WALLOWAY BASIN

GROUNDWATER STATUS REPORT

2009-10

Government of South Australia
Department for Water

SUMMARY 2009 - 10

The Walloway Basin is in the southern Flinders Ranges in the Mid-North of South Australia, approximately 85 km east of Port Augusta and 350 km north of Adelaide. It is a local scale groundwater resource which has no management regime in place as it has not been prescribed under South Australia's Natural *Resources Management Act 2004*.

The Basin consists of an inter-montane valley filled with sediments which are up to 330 m thick. The only significant extractions occur from the deep Tertiary confined aquifer for the Orroroo town water supply which totalled 60.5 ML for 2009-10.

Both groundwater levels and salinities in the Tertiary confined aquifer have been showing stable trends.

There is insufficient data to comment on trends in the shallow unconfined aquifer. Improvements in the monitoring network have been recommended to address this data gap.

ASSESSMENT OF STATUS

The Walloway Basin has been assigned a status of green "No adverse trends, indicating a stable or improving situation" based on current trends. This status is supported by;

- Stable water levels in the confined aquifer.
- Stable salinity levels in the confined aquifer.

At the current small level of extraction from the confined aquifer, it is considered that the observed groundwater level and salinity trends are unlikely to lead to a change in capacity to serve the current consumptive uses of the groundwater resource in the long term.

STATUS

No adverse trends, indicating a stable or improving situation

Trends are either stable (no significant change), or improving (i.e. decreasing salinity or rising water levels).

Adverse trends indicating low risk to the resource in the medium term

Observed adverse trends are gradual and if continued, will not lead to a change in the current beneficial uses of the groundwater resource for at least 15 years. Beneficial uses may be drinking water, irrigation or stock watering.

Adverse trends indicating high risk to the resource eventuating in the short to medium term

Observed adverse trends are significant and if continued, will lead to a change in the current beneficial uses of the groundwater resource in about 10 years.

Degradation of the resource compromising present use within the short term

Trends indicate degradation of the resource is occurring, or will occur within 5 years. Degradation will result in a change in the beneficial use (i.e. no longer suitable for drinking or irrigation purposes) and may take the form of increasing groundwater salinities, or a fall in the groundwater levels such that extractions from the aquifer may not be possible.

BACKGROUND

The Walloway Basin is located in the southern Flinders Ranges in the Mid-North of South Australia, approximately 85 km east of Port Augusta and 350 km north of Adelaide. It is a local scale groundwater resource which has no management regime in place as it has not been prescribed under South Australia's *Natural Resources Management Act 2004*.

HYDROGEOLOGY

The Walloway Basin consists of an inter-montane valley about 70 km long orientated in a north-south direction, flanked by Adelaidean fractured rocks. The valley is filled with fluvial and lacustrine Tertiary sediments overlain by alluvial outwash sediments of Quaternary to Recent age. The maximum thickness of sediments is about 330 m. Figure 1 provides a geological cross section across the basin.

The Quaternary sediments consist of interbedded sandy clays and thin sandy beds. The shallow Quaternary aquifers provide stock quality groundwater throughout the basin.

The confined Tertiary aquifer directly overlies bedrock and is continuous over the full length of the basin. It consists of fine grained sand layers interbedded with silts and clays over a thickness of about 150 m. Lignite seams up to 20 m thick are also present. Overlying this sequence is a stiff Tertiary clay confining layer up to about 90 m thick.

