Hydrological monitoring for the Wungong Catchment Trial

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Summary

In 2005, following approval and funding for the Wungong Catchment Trial, a number of streamflow gauging stations, pluviometers, and groundwater monitoring bores were re-established within and around the Wungong Catchment. Observations indicate that while rainfall has remained relatively constant since the early 1990s, streamflows and groundwater levels have declined during the 2000s. The winter of 2009 was the second winter following forest treatment in the Cobiac catchment, and results to date are showing a return towards the streamflow and groundwater level patterns observed during the 1990s. This winter, particularly the month of July, was one of the best on record, so further work is needed to determine the extent that the forest treatment contributed to the improved streamflow and groundwater level results.

Introduction

Streamflow and catchment rainfall gauging in the south west of the State was initiated in the late 1960s. During the 1970s and 1980s a number of small catchments were established as part of a co-operative research program between the forestry and water resource agencies, and it is the information gathered from these research catchments that led to the development of the Wungong Catchment Trial.

The 1990s saw a scaling-back of the gauging network, and as the Trial requires information from both treated and reference catchments to quantify impacts on the quantity, quality and variability of streamflow, a number of gauging sites were re-opened by the Department of Water, with funding from Water Corporation.

Methodology

Following a review of the streamflow and rainfall gauging in the vicinity of the Wungong Catchment, the required gauging sites were progressively re-opened and upgraded where necessary during 2005. A new gauging station was also established at Chandler Road to monitor the first area (TA1) to be treated.

The streamflow and rainfall gauging network associated with the Wungong Catchment Trial is provided in Table 1.

Table 1 Summary of gauging network associated with the Wungong Catchment Trial

WUNGONG CATCHMENT TRIAL HYDROLOGY RESEARCH Gauged Catchments						
Stream gauging stations	Station Number	catchment area km²	Historic rainfall mm (PWD 1980)	Runoff 83-98ave mm	Gauging Station Record + still operating	Pluviometer Station Numbers
Wungong Brook Catchment						
Wungong Brook, Vardi Road	616041	80.84	1280-1000, 1170#	150	May 1981 - +	509269, 509273, 509576
Wungong Brook, Cobiac	616058	3.64	1110#		May1992 -June98, May 2005- +	509576
Wungong Chandler Road	616124		1200-1250, 1220#		May 2005 - +	509269
* Seldom Seen Creek, Travellers Arms	616021	7.21	1290-1260 1250	236	May 1966 - +	509269
* More Seldom Seen Creek, Ceriani Farm	616022	3.41	1300-1280 1275	211	April 1966 - +	509270
* Waterfall Gully, Mount Curtis control	616023	8.62	1320-1255 1275	275	April 1966 - +	509271 509269
Correlation and Regional Context						
31 Mile Brook, 31 Mile Road	616026	10.96	1230-1120 1180#	151	July1985 -April 99; April 2006 - +	509610
39 Mile Brook Jack Rocks	614031	55.36	1220-980, 1120#	101	May1981-April 99; April 2006 - +	509232, 509324
North Dandalup North Rd	614036	79.74	1320-1130, 1240#	96	March1983 -99; May 2006- +	509189, 509548, 509349
Canning River Glen Eagle	616065	520.00	850	25	June1950-May 99; May 2008 - +	509273, 509410, & Millars Rd
Canning River, Millars Road	616039	140.59	920-700, 800#	12	June1985-April 99; May 2008 - +	509422, 509423
* Big Brook O'Neil Rd	614037	148.99	1200-850, 1050#	34	April 1983 - +	509221, 509589,
Harvey River, Dingo Road	613002	147.21	1250	238	March 1970 - +	509119, *509223,4, 509116,7*
* Little Dandalup Trib, Bates,	614062	2.22	1300#		July 1988 - +	509579
Wildfire Impact (Jan 2005 wildfire)						
Little Darkin, Hairpin Bend	616010	37.82	980-850 900	23	May1969-May99; April 2005 - +	509159, 509155
Pickering Brook, Slavery Lane	616009	29.44	1160-980 1050	63	May1969-May99; April 2005 -+	509280, 509631
NOTE: Historic catchment rainfall average taken from "Streamflow Records of WA to 1982" (# or equivalent) shown as PWD 1980. Average annual runoff for 1983 to 1998 is provided for basic comparison of gauged catchments listed * station operated with funding from ALCOA for Bauxite Research.						

