Padthaway PWA

Unconfined aquifer

2015 Groundwater level and salinity status report

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

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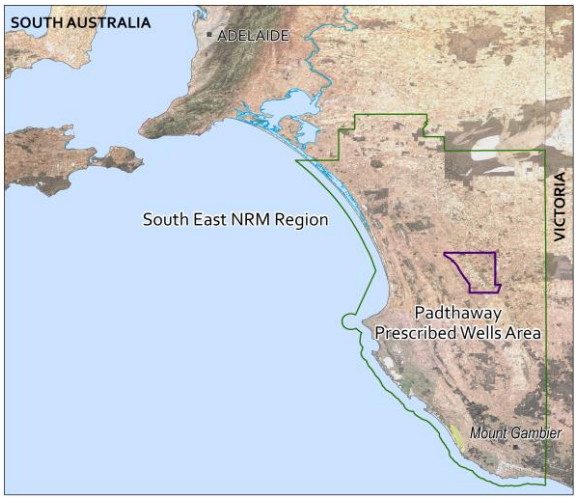
2015 Summary



The Padthaway Prescribed Wells Area (PWA) is located in the upper South East of South Australia, approximately 250 km south-east of Adelaide, in the South East NRM Region. 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 resources.

The Padthaway PWA is underlain by sediments of the Murray and Gambier Basins and can be divided topographically into two discrete landforms, each with different hydrogeological characteristics and groundwater management issues. The low-lying Padthaway Flat lies to the west, with the Padthaway Range to the east. Both regions are underlain by an unconfined aquifer comprising various Quaternary and Tertiary limestones, sandstones and sands. The confined Tertiary sand aquifer is generally thin or absent in the Padthaway PWA.

The Quaternary-aged Padthaway, Coomandook and Bridgewater Formations form the unconfined aquifer on the Padthaway Flat. The Bridgewater Formation also forms the unconfined aquifer in the Padthaway Range, where it is underlain by the Tertiary-aged Gambier Limestone. The main source of recharge to the unconfined aquifer is the direct infiltration of rainfall. Groundwater generally flows in a south-westerly direction but changes to north-westerly along the inter-dunal Padthaway Flat.

Trends in groundwater levels and salinity in the Padthaway PWA are primarily climate driven: below-average rainfall results in a reduction in recharge to the aquifers and can also result in increased irrigation extraction, which together can cause groundwater levels to fall and salinities to increase. Conversely, increased rainfall may result in increased recharge, decreased irrigation extraction and a rise in groundwater levels and declines in salinity. Rising groundwater levels and salinity can also be caused by the clearing of deep-rooted native vegetation and replacement with shallow-rooted pasture and crops, as this typically results in increased recharge and the potential for saline soilwater to be displaced into the groundwater. The recycling of irrigation drainage water can also cause salinity levels to increase. The response of groundwater level to rainfall varies between the Padthaway Flats and Padthaway Range Management Areas, primarily due to the depth of the watertable and the lithology of the sediments (predominantly clay content). Groundwater levels are more responsive to rainfall on the low-lying flat as the watertable is shallow. In the ranges, the watertable is more than 10 m below the ground surface resulting in a delayed response, with a lag time dependent on the depth to the watertable, permeability of the sediments and type of land use.

The Marcollat rainfall station (BoM Station 26017) is located in the north-west of the PWA and recorded 346 mm of rainfall in 2014–15, 171 mm less than the long-term average annual rainfall (1900–2015) and the lowest in 37 years (Figs 1 and 2). Although the average annual rainfall for the past five years is comparable to the long-term average, there is a trend of decreasing rainfall over those five years (Figs 1 and 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 summer of 2010–11, where December alone received more than five times its long-term monthly average. The 2014–15 water-use year has been particularly dry, with nine months recording below-average rainfall, though Januray received twice its average.

Licensed groundwater extractions from the unconfined aquifer totalled 48 375 ML[1] in 2014–15, which is nearly double that of the previous water-use year and 85% of the total allocation volume for the Padthaway PWA (Fig. 3). This volume is the highest volume extracted over the last five years and exceeds the five-year average extraction rate by about 65% (Fig. 3). In 2014–15, 26% of licenced wells recorded no extraction because of faulty meters, so extraction volumes were estimated based on cropped area and delivery supplement. This, coupled with low rainfall, may explain the sudden rise in extraction recorded in 2014–15.