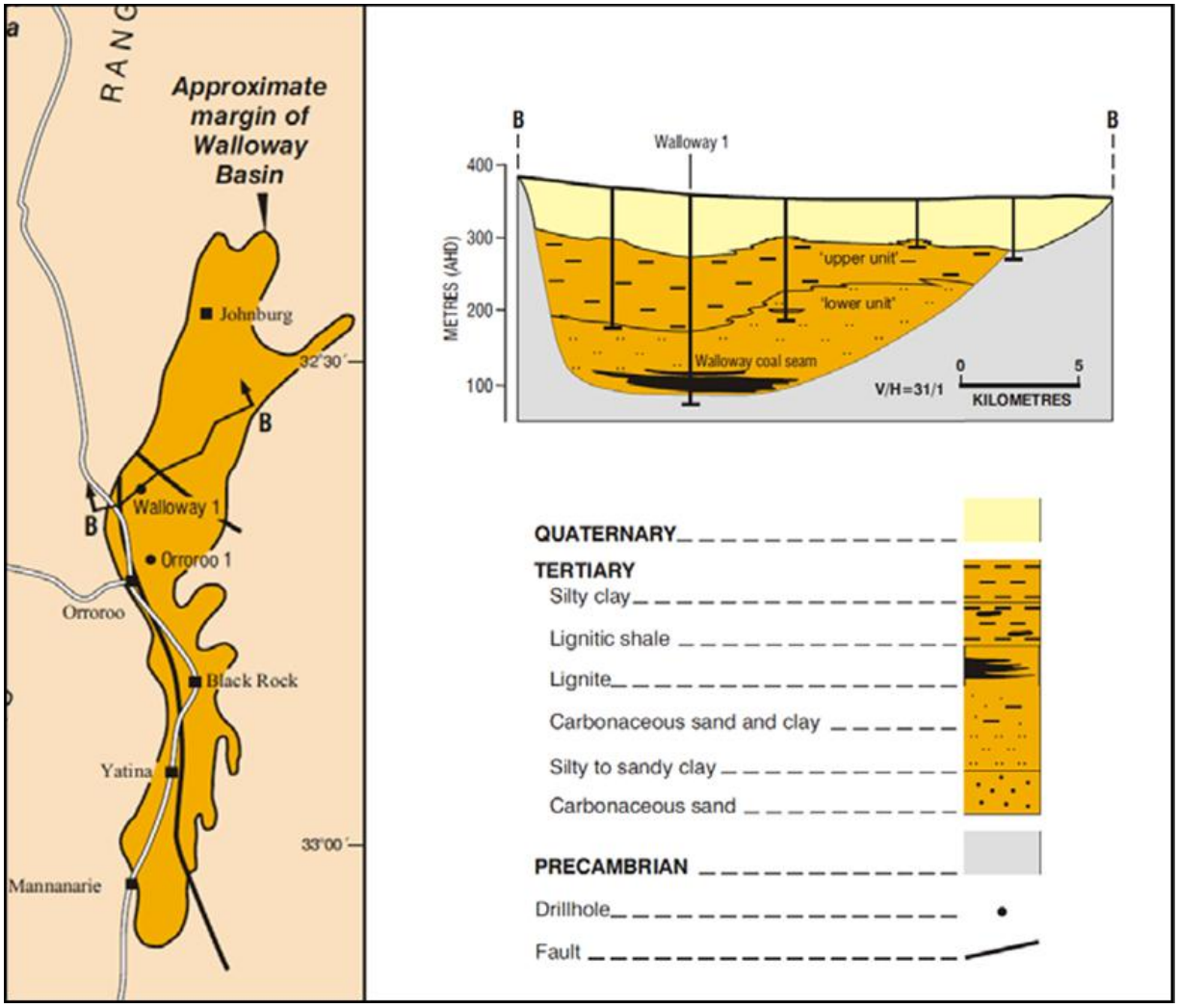

Figure 1. Geological cross section and plan view of the Walloway Basin

GROUNDWATER FLOW AND SALINITY

The salinity distribution for the Tertiary confined aquifer is presented in Figure 2. Groundwater movement in the Tertiary confined aquifer is from the recharge areas in the south toward the north. Groundwater salinities are generally below 3000 mg/L over most of the basin, with the higher salinities over 3000 mg/L generally located along the eastern margin.

Currently there is insufficient information to create water level contours for the confined aquifer, but groundwater flow is thought to be northwards. New data is expected in mid 2011.

