



Groundwater trends in the Northern Adelaide Plains PWA 2005 to 2008

Introduction

This fact sheet contains a summary of trends in groundwater levels and rates of extraction across the North Adelaide Plains Prescribed Wells Area (PWA). It focuses on trends of groundwater levels between January 2005 and December 2008.

Introduction

The Adelaide and Mount Lofty Ranges Natural Resources Management Board (the Board) has been working on the development of a new water allocation plan (WAP) for the Northern Adelaide Plains (NAP). It is important that up-to-date monitoring information is used as the basis for the new plan. This fact sheet summarises latest trends in groundwater levels using the three years of data from 2005 to 2008.

Background

Groundwater is used across the NAP all year. In winter, groundwater is used primarily for crops grown in glasshouses; however, in years of low winter rainfall irrigation can occur across all crops.

Groundwater level trends across the NAP have been determined from available groundwater level monitoring and metering data provided by the Department of Water Land and Biodiversity Conservation. This information is being used by the Board and the NAP WAP Advisory Committee to develop policy aimed at effectively managing the available groundwater resources across the NAP.

The information in this fact sheet is based on the best available data at the time of publication. Groundwater metering data is generally collected twice each year; once in February and again at the end of the irrigation year in July.

Groundwater levels have been collected at regular intervals from monitoring wells. Currently, groundwater levels are collected at three monthly intervals.

Trends in water use data have been evaluated using data between water-use years 2005/06 and 2007/08. Trends in groundwater levels have been evaluated using data between the calendar years 2005 and 2008. Figure 1 illustrates the relationship between calendar years and water-use years.

Rainfall and groundwater extraction

- When looking at the groundwater level trends for resource management purposes, it is important to consider trends in rainfall and the rate of groundwater extraction. Rainfall quantity and timing can have a direct impact on groundwater level trends by influencing irrigation scheduling.
- Figure 2 presents the annual rainfall and long term average annual against the groundwater and reclaimed water use for irrigation years 1999/00 to 2007/08. The average annual rainfall of 426.2 mm/yr was calculated over the available period of record: 1972-2008. In a year when there is below average rainfall (e.g. 2006/07 season), irrigation will often start earlier thereby resulting in greater volumes of groundwater being extracted and prevent a full recharge of the aquifer. For example dry winters have been experience in the past two years



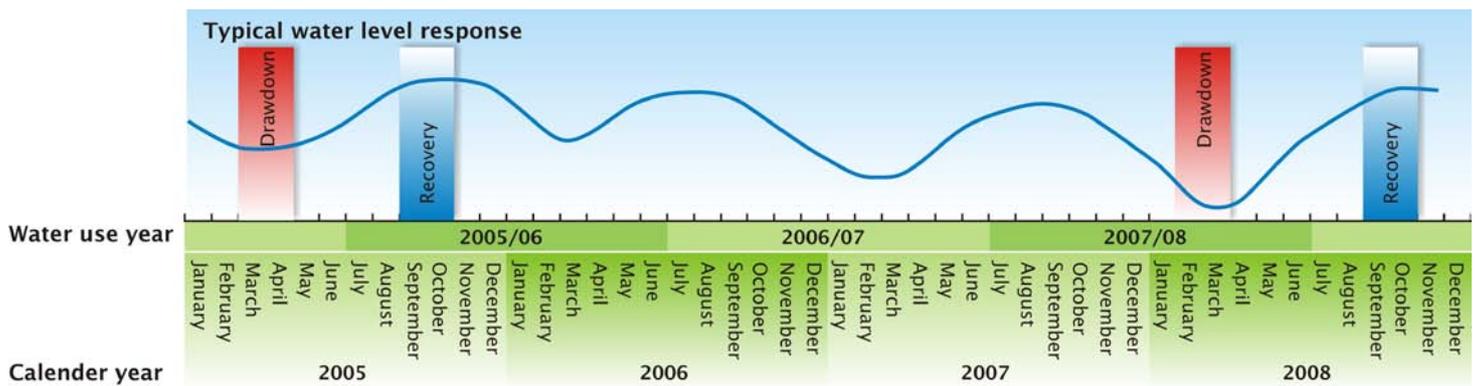


Figure 1: Relationship between water-use year and calendar year, with typical response of groundwater water levels showing recovery and drawdown levels during 2005 and 2008.

where irrigation commenced in June before the aquifer is fully recharged.