Between 1970 and the mid-2000s, a rise in groundwater level of up to 4.5 m was recorded by monitoring wells in the Padthaway Range Management Area. This was followed by a slight decline, with some recovery observed in 2010. In the five years to 2015, 73%

[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.

of monitoring wells in the Padthaway Range Management Area recorded a trend of stable or rising groundwater level, while a declining trend was observed in the remaining monitoring wells (Fig. 4). Rises in groundwater level ranged between 0.14 and 0.29 m/y, while declines were between 0.11 and 0.52 m/y.

Monitoring wells in the Padthaway Flats Management Area reveal a decline in groundwater level between 1970 and 1978, then a gradual rise until 1992–94. This was followed by a decline of around 2 m, with a recovery of about one metre since 2009. In the five years to 2015, 82% of monitoring wells recorded a declining groundwater level, with one well recording its lowest groundwater level on record in 2015. Eighteen per cent of monitoring wells show a five-year trend of stable or rising groundwater levels. Declines ranged between 0.11 and 0.76 m/y with a median of 0.19 m/y. Most wells with a declining trend recorded a groundwater level between 0.5 and 1.0 m above the lowest level ever recorded in 2015.

Groundwater salinity trends in the shallow unconfined aquifer are influenced by rainfall patterns, the efficiency of various irrigation practices and throughflow from the Padthaway Range that is influenced by vegetation clearance and the flushing of the salt store. As such, salinity trends are quite variable across both management areas, but most monitoring wells show long-term trends of rising salinity.

In 2015, groundwater salinities ranged between about 970 and 8070 mg/L across the Padthaway PWA (Fig. 5). In the Padthaway Range Management Area, all monitoring wells show a five-year trend of stable salinity (Fig. 6). Most monitoring wells in the Padthaway Flats Management Area also show a five-year trend of stable salinity, but 29% show a trend of increasing salinity.

To determine the status of the unconfined aquifer for 2015, the trends in groundwater level 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 a detailed explanation of the new method of status assessment.

Padthaway Range Management Area

The unconfined aquifer of the Padthaway Range Management Area 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 Padthaway Range Management Area is based on:

- most monitoring wells (73%) recording a five-year trend of stable or rising groundwater levels
- all monitoring wells show a five-year trend of stable groundwater salinity.

Padthaway Flats Management Area

The unconfined aquifer of the Padthaway Flats Management Area has 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 Padthaway Flats Management Area is based on:

- most monitoring wells (82%) recording a five-year trend of declining groundwater levels, with one well recording its lowest groundwater level on record in 2015.

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

To view the *Padthaway PWA groundwater level and salinity status report 2011*, which includes background information on hydrogeology, rainfall and groundwater-dependent ecosystems, and descriptions of all status symbols, visit WaterConnect.

To view or download groundwater level and salinity data from monitoring wells within the Padthaway PWA, please visit Groundwater Data on WaterConnect.

For further details about the Padthaway PWA, please see the *Padthaway Prescribed Wells Area Water Allocation Plan* on the Natural Resources South East website.