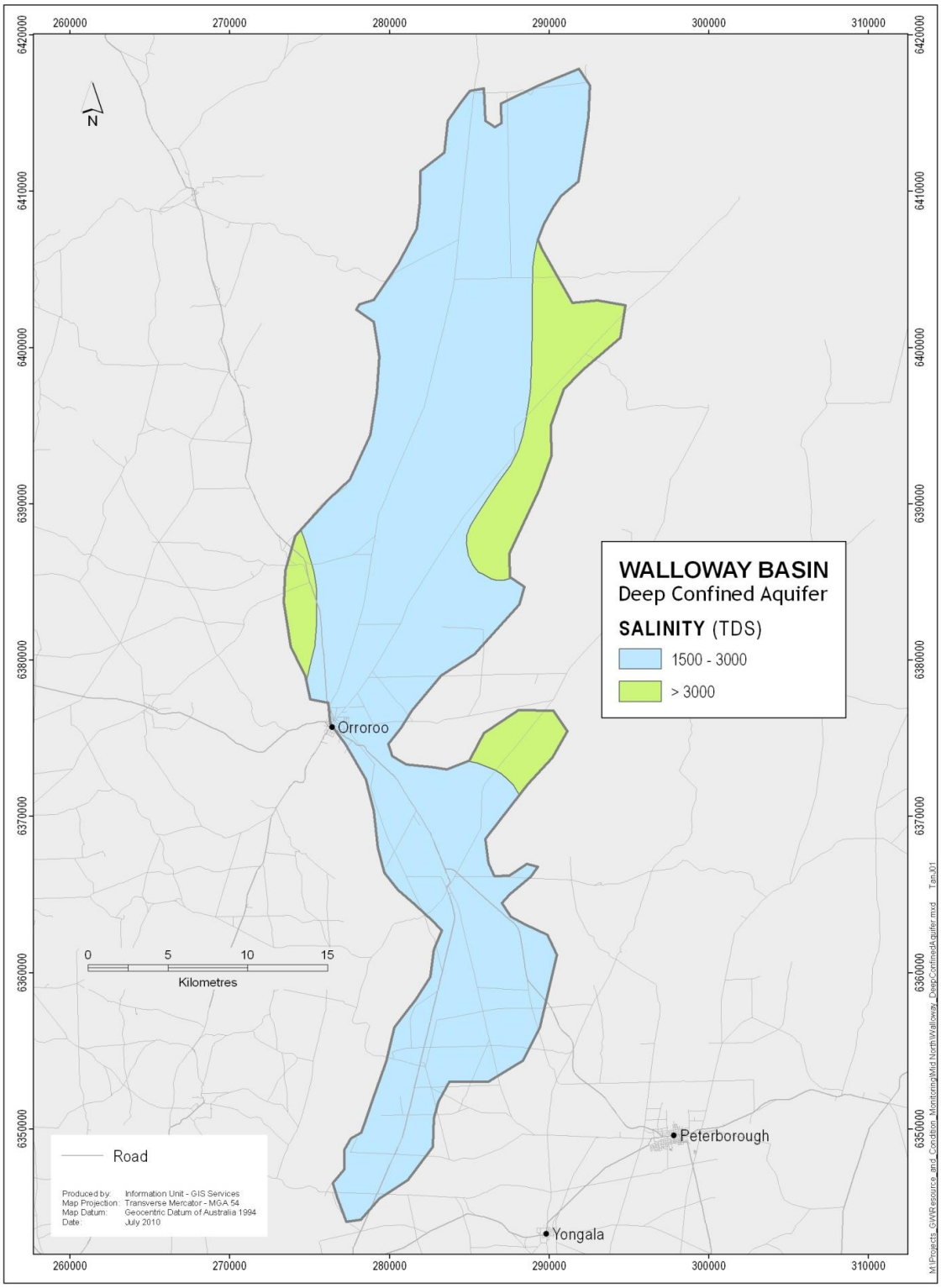

Figure 2. Salinity distribution for the Tertiary confined aquifer in the Walloway Basin

GROUNDWATER DEPENDENT ECOSYSTEMS

Whilst groundwater dependent ecosystems (GDEs) have not been used in the assessment of the status of the resource, it is important to note the presence and ecological characteristics of the GDEs found in the Walloway Basin.

Water Allocation Plans must include an assessment of the water required by ecosystems, including water from both surface water and groundwater resources. Groundwater dependent ecosystems can be defined as ecosystems where groundwater provides all or part of the water quantity, chemistry or temperature either permanently, seasonally or intermittently. It is generally considered that shallow watertables, i.e. those less than 10 m below the surface are more likely to support GDEs than deeper watertables. The exception to this is stygofauna (animals that inhabit water filled cracks and pools below the ground), which can be found at greater depths.

Existing datasets suggest that it is unlikely that *groundwater dependent* surface ecosystems exist within the Walloway Basin given the large depth to groundwater, however it is possible that stygofauna may exist within the region's aquifers.

RAINFALL

Rainfall is a very important part of the groundwater balance because it is a source of replenishment or recharge to aquifers by infiltration through the soil or by percolation from streamflow in drainage lines.

The climate of the Walloway Basin is characterised by hot, dry summers and cool to cold, wet winters. The Bureau of Meteorology rainfall station at Orroroo (19005) was chosen for analysis of rainfall trends (Fig. 3). The annual average rainfall is 313 mm at Orroroo and decreases in a north-easterly direction to about 250 mm at the northern extent of the basin.

Cumulative deviation from mean monthly rainfall is graphed in blue in Figure 3 to identify periods where rainfall trends are above or below average. An upward slope indicates a period where the rainfall is greater than the average, while a downward slope indicates a period where the rainfall is below the average.

There have been very wet periods in 1973-74 and 1992-93, but since 2002, generally below average rainfall conditions have prevailed. Slightly above average rainfall was recorded in 2009-10.

