Rainfall and streamflow summary
January to October 2011
Water Resource Assessment Branch

Introduction
The following rainfall and streamflow summary for January to October 2011 is based on information from the Department of Water, the Bureau of Meteorology, the Department of Agriculture and Food and the Water Corporation. This summary is produced monthly from May to October making this the final summary for 2011.

Rainfall for October was above average to very much above average for the majority of Western Australia (compared to the 1900 to present period). Parts of the Goldfields recorded the highest rainfall on record. The area from Perth to Augusta in the South West of Western Australia (WA) recorded very much below average to average rainfall and the area inland from Port Hedland recorded below average to average rainfall (Figure 2). The Bureau of Meteorology outlook for the next three months indicates a greater than 50 per cent chance of exceeding the median rainfall (1900 to 2005) for the whole state. The South West and Kimberley regions have up to 70 per cent chance of exceeding the median rainfall (Figure 7).

In South West WA 10 of the 14 streamflow gauging stations analysed recorded average flow for October. Three gauges recorded less than average flow and one station recorded above average flow (Figure 9). The year to date streamflow is generally less than average across South West WA (Figure 1). Only two stations recorded an average flow and five sites are well below average.
Figure 1 - Year to date rainfall for Western Australia and year to date streamflow for South West Western Australia (January to October 2011)
(Rainfall map courtesy of Bureau of Meteorology website (1 January to 2 November 2011), copyright Commonwealth of Australia reproduced by permission.)
Rainfall – October

The October rainfall deciles for Western Australia are shown in Figure 2. Most of the state experienced above average to very much above average rainfall and areas of the Goldfields recorded the highest rainfall on record (compared with the period 1900 to present). The coastline area from Perth to Augusta in South West WA recorded below average to average rainfall with the area around Busselton recording very much below average rainfall. The area inland from Port Hedland recorded below average to average rainfall (Figure 2).

Figure 2 - Monthly rainfall deciles (October 2011) for WA
(Courtesy of Bureau of Meteorology, copyright Commonwealth of Australia reproduced by permission.)
Rainfall – year to date

Figure 3 shows the year to date rainfall (January to October 2011) as a percentage of average annual rainfall. Year to date rainfall in the South West of Western Australia is at 60 to 100 per cent of the average rainfall for the year. The Goldfields, Kimberley, Pilbara and Gascoyne regions have experienced rainfalls greater than the annual average.

Figure 3 - Year to date rainfall (January to October 2011) for WA as a percentage of the 1961-1990 mean annual rainfall
(Courtesy of Bureau of Meteorology, copyright Commonwealth of Australia reproduced by permission.)
Monthly rainfall – May to October

The rainfall deciles for May to October (compared with the period 1900 to present) are shown in Figure 4. Monthly rainfall deciles across the South West WA have remained consistently very much below average to average over the May to October period. The monthly rainfall deciles throughout the rest of the state have varied from very much below average to the highest on record over the May to October period.

Figure 4 - Monthly rainfall deciles (May to October 2011) for WA
(Courtesy of Bureau of Meteorology, copyright Commonwealth of Australia reproduced by permission).
Figure 4 - Monthly rainfall deciles (May to October 2011) for WA (continued)
Figure 4 - Monthly rainfall deciles (May to October 2011) for WA (continued)
Figure 4 - Monthly rainfall deciles (May to October 2011) for WA (continued)
South West WA rainfall – October

Data from 21 rainfall stations across South West WA are summarised to show the current rainfall condition across the region in comparison to historical rainfall since 1975. The period post 1975 is used because there has been an observed reduction in rainfall and runoff in the south west from 1975 in comparison to long-term averages.

Figure 4 indicates that October rainfall over the south west is varied and ranges from well below average to the highest on record. The south western pocket from the Peel region to Albany varies from well below average to average, however the northern and eastern areas vary from average to the highest rainfall on record.

![South West Western Australia Rainfall Deciles - October 2011](image)

Figure 4 - Monthly rainfall deciles (October 2011) for South West WA
South West WA rainfall – year to date

Rainfall for 12 out of 21 stations analysed in South West WA recorded average total rainfall from January to October (Figure 5). Three stations, Wanneroo, Cowaramup and Margaret River received below average rainfall and Kirup received well below average rainfall. Four stations, Geraldton, Dalwallinu, Katanning and Denmark have received above average rainfall.

The spatial variation in rainfall is highlighted by Donnybrook and Kirup which are in close proximity to each other but are in distinctly different rainfall categories.

Figure 5 - Year to date rainfall deciles (January to October 2011) for South West WA
Perth rainfall

The year to date rainfall for Perth (Mt Lawley 009225), with reference to the 1975 to 2010 minimum, maximum, and percentile rainfall is shown in Figure 6. Perth recorded 64 mm of rainfall during October, which is 22 mm higher than the monthly average from 1975 to 2010. This rainfall brought the cumulative rainfall total (January to October) to 745 mm, which is at the 60th percentile rainfall total for the year to date.

Figure 6 - Year to date rainfall (January to October 2011) for Perth (Mt Lawley, 009225) with reference to the 1975-2010 period minimum, maximum and percentile rainfalls
Rainfall outlook

Two sources of rainfall outlooks are usually used; the Bureau of Meteorology three month outlook across Australia, and the Department of Agriculture and Food statistical seasonal forecasts specific for south west Western Australia. The Department of Agriculture and Food only completes forecasts up to October so only the Bureau of Meteorology forecast is available. Percent consistent figures are shown to indicate the skill in the forecast.