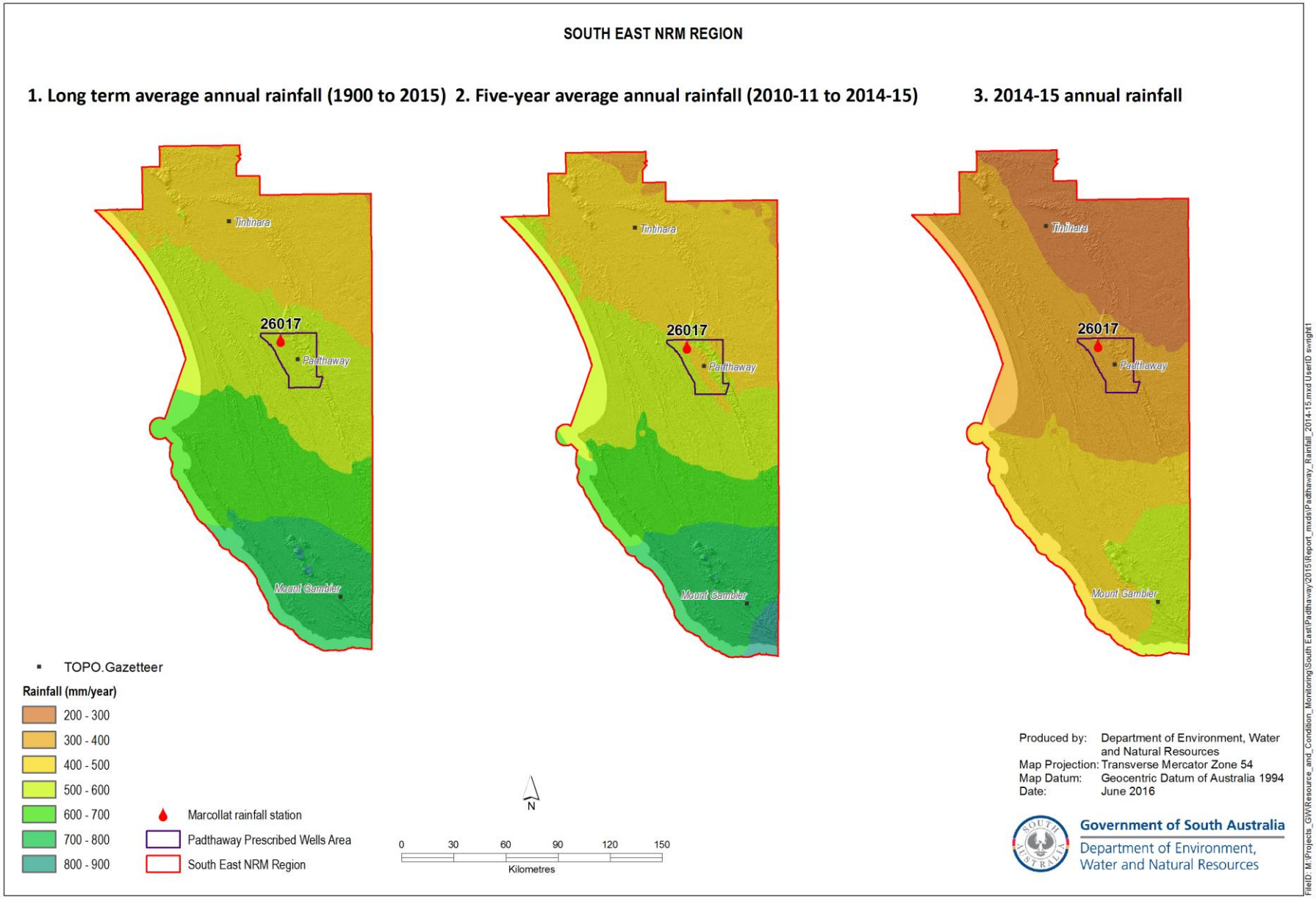


Figure 1. (1) Long-term and (2) five-year average annual rainfall, and (3) annual rainfall for the 2014–15 water-use year in the South East NRM Region[2]

[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.