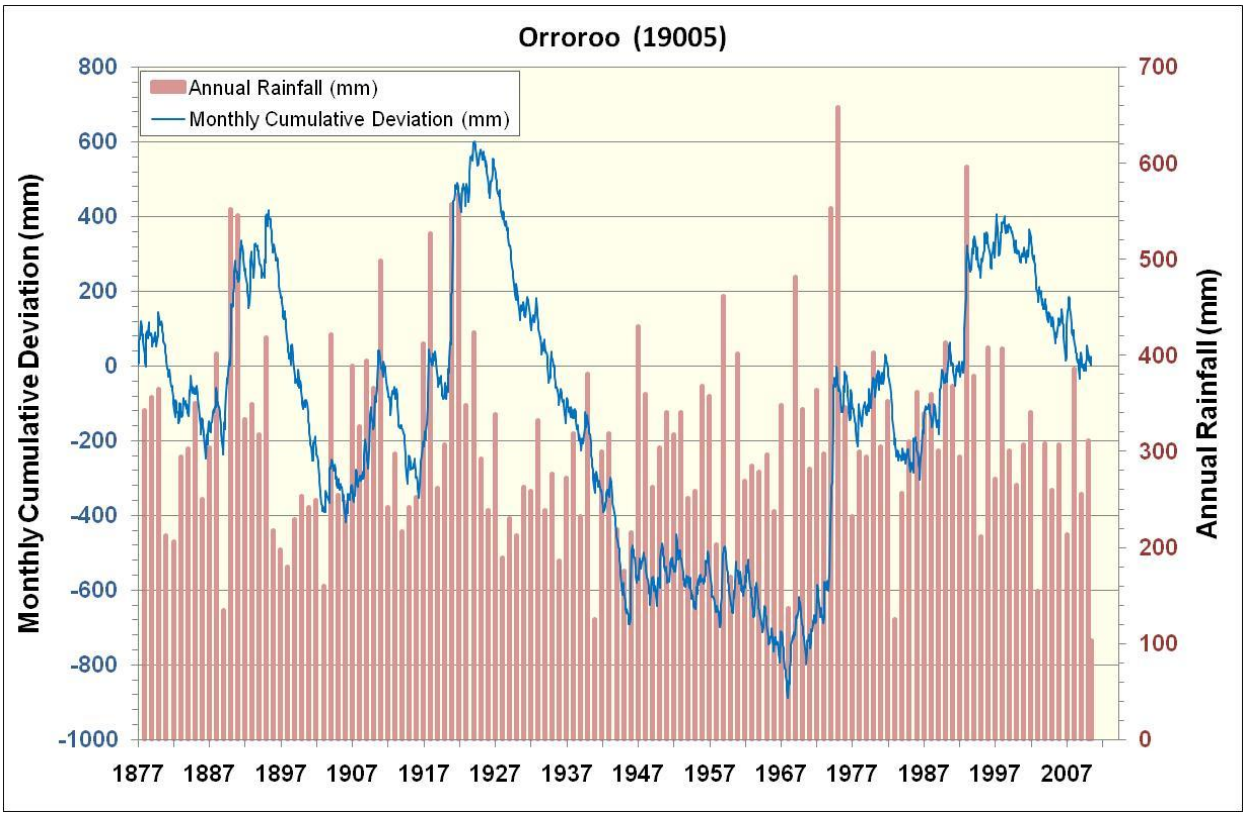

Figure 3. Annual Rainfall and cumulative deviation for mean monthly rainfall at Orroroo in the Walloway Basin

GROUNDWATER USE

Groundwater is the primary source of water in the basin and is used for town water supplies, stock supplies and domestic use. As the Walloway Basin is not prescribed under the *Natural Resources Management Act 2004*, there is no licensing of groundwater extractions and no metering of extraction volumes (apart from town water supplies).

SA Water extracted 60.5 ML from the Tertiary confined aquifer during 2009-10 for the Orroroo town water supply. There is no evidence of any significant irrigation being carried out.

WATER LEVEL NETWORK

The water level observation network for the Walloway Basin is shown in Figure 4. Monitoring began in 1985, and there are currently 5 wells being monitored on a semi regular three monthly frequency.

Two aquifers are monitored;

1. Three wells monitor the shallow Quaternary aquifer (less than 50 m deep) which consists mainly of silts and clays,
2. Two wells monitor the main Tertiary confined aquifer (more than 50 m deep) which comprises sand and gravel layers interbedded with clay.