Rainfall data in Figure 2 illustrates that:

- Rainfall for the period 2000 to 2001 was above the long-term average;
- Rainfall during 2002 and 2003 was below the long-term average; Above average rainfall occurred during 2004 and continued during 2005, where heavy spring rains boosted the total annual rainfall allowing the groundwater levels to recover;
- Below average rainfall occurred in 2006 with the dry winter and spring;
- Rainfall in 2007 was marginally above average at 431 mm, due to heavy autumn rains. However, in general below average rainfall occurred during winter and spring through to the summer of 2008; and
- Below average rainfall occurred during 2008 with below average winter and spring rains.

Of the total groundwater demand, 2% is taken from the Quaternary aquifer/s, (mainly Q4), 19% is taken from the T1 aquifer and the balance (79%) is taken from the T2 aquifer (Figure 2).

The following points regarding groundwater extraction are noteworthy:

- Metered groundwater extraction (Figure 2) from the T1 and T2 aquifers totalled 13.2 in 2005/06 (not including Kangaroo Flat); the lowest recorded use for the available period of record, and increased to 18.9 GL in 2006/07, a year of below average rainfall. Extraction in the 2007/08 water-use year decreased slightly to 18.4 GL.
- Metered groundwater extraction in the Kangaroo Flat area over the last three water-use years was 1.2 GL in 2005/06, 2.7 GL in 2006/07 and 2.0 GL in 2007/08.
- The use of reclaimed water from the Virginia pipeline scheme averaged at approximately 9 GL from the scheme's inception (2000/01) until water-use year 2005/06. Use of reclaimed water peaked at 14.9 GL in 2006/07 and decreased to 13.0 GL in 2007/08.