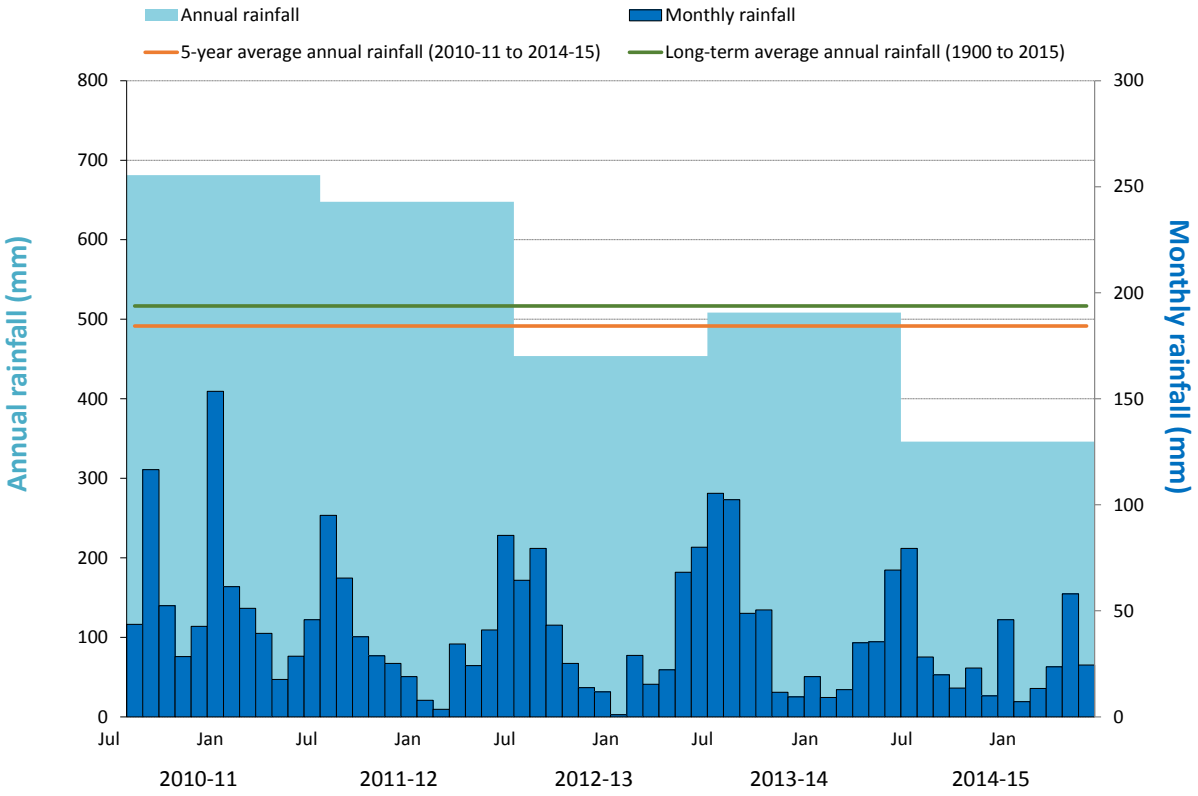


Figure 2. Annual (July–June) and monthly rainfall for the past five water-use years, and the five-year and long-term average annual rainfall recorded at Marcollat (BoM Station 26017)[3]

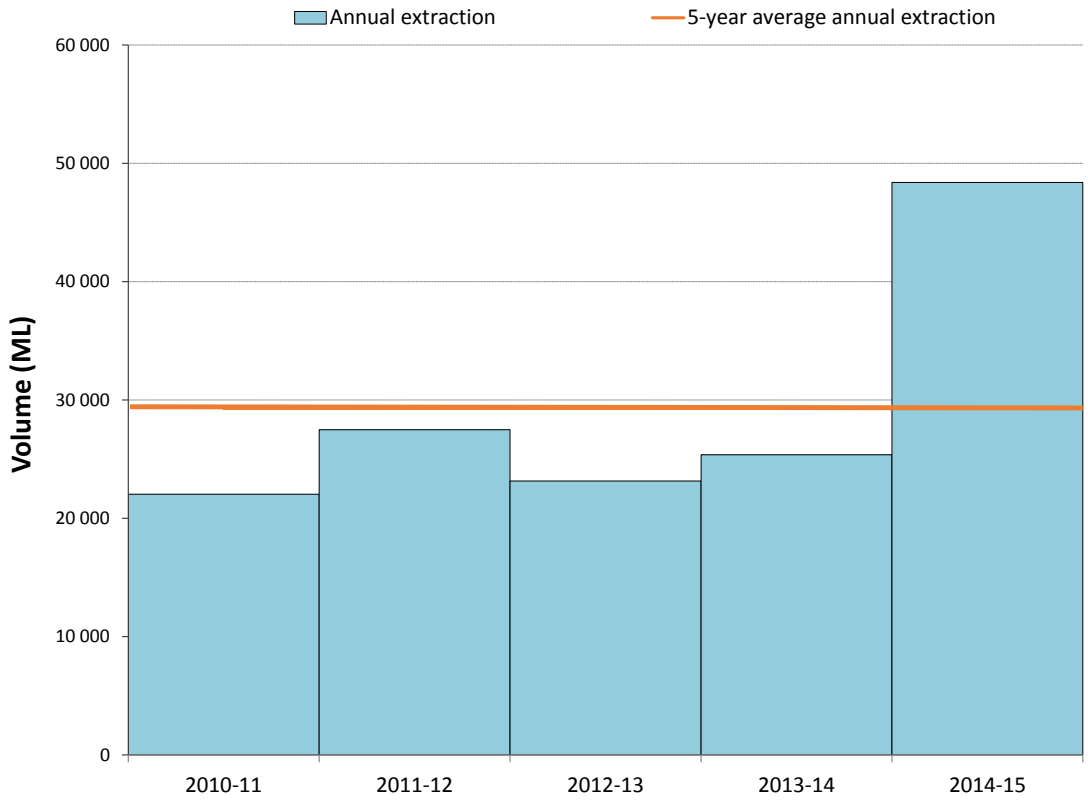


Figure 3. Licensed groundwater extraction volumes for the past five water-use years, from the unconfined aquifer in the Padthaway Prescribed Wells Area[4]

[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.

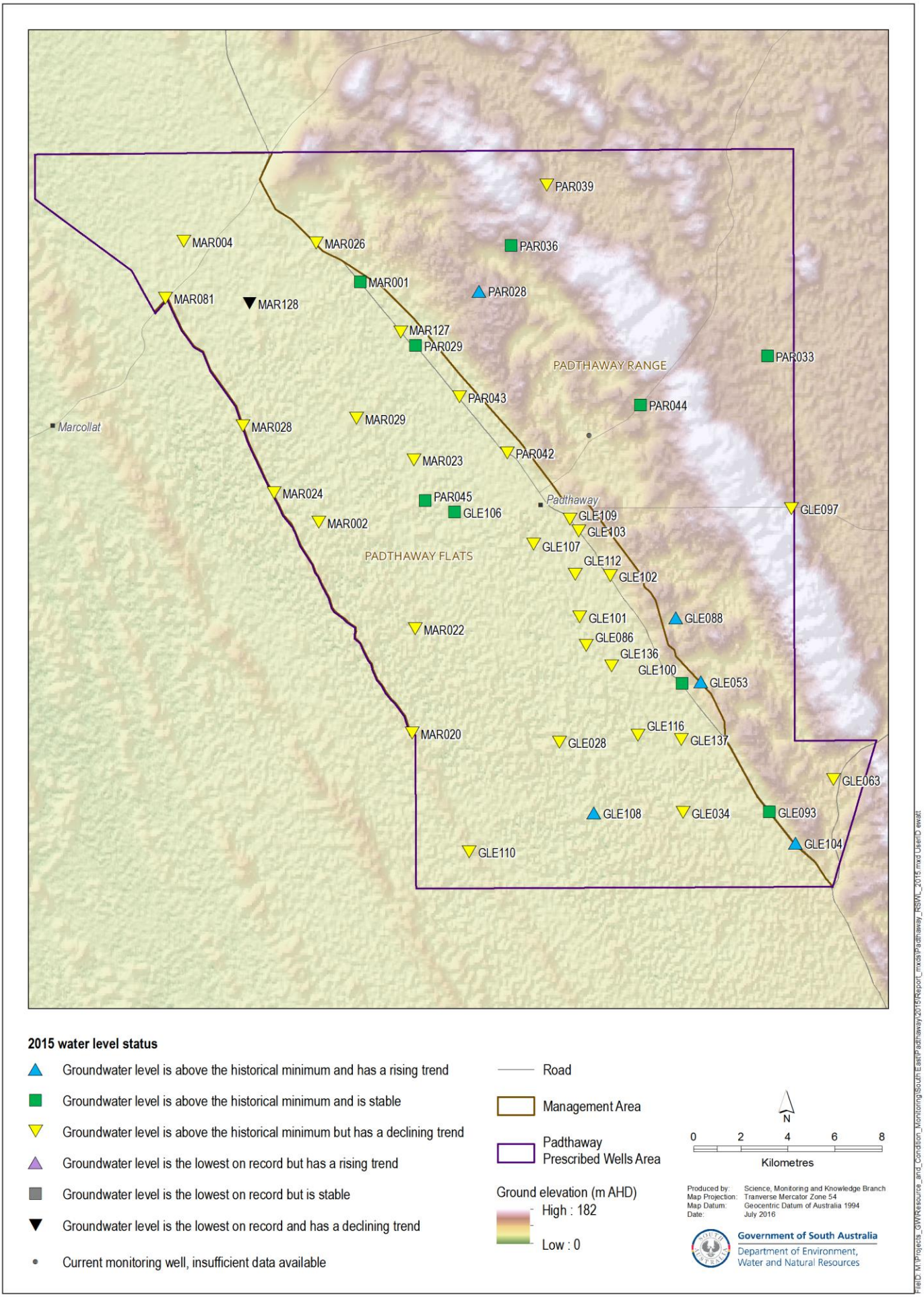


Figure 4. 2015 status of groundwater levels in the unconfined aquifer (Padthaway Prescribed Wells Area) based on the five-year trend from 2011 to 2015