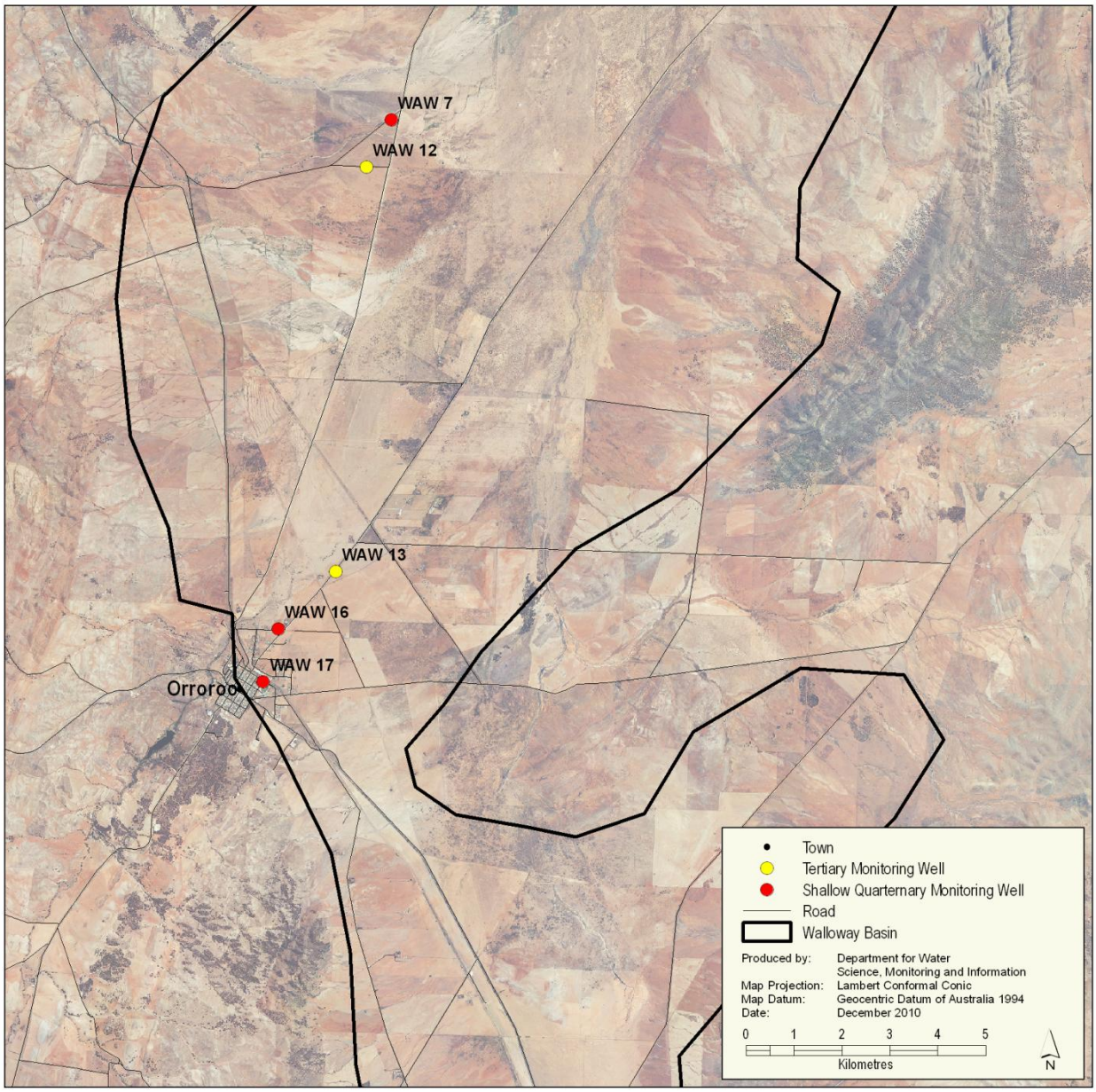

Figure 4. Location of groundwater level observation wells in the Walloway Basin

SALINITY NETWORK

The salinity observation network for the Walloway Basin is shown in Figure 5. There are currently only two town water supply wells developed in the Tertiary confined aquifer that are monitored for salinity at monthly intervals.

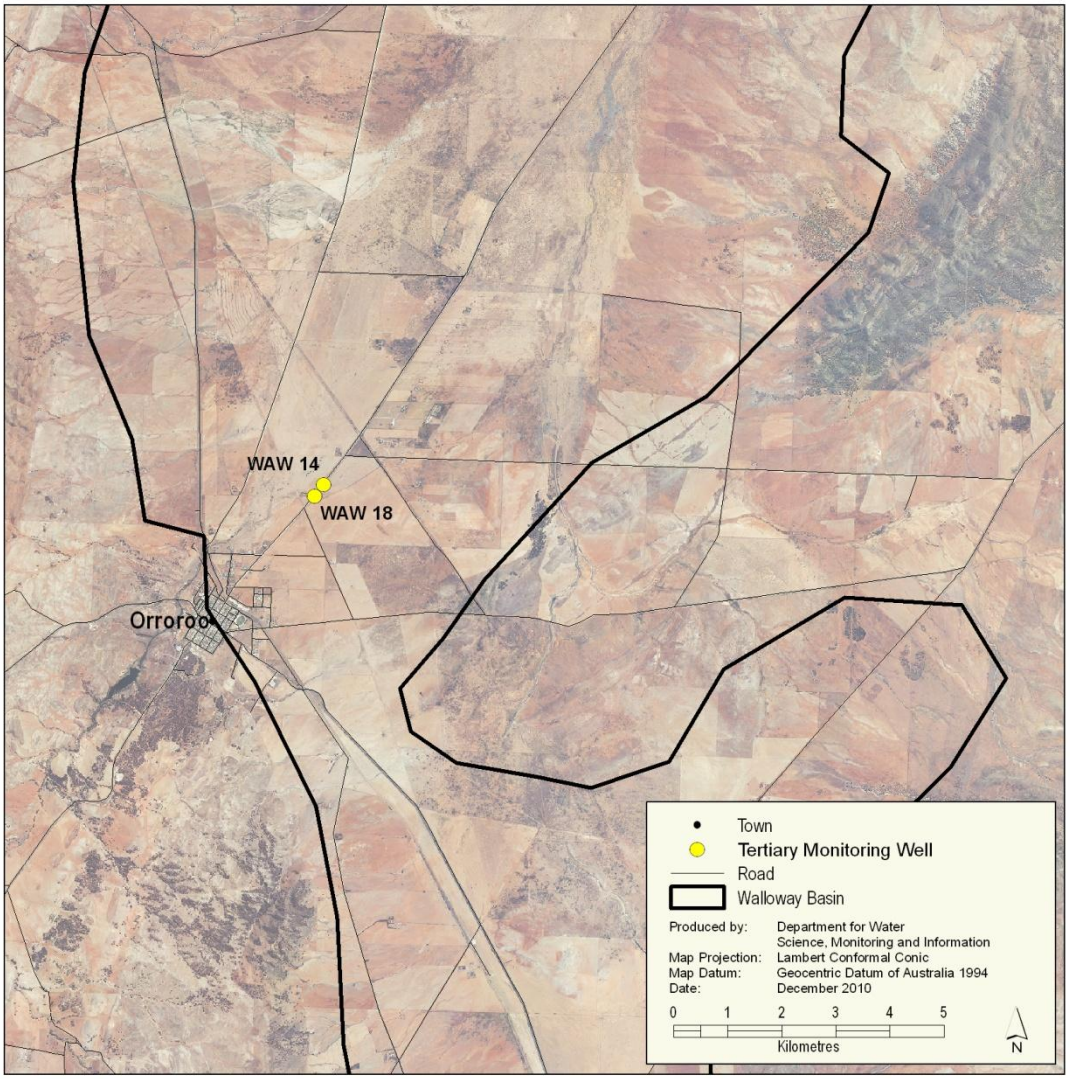

Figure 5. Location of groundwater salinity observation wells in the Walloway Basin

Hydrographs are presented following for observation wells located in the two different aquifers in the Walloway Basin.

SHALLOW QUATERNARY AQUIFER

All watertable trends in the shallow aquifer (Fig. 6) have shown a steady decline for a number of years. Because of very limited extraction from this aquifer, this decline can be attributed to the consistently below average rainfall since 1992. There is insufficient data to comment on recent trends, and monitoring should resume for wells with historical records.

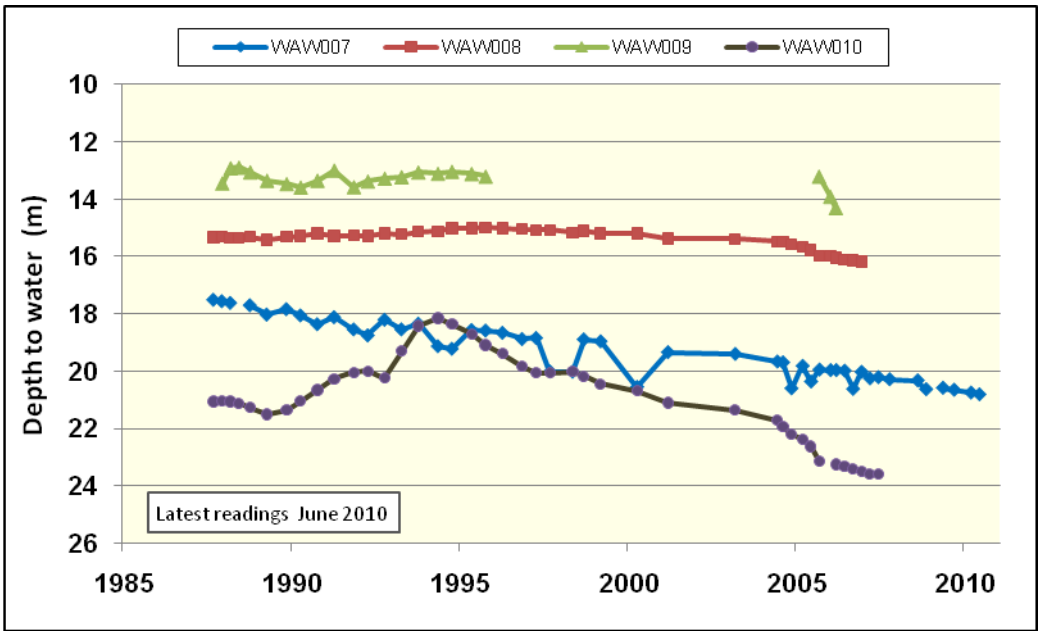

Figure 6. Groundwater level trends for the Quaternary aquifer in the Walloway Basin

TERTIARY CONFINED AQUIFER

Figure 7 presents groundwater level trends in the confined aquifer. WAW013 is located close to the Orroroo town water supply wells and displays small seasonal drawdowns in response to that extraction. The general downward trend in the water level shows a broad relationship with rainfall that has been consistently below average. This could be due to a good lateral connection with the fractured rock aquifers in the ranges to the west, or the process of hydrostatic loading. A rising watertable results in more water being stored in the unconfined aquifer, and consequently more weight pressing down on the confining layer. This extra weight increases the hydrostatic pressure on the underlying confined aquifer and causes confined water levels to rise. Conversely, a falling watertable will cause a decreasing pressure level. Levels since 2004 appear to be stable.

The trends in WAW012 are unusual and may indicate casing failure and connection to the shallow aquifer.

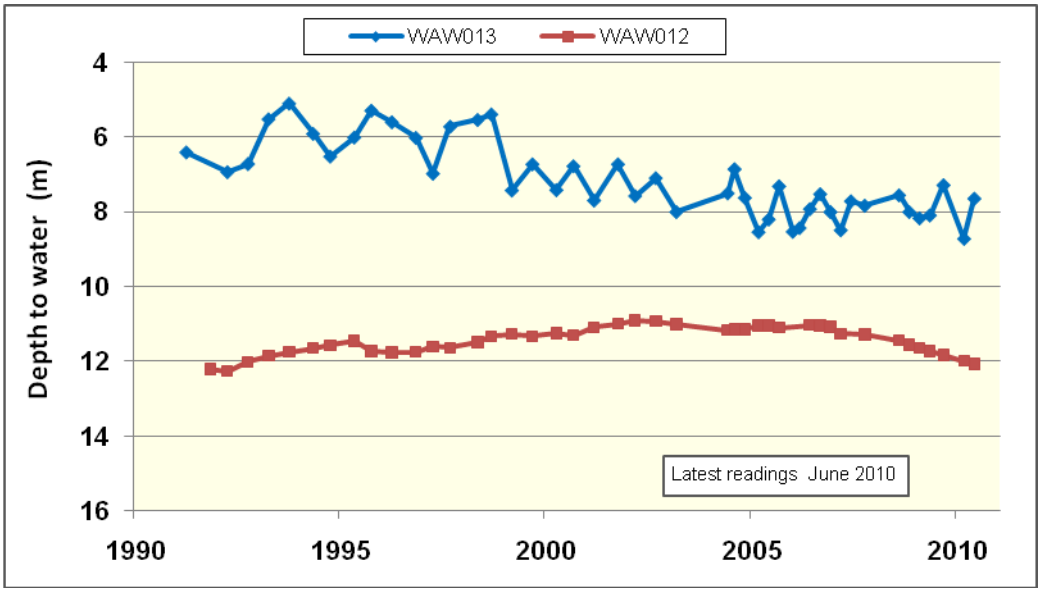

Figure 7. Groundwater level trends of the confined aquifer in the Walloway Basin

GROUNDWATER SALINITY TRENDS

Groundwater salinity trends have been observed in both aquifers.

SHALLOW QUATERNARY AQUIFER

Historical salinity data shows stable trends as presented in Figure 8.