The Bureau of Meteorology produces three monthly forecasts of the probability of exceeding the median rainfall. The percentiles are calculated over the 1900 to 2005 period. The outlook for total rainfall over the January quarter (November to January) for Western Australia is shown in Figure 7.

The outlook for the next three months indicates a greater than 50 per cent chance of exceeding the median rainfall (1900 to 2005) across the whole state. The South West and Kimberley regions have up to 70 per cent chance of exceeding the median rainfall over the next three months (Figure 7). For the Kimberley region, summer is typically when rainfalls are highest (wet period). Typically, rainfall in November is low throughout the south west with a long term average of 27 mm, which makes up only four per cent of the long term annual average rainfall.

The percent consistent figure shows there is very poor predictive skill in the seasonal forecast for this period for the majority of the state. The Kimberley region shows more reasonable predictive skill for this period.
Figure 7 - Probability of exceeding median rainfall (1900-2005) for October to December 2011 across Western Australia
(Courtesy of Bureau of Meteorology, copyright Commonwealth of Australia reproduced by permission)
Streamflow – October

Fourteen telemetered streamflow gauges across the South West WA were analysed for the month of October (Figure 8) and the year to date (Figure 9).

In South West WA 10 of the 14 streamflow gauging stations analysed recorded average flow for October (Figure 9). Three gauges recorded less than average flow, Gingin Brook and Lefroy Brook recorded below average flow; and Harvey River recorded well below average flow. One station, Young River, recorded above average flow.

Figure 8 - Monthly streamflow deciles (October 2011) for South West WA
Streamflow – year to date

The year to date streamflow is generally less than average across South-West WA (Figure 9). Five sites, Gingin Brook, Harvey River, Carbunup River, Lefroy Brook and Kalgan River recorded well below average streamflow. Only two stations, Collie River and Young River, recorded average flow.

Figure 9 demonstrates the non-linearity between rainfall and streamflow (that is, a small proportion of the rainfall becomes streamflow). While many towns have recorded average year to date rainfall (Figure 5), the streamflow remains below average (Figure 9).

Figure 9 - Year to date streamflow deciles (January to October 2011) for South West WA
Surface water storage – Perth IWSS

As of 4 November 2011, the total volume of water stored in the dams supplying water to the Integrated Water Supply System (IWSS) was 218 GL, which is approximately 36 per cent of the total capacity (Figure 10). As a comparison, at this time last year storages were at 210 GL. Dam levels have exceeded those recorded at the same time last year and those recorded in 2006.

From 1 May, an estimated 500 mm ± 10% of rainfall at Jarrahdale was needed to start streamflow into the northern IWSS reservoirs (10 of the 12 IWSS reservoirs). Rainfall from 1 May to 31 October at Jarrahdale was 910 mm resulting in streamflow generating consistent inflows to the IWSS storage (Figure 10).

Figure 10 - Total volume of water stored in the Integrated Water Supply System reservoirs (Water Corporation 2011)
Groundwater

The Gnangara Mound is an important source of water for public water supply, irrigated agriculture, parks and gardens, industry and groundwater dependant ecosystems in Perth and IWSS supplied areas. Groundwater levels across the Gnangara Mound have been in decline for the last 30 years.

Figure 11 shows historical monthly average Gnangara groundwater levels. Groundwater levels shown on the graph are based on data from more than 50 bores located across the mound’s superficial aquifer. These measurements were averaged to produce a single average groundwater level for each month. The water levels are taken at the beginning of the month. However, the average groundwater level is shown on the graphic as the middle of the month.

The level for October this year is the second lowest October average groundwater level on record (since 1997). This is the first time this year that the groundwater level exceeded the lowest average groundwater level on record, by exceeding the 2010 average. Currently the average groundwater level is approximately 0.1 m higher than the previous October minimum that occurred last year.

From 1 January, an estimated 800 mm ± 10% of rainfall at Perth Airport is needed to recharge Gnangara groundwater levels to those recorded at the end of last winter. Rainfall from 1 January to 31 October at Perth Airport is 730 mm and the monthly average groundwater level has just surpassed the average level recorded in October last year.

Figure 11 - Average groundwater level across the Gnangara Mound (Department of Water). Groundwater levels shown on the graph are based on data recorded from over 50 bores located across the mound’s superficial aquifer. These measurements were averaged to produce a single average figure for each month.
Appendices

Appendix A – legend definitions

Serious deficiency – rainfall in the lowest 10% of historical totals, but not in the lowest 5%

Severe deficiency – rainfalls in the lowest 5% of historical totals

Lowest on record – lowest since at least 1900 when the rainfall data analysis began (for streamflow lowest since 1975)

Well below average – rainfalls in the lowest 10% of historical totals

Below average – rainfalls in the lowest 30% of historical totals, but not in the lowest 10%

Average – rainfalls in the middle 40% of historical totals

Above average – rainfalls in the highest 30% of historical totals, but not in the highest 10%

Well above average – rainfalls in the highest 10% of historical totals

References