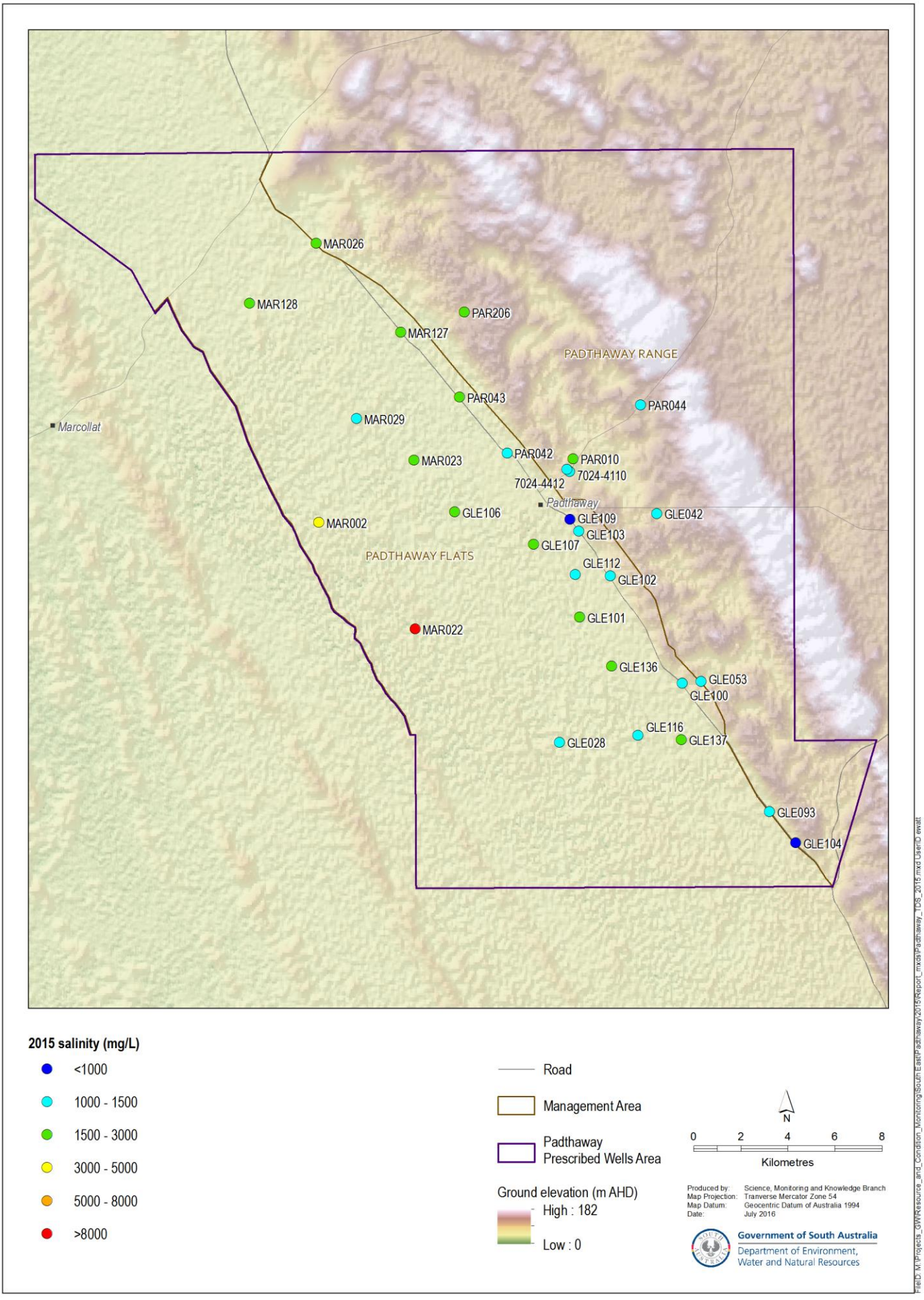


Figure 5. 2015 groundwater salinity in the unconfined aquifer (Padthaway Prescribed Wells Area)