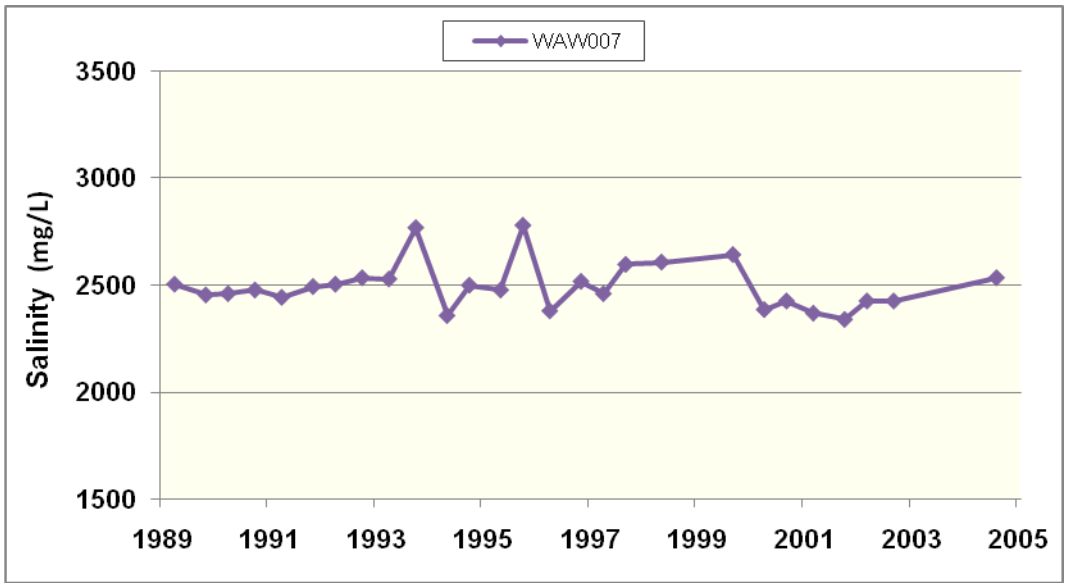

Figure 8. Groundwater salinity trends of the unconfined aquifer in the Walloway Basin

TERTIARY CONFINED AQUIFER

Salinities in the confined aquifer monitored by town water supply wells show relatively stable trends as indicated in Figure 9. Apart from some variations that are probably due to sampling procedures, the salinity levels have shown no significant change over the last 23 years.

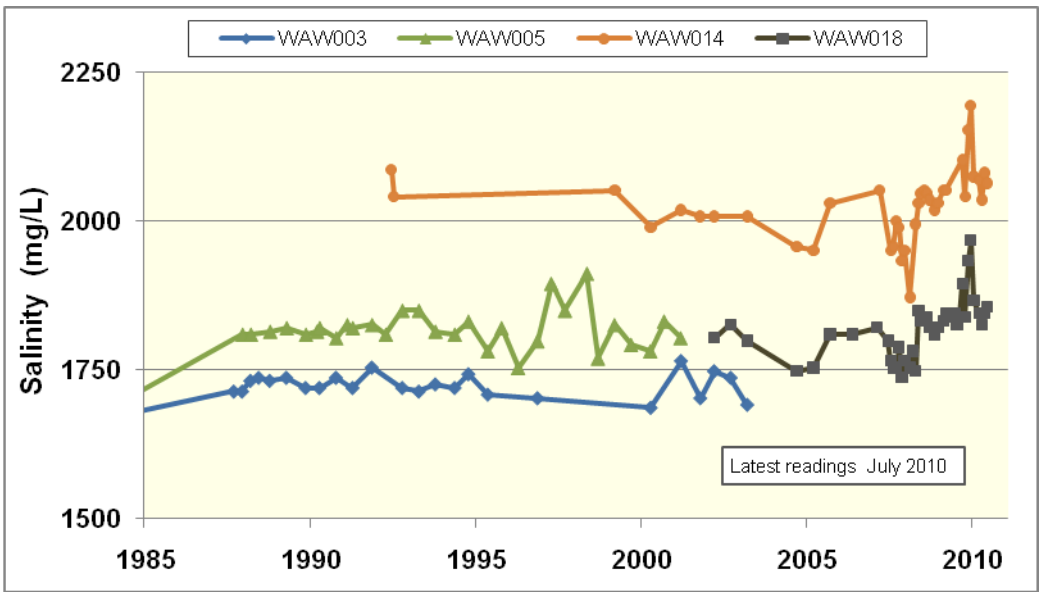

Figure 9. Groundwater salinity trends of the confined aquifer in the Walloway Basin