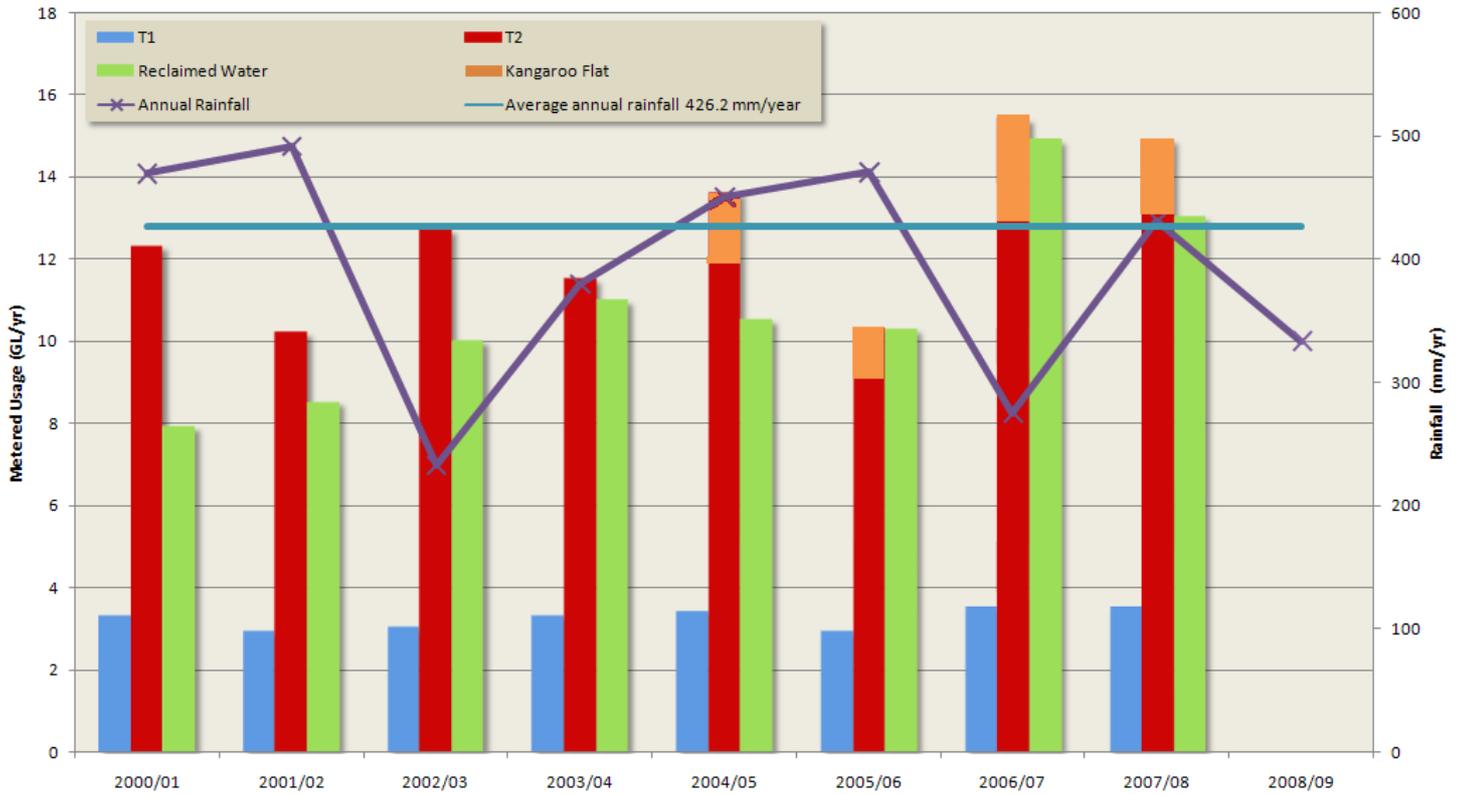


Figure 2: Metered groundwater use and reclaimed water use with annual rainfall (station 23083) and annual average rainfall. Note: Average annual rainfall calculated over the available period of record (1972-2008). Metered data applies to a water-use year. Annual rainfall applies to a calendar year. GL stands for gigalitres (equals 1000 megalitres (ML)).

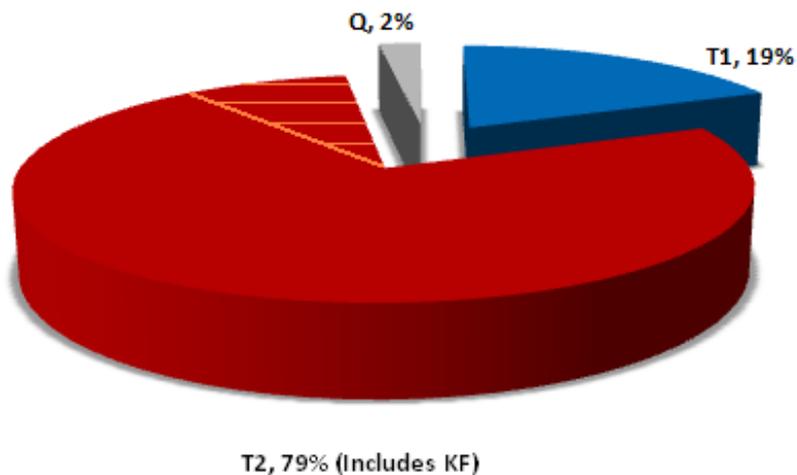


Figure 3: Percentage of groundwater use by aquifer for water use year 2007/08.





Groundwater level trends

Background to data analysis

- When looking at the patterns and magnitude of change in groundwater levels, it is important to consider the changing pattern of groundwater extraction across the NAP PWA. These patterns are illustrated in the 'difference in intensity of use' maps for the main aquifers (T1 and T2).
- These maps were created using a GIS statistical analysis technique to produce a spatial intensity estimate over a radius of approximately 1 km around each production well.
- The 'difference in intensity of use' analysis only includes data from wells where the aquifers from which groundwater is extracted has been designated. A total volume of 3 ML of unaccounted extraction has not been included in the analysis for 2007/08 water-use year.

T1 Aquifer

Intensity of groundwater use from the T1 Aquifer

- There has been a 21% increase (0.6 GL) in the volume of water extracted from the T1 Aquifer between water-use year 2005/06 (2.9 GL) and water-use year 2007/08 (3.5 GL). Correspondingly there has been an increase in the 'intensity of use' across areas of the T1 aquifer.
- The 'intensity of use' during 2007/08 water-use year presented in Figure 4, shows high intensity of groundwater use north, east and within the Dry Creek area, and in areas around Waterloo Corner, Virginia, Port Gawler and Buckland Park.
- Figure 5 illustrates the 'difference in intensity of use' between water-use years 2005/06 and 2007/08. The results show there has been a decrease in intensity of groundwater use within the Dry Creek area and around Waterloo Corner, indicating that groundwater use has declined in these areas (possibly transferred and used in other areas).
- The results show there has been an increase in intensity of groundwater use in an area east of Dry Creek and in the Waterloo Corner, Virginia and Port Gawler areas.

All other areas have either slightly increased or remained the same.



Figure 4: 'Intensity of use' from the T1 Aquifer during the water use year 2007/08.



Figure 5: 'Difference in intensity of use' from the T1 Aquifer between the water-use years of 2005/06 and 2007/08.



Groundwater level trends in the T1 Aquifer

- Figure 6 shows the difference in recovered groundwater levels between 2005 and 2008. The recovered water levels are measured prior to the irrigation season (generally between August and October), when the groundwater levels are at their highest (Figure 1). Figure 6 shows there has been a general decline in groundwater over the aquifer with only 16% of monitoring wells analysed showing an increase in level. Declining levels generally ranged between 0.5 and greater than 2 metres, with approximately 55% of monitoring wells analysed showing a decline of greater than 1 metre.
- Declines in recovered groundwater levels correlate with regions of high 'intensity of use' for water-use year 2007/08. For example, 2008 recovered levels were 0.5 to 1.9 metres lower than 2005 levels in the Port Gawler, Buckland Park and Dry Creek areas (Figure 4).
- Rises in recovered groundwater levels located in the Waterloo Corner area correlate with decreases in 'difference in intensity of use' between water-use years 2005/06 and 2007/08 (Figure 5).
- Figure 7 shows the difference in groundwater levels between 2005 and 2008 at the end of the irrigation season (generally between February and May) when the groundwater levels are at their lowest (drawdown).

Figure 7 shows there has been a general decline in groundwater levels over the aquifer with 2008 groundwater levels 1 to greater than 2 metres lower than 2005 levels in approximately 80% of monitoring wells analysed.



Figure 7: Difference in 2005 and 2008 groundwater levels in the T1 Aquifer after the irrigation season (drawdown).

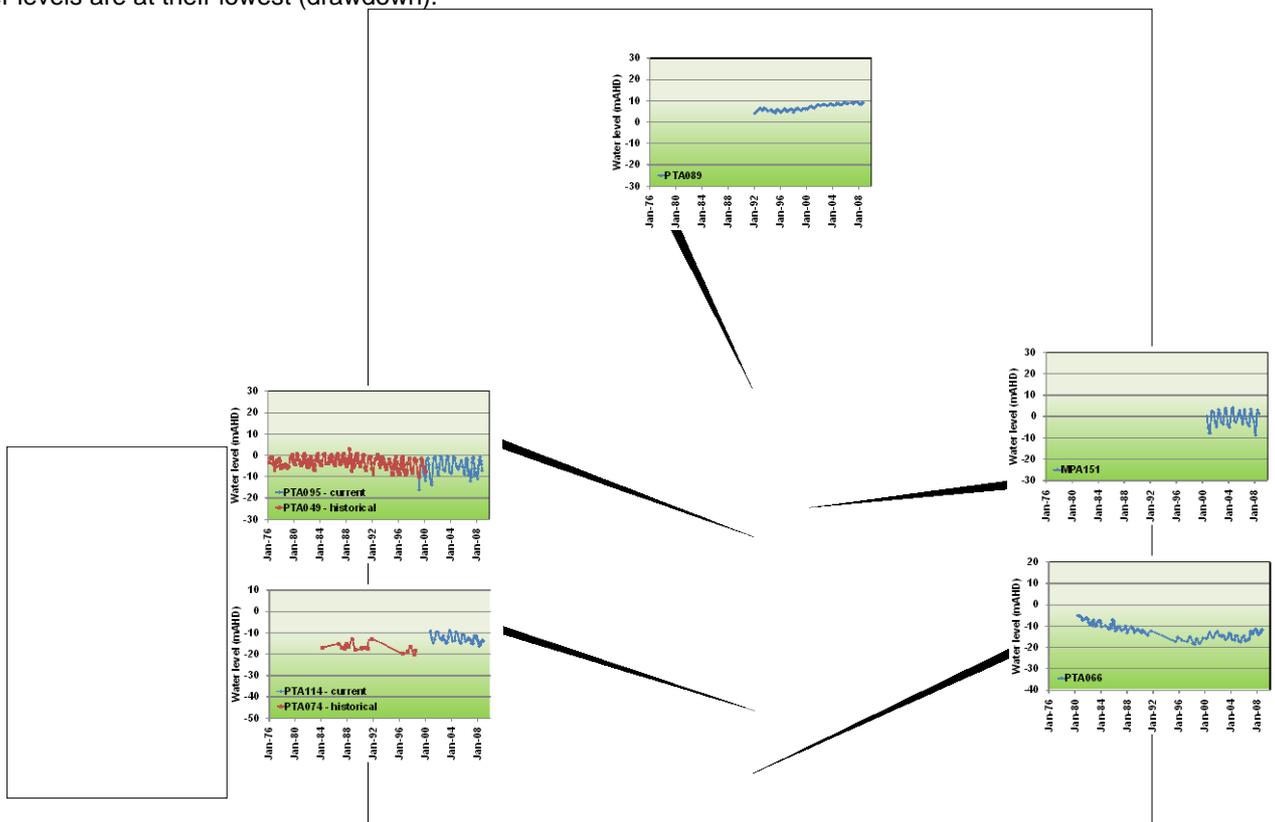


Figure 6: Difference in 2005 and 2008 recovered groundwater levels in the T1 Aquifer before the irrigation season.





T2 Aquifer

Intensity of groundwater use from the T2 Aquifer

- There has been a 45% (4.6 GL) increase in the volume of water extracted from the T2 Aquifer between water-use years 2005/06 (10.3 GL) and 2007/08 (14.9 GL). Correspondingly there has been an increase in the 'intensity of use' across areas of the T2 aquifer.
- The 'intensity of use' during water-use year 2007/08 displayed in Figure 8, shows high intensity areas north of Virginia, around Angle Vale Road between Virginia and Angle Vale, between Angle Vale and Andrews Farm, and along Two Wells Road west of Port Gawler.

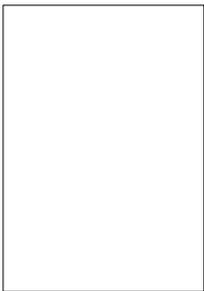


Figure 8: 'Intensity of use' from the T2 Aquifer during the water-use year of 2007/08.

- Figure 9 shows the 'difference in intensity of use' of groundwater extracted over the three water-use years between 2005/06 and 2007/08.
- The results show that there has been a slight decrease in the intensity of groundwater use in areas south and west of Virginia, areas north of Angle Vale and in areas surrounding Port Gawler.
- There has been an increase in the intensity of groundwater extraction over the past three water-use years in areas north Virginia, south of Angle Vale, and in some areas between Angle Vale and Kangaroo Flat.



Figure 9: 'Difference in intensity of use' from the T2 Aquifer between the water-use years of 2005/06 and 2007/08.





Groundwater level trends in the T2 Aquifer

- Figure 10 shows the difference in recovered groundwater levels between 2005 and 2008. The results show there has been a general decline of groundwater levels over the aquifer ranging between 0.5 metres and greater than 2 metres in approximately 77% of analysed monitoring wells. Recovered groundwater levels in 45% of the monitoring wells analysed have declined by greater than 2 metres over the last three years.
- Despite the general trend of declining levels, 17% of monitoring wells showed a rise in recovered groundwater levels. These wells were generally located in the north-east of the NAP in the area north of Angle Vale and Kangaroo Flat. The outside of the areas of groundwater usage.
- In general the hydrographs displayed in Figure 10 show that groundwater levels have not generally recovered to levels recorded in 2000.
- Figure 11 shows the difference in groundwater levels between 2005 and 2008 at the end of the irrigation season (drawdown). The results show there has been a general decline in drawdown groundwater levels over the aquifer with 2008 groundwater levels 0.5 to greater than 2 metres lower than to 2005 levels in approximately 89% of wells analysed. In 62% of monitoring wells analysed drawdown levels were 2 metres lower in 2008 than in 2005.

The hydrographs displayed in Figure 10 show that drawdown levels are not falling to the levels recorded during the mid 1990's.

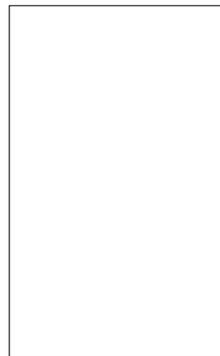


Figure 11: Difference in 2005 and 2008 groundwater levels in the T2 Aquifer following the irrigation season (drawdown).

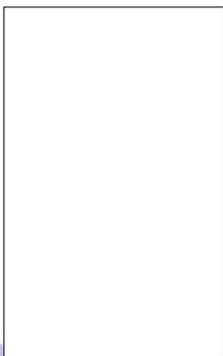
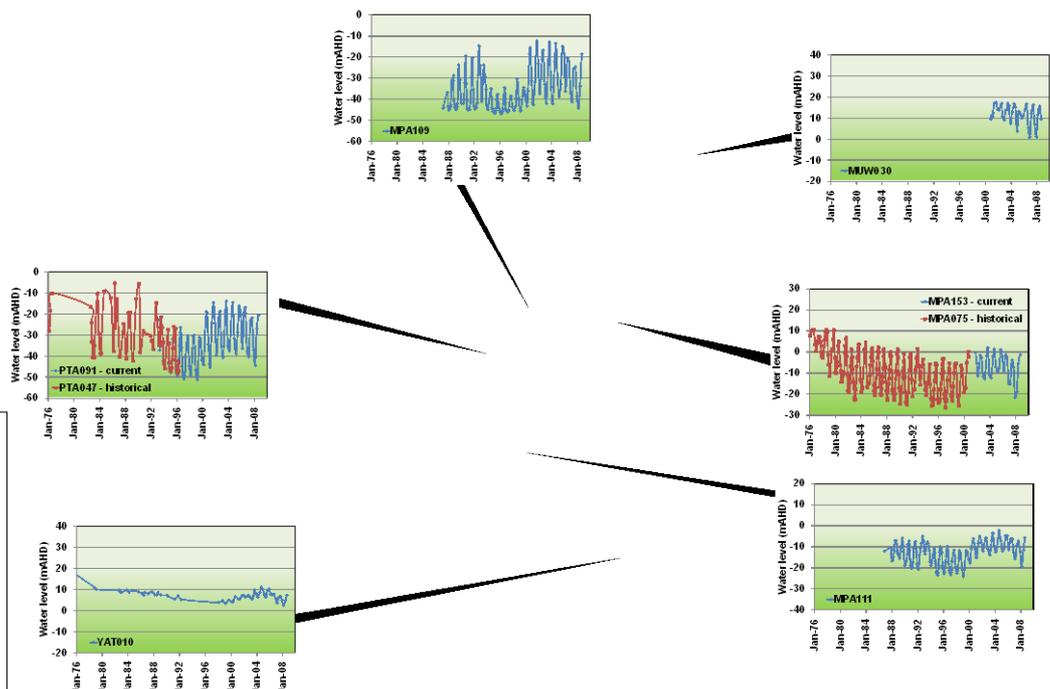


Figure 10: Difference in 2005 and 2008 recovered groundwater levels in the T2 Aquifer before irrigation season.





Key Findings

- There has been an increase in the groundwater extraction from the T1 and T2 aquifers of 5.2 GL (47%) between water-use years 2005/06 (13.2 GL) and 2007/08 (18.4 GL). An increase in extraction of 0.6 GL occurred in the T1 aquifer and 4.6 GL in the T2 aquifer. However, in comparison to the 2006/07 water-use year (18.9 GL), extraction has slightly decreased during 2007/08 by 0.5 GL (2.6%).
- There has been an increase in the 'intensity of use' in high use areas between water-use years 2005/06 and 2007/08 across both aquifers. Areas of higher 'intensity of use' in the T1 aquifer include areas north, east and within the Dry Creek area, and areas around Waterloo Corner, Virginia, Port Gawler and Buckland Park; and in the T2 aquifer the intensity of use had increased in areas north of Virginia, around Angle Vale Road between Virginia and Angle Vale, between Angle Vale and Andrews Farm, and along Two Wells Road west of Port Gawler.
- There has been a general decline in recovered groundwater levels within both the T1 and T2 aquifers over the past three years. Levels declined by greater than 1 metre in 55% of monitoring wells analysed in the T1 aquifer and 60 % of monitoring wells analysed within the T2 Aquifer.

Conclusions

- It has been estimated through groundwater modeling that use at the 2003/04 rates generally results in groundwater levels remaining within acceptable limits over the next 20 years. However, current usage is greater than 2003/04 usage and the observed declining trend in groundwater levels of 1 to greater than 2 metres across the region is consistent with the increase in extraction.
- The AMLR NRM Board (assisted by community input) is currently developing a draft WAP which will contain guiding principles that will aim to minimize unacceptable impacts to the aquifer.
- The WAP will seek to balance the right to use groundwater and the capacity of the aquifer (sustainable yield) to support extraction in the long term.

