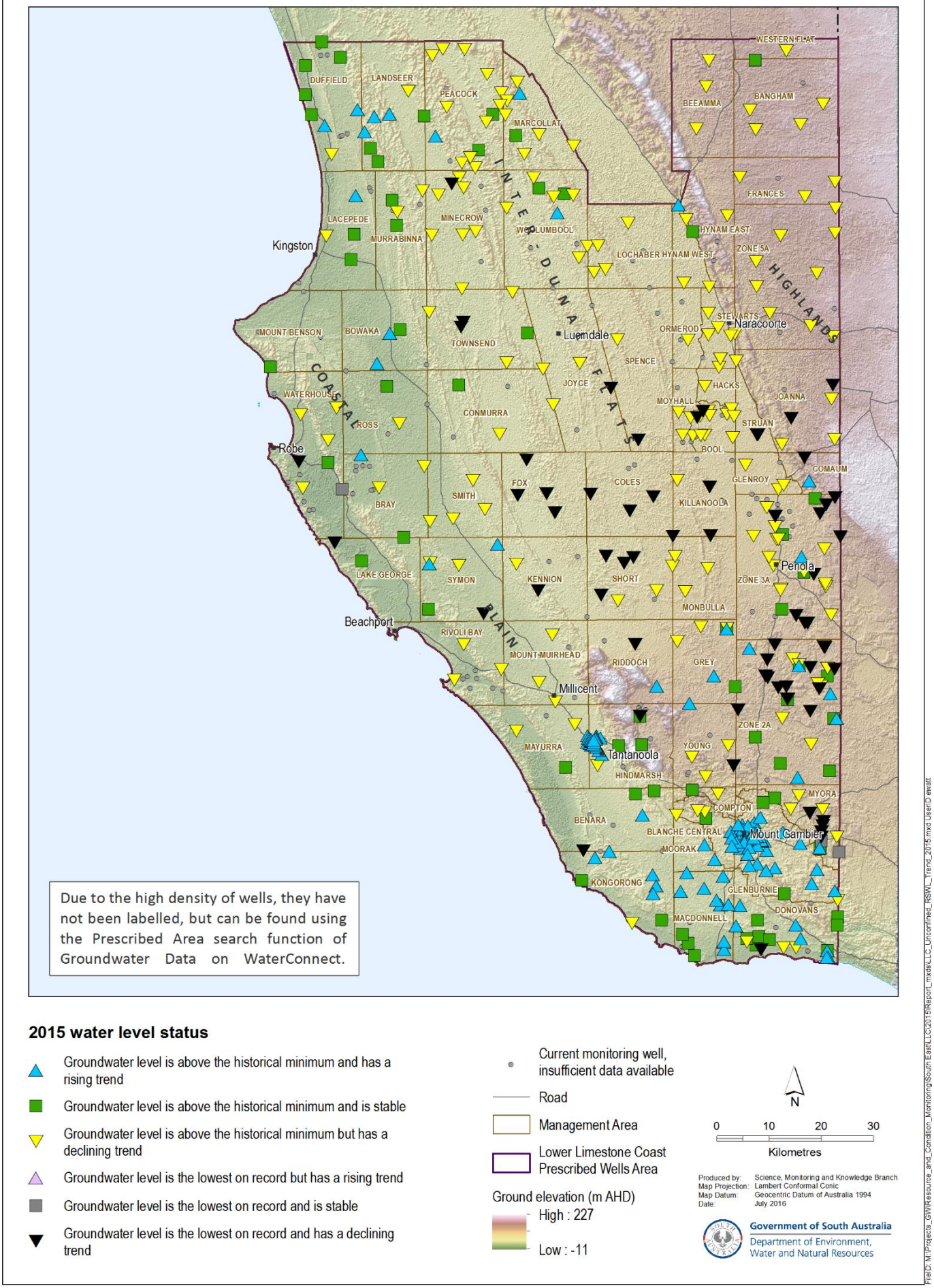


Figure 4. 2015 status of groundwater levels in the unconfined aquifer (Lower Limestone Coast Prescribed Wells Area) based on the five-year trend from 2011 to 2015