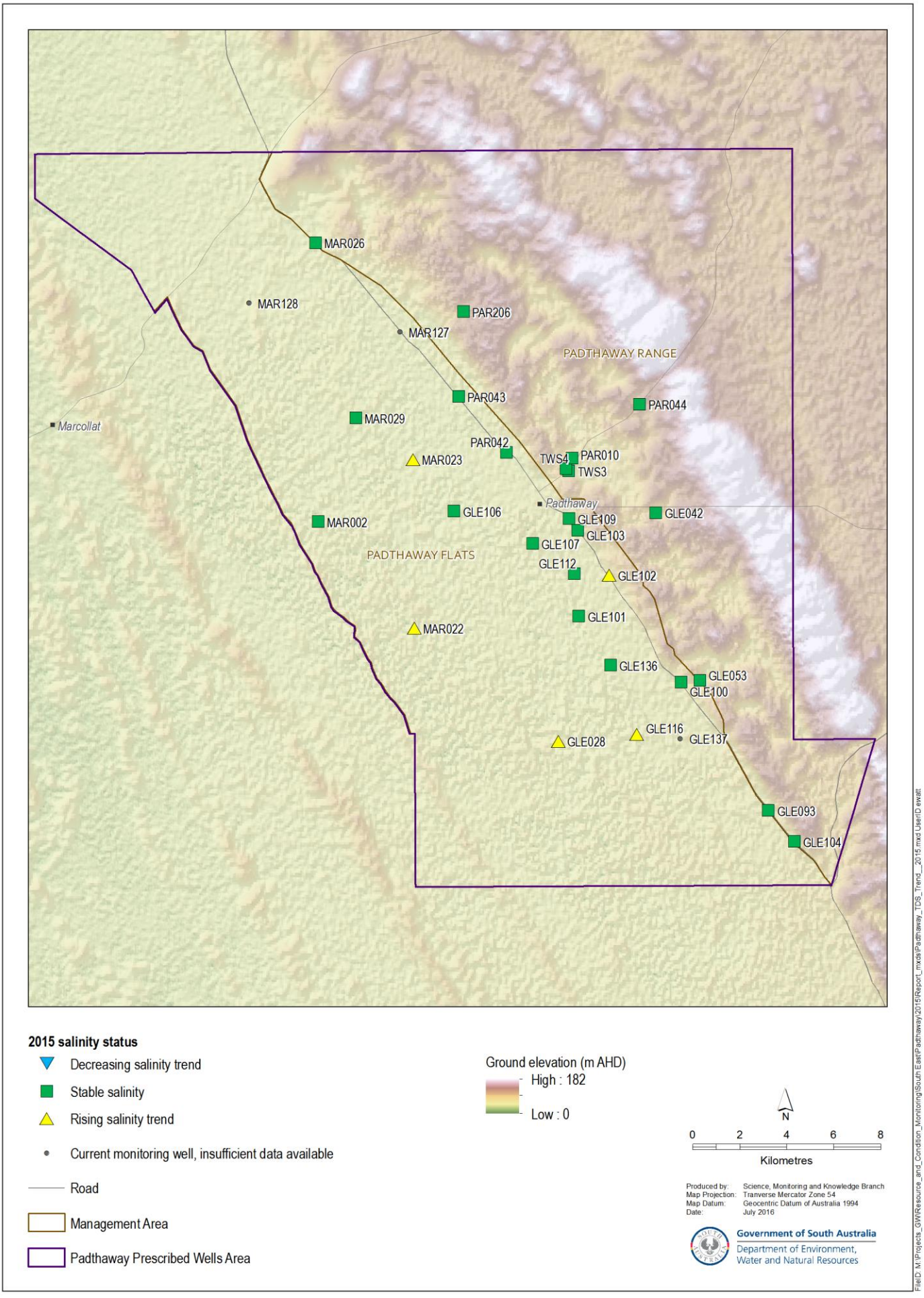


Figure 6. 2015 status of groundwater salinity in the unconfined aquifer (Padthaway Prescribed Wells Area) based on the five-year trend from 2011 to 2015

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