In addition to the streamflow gauging, groundwater monitoring bores with a sufficient historical record were identified and the monitoring re-established. The bores and the associated gauging station were installed in the early 1990s by Alcoa as part of their bauxite mining research catchment network. They were monitored throughout the 1990s until the catchment, known as Cobiac, was 'mothballed' in 1998 following Alcoa's decision to close the Jarrahdale minesite.

The location of the Cobiac catchment in relation to the larger Wungong Catchment area is shown in Figure 1.

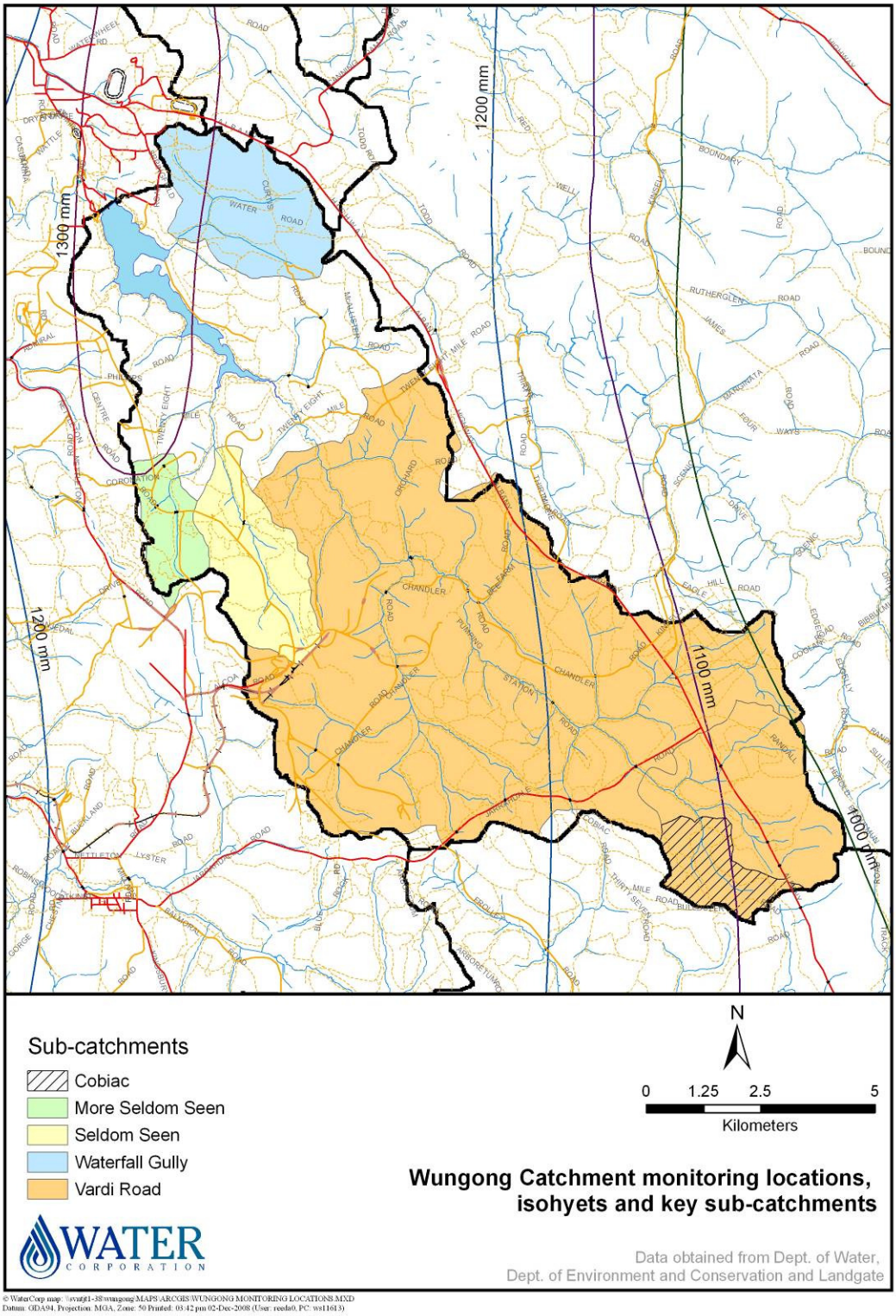

Figure 1 Location of the Cobiac catchment

Results and Discussion

The main gauging station on Wungong Brook, Vardi Road, has a very good historical streamflow correlation with the nearby untreated catchment of 31 Mile Brook, located within the catchment of the Canning Reservoir. A comparison of the streamflow, represented as mm of runoff, is shown in Figure 2.

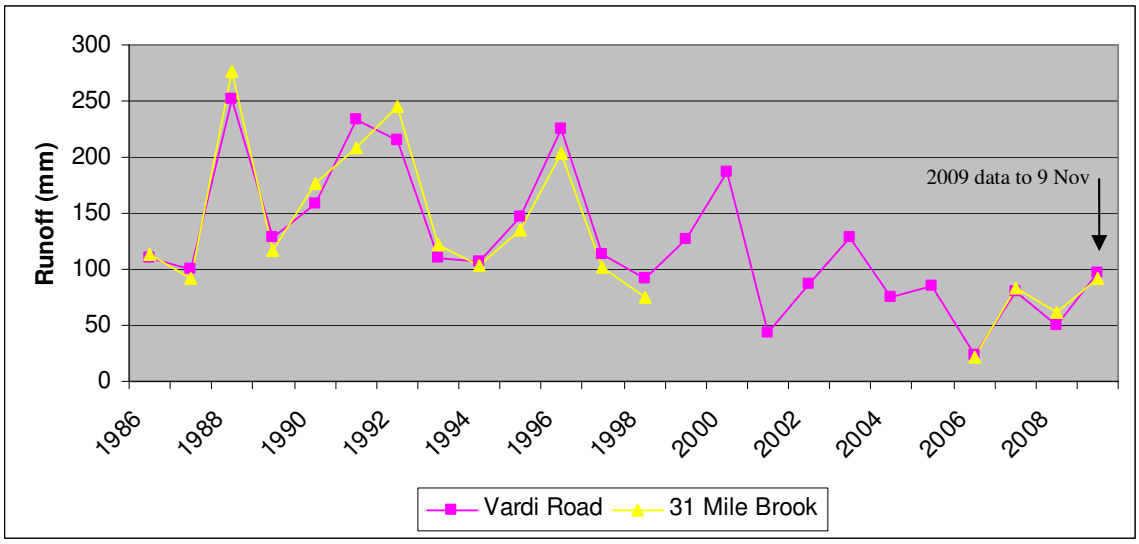

Figure 2 Streamflow comparison between Vardi Road, and the untreated 31 Mile Brook catchment

Although rainfall over the period of record shown in Figure 2 has been more or less consistent, the decline in streamflow is evident.
We have not yet seen an end to the 2009 streamflow season, with Figure 2 showing the flow up until 9 November 2009.
The area treated to date is a small proportion of the Vardi Road catchment so improvements in streamflow relative to the untreated case should first be observed at the Chandler Road and Cobiac gauging stations that monitor the currently treated areas.

Groundwater level records for a monitoring bore located adjacent to the Cobiac gauging station are shown in Figure 3.

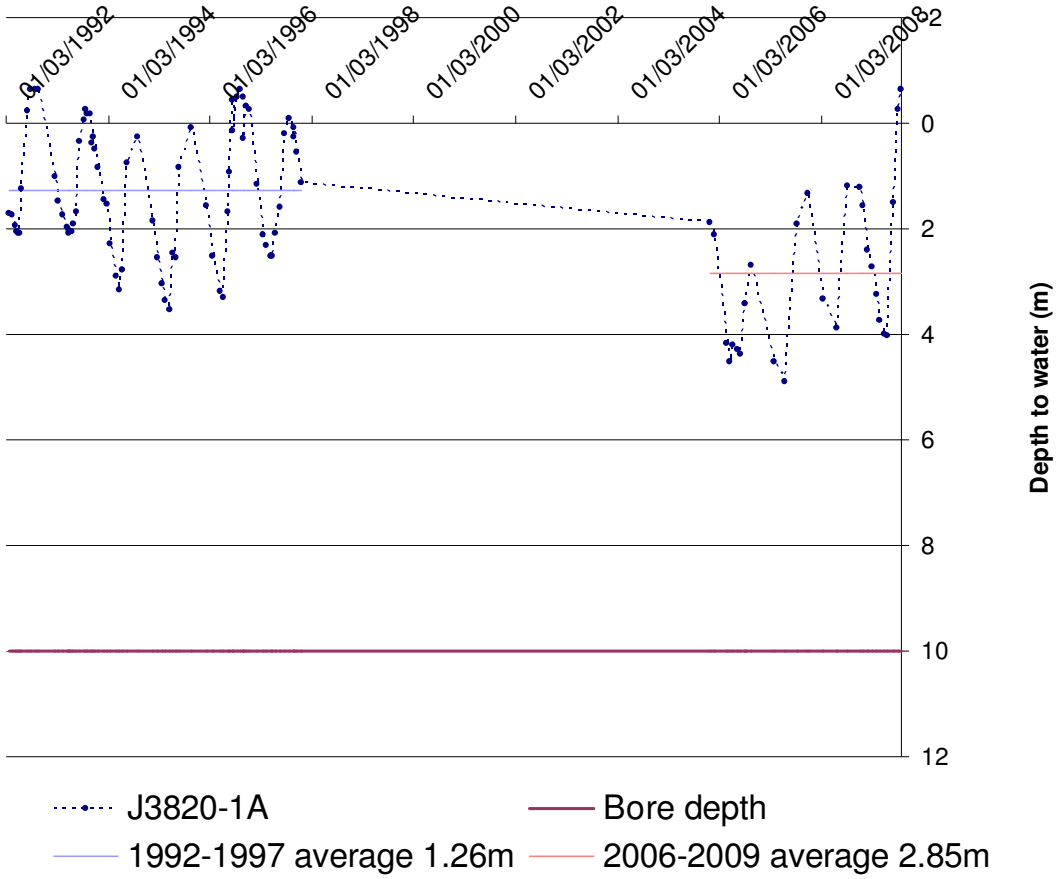

Figure 3 Groundwater levels for a monitoring bore located next to the Cobiac gauging station

Two distinct monitoring periods are evident – the 1990s when the monitoring was undertaken by Alcoa, and since 2005 when monitoring was re-established as part of the Wungong Catchment Trial.

It is clear that there has been a reduction in groundwater level in the latter period, and this pattern is repeated in bores throughout the catchment. It is also clear that there has been a great improvement in groundwater recharge following the 2009 winter, with groundwater intersecting the surface and contributing to streamflow once more. Given the significant rainfall received in the catchment, particularly over the month of July, it is unclear at this stage how much the treatment within the catchment has contributed to these improvements in groundwater recharge.

Conclusions

The extensive hydrological monitoring associated with the Wungong Catchment Trial has given an excellent basis for comparison between the pre- and post-treatment periods. With the winter of 2009 being the second following treatment for the critical gauging stations within the Wungong Catchment, it is not yet possible to conclude from monitoring alone what contribution thinning has played in the results recorded to date. Work continues, and updates will be provided as more information comes to hand.