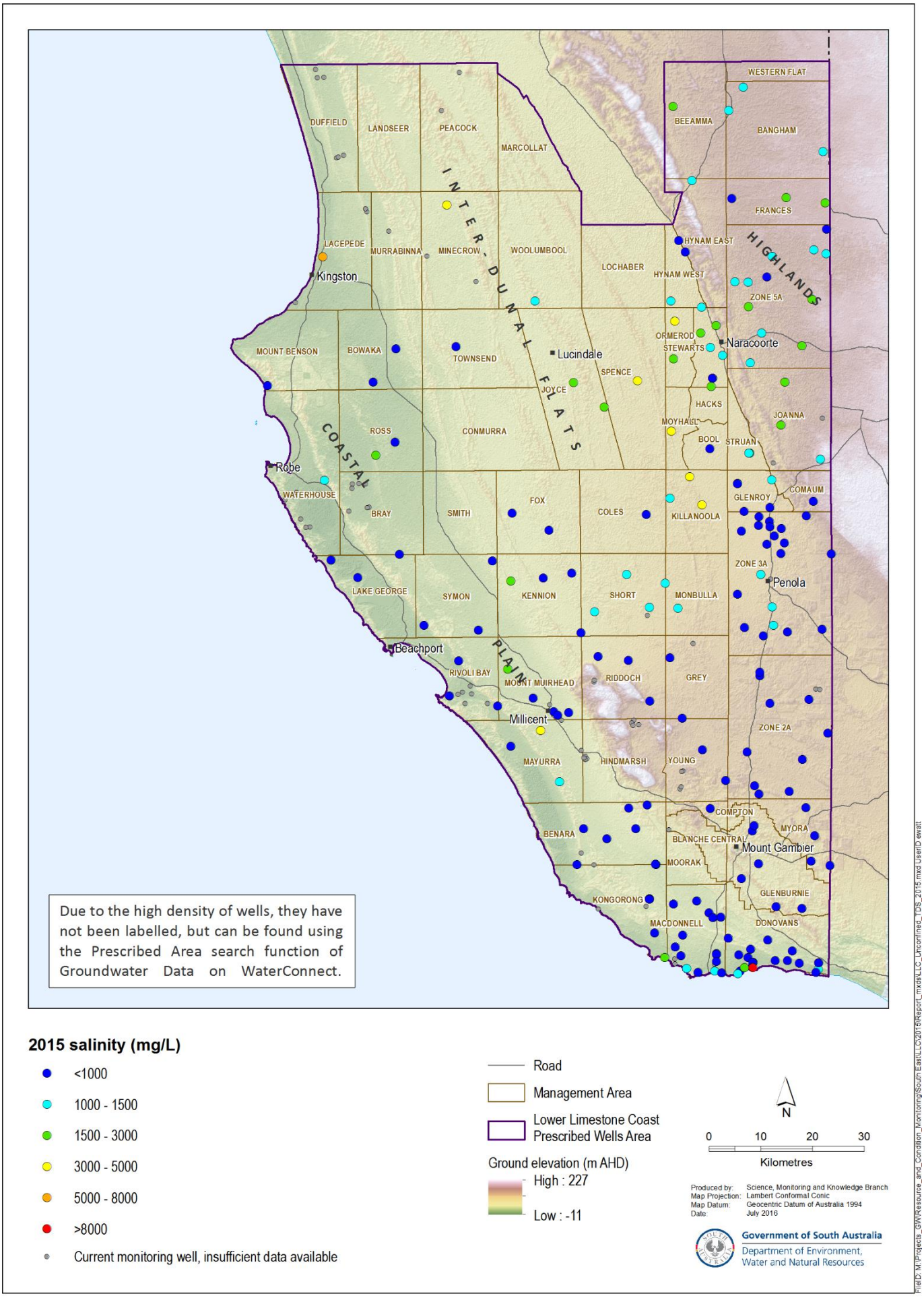


Figure 5. 2015 groundwater salinity of the unconfined aquifer (Lower Limestone Coast Prescribed Wells Area)

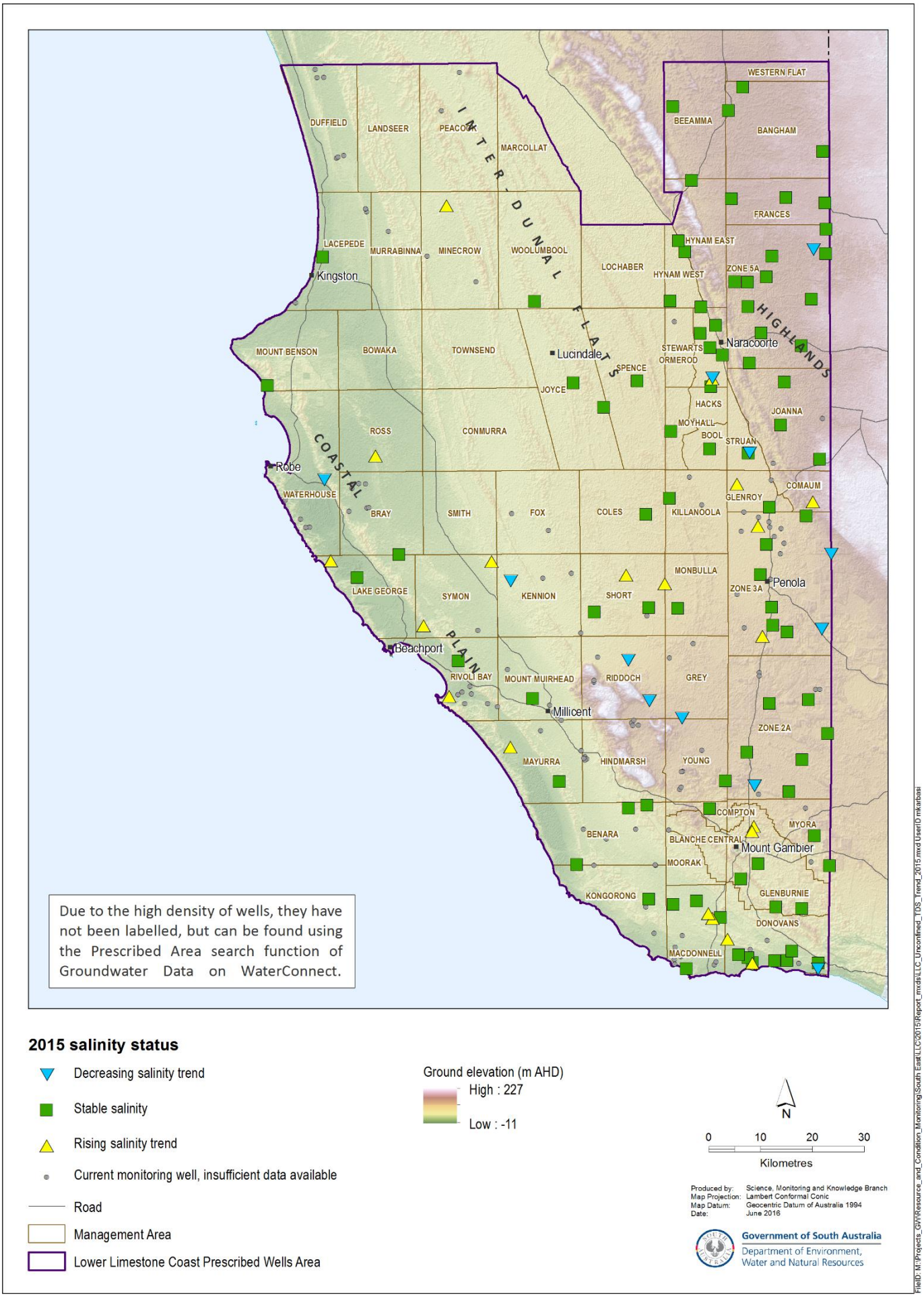


Figure 6. 2015 status of groundwater salinity in the unconfined aquifer (Lower Limestone Coast Prescribed Wells Area) based on the five-year trend from 2011 to 2015

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