

Update #1 on water quality monitoring in the Edward-Wakool system

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Water moving through Yallakool regulator 8/3/16 (Photo: R Watts)

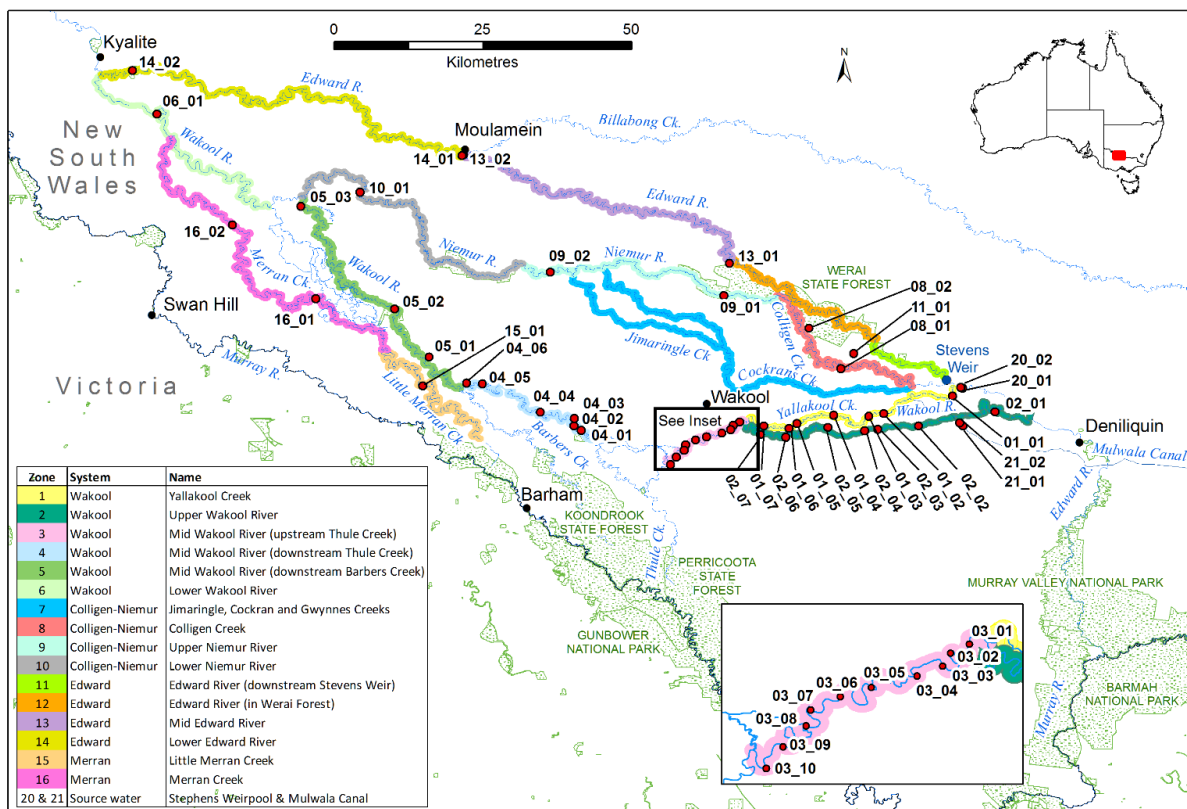


Stevens Weir 8/3/16 (Photo R. Watts)

Monitoring sites

Water quality will be monitored at the following sites (see Figures 1 and 2) over 6 weeks between 1st March and 5th April 2016:

1. Yallakool Creek, LTIM zone 1 site 2 (Hopwood)
2. Yallakool Creek, LTIM zone 1 site 7 (Windra Vale)
3. Upper Wakool River, LTIM zone 2 site 2 (Yaloke)
4. Upper Wakool River, LTIM zone 2 site 6 (Widgee 1)
5. Mid Wakool River, LTIM zone 3 site 2 (Tralee)
6. Mid Wakool River, LTIM zone 3 site 10 (Llanos Park)
7. Mid Wakool River, LTIM zone 4 site 1 (Barham Bridge)
8. Mid Wakool River, LTIM zone 4 site 6, (Noorong 2)
9. Mid Wakool River, LTIM zone 5 site 2 (Gee Gee Bridge)
10. Colligen Creek, Murray LLS aquatic veg project sample site 1 (Bowen Park)
11. Colligen Creek, Murray LLS aquatic veg project sample site 4 (Werai station)
12. Mulwala canal, LTIM zone 21 site 1 (canal 1)
13. Edward River, LTIM zone 20 site 2 (Stevens Weir)
14. Niemur River, at Mallan School (not shown on map, but is upstream of zone 10 site 1)(will be sampled weeks 3 to 6)



Created by Spatial Data Analysis Network,
Charles Sturt University, May, 2015

Data Source: NSW "Place Point" & "Hydroline" spatial data; Digital Cadastral Database [CD-ROM], LPMA, 2008, New South Wales; Australian Reserves GEOADATA TOPO 250K Series 3, 2006, OEH NSW National Parks 2012

Figure 1. Edward-Wakool Long term Intervention Monitoring sites

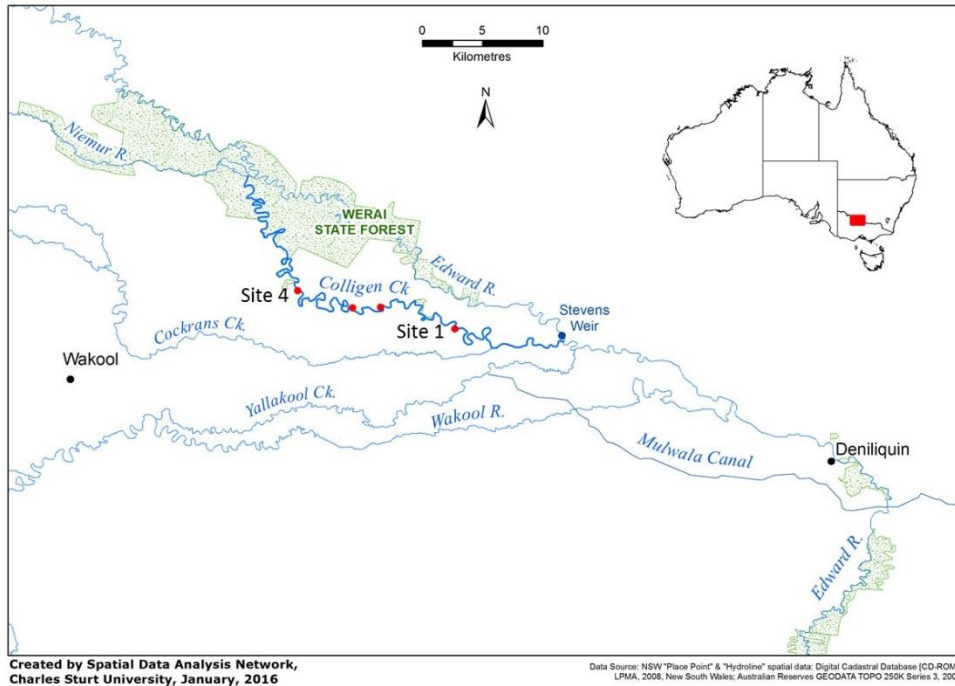


Figure 2. Monitoring sites for aquatic vegetation in Colligen Creek. Water quality will be sampled at sites 1 and 4.

Parameters sampled

Spot water quality: temperature ($^{\circ}\text{C}$), electrical conductivity (mS/cm), dissolved oxygen (mg/L, %), pH, and turbidity (NTU).

Hydrological data: available through automated gauging stations 409020 Yallakool Creek @ Offtake, 409019 Wakool River offtake regulator, 409045 Wakool River at Wakool-Barham Road, 409024 Colligen Creek regulator, 409062 Wakool River Gee Gee Bridge, 409086 Niemur at Mallan School.

Loggers: temperature and dissolved oxygen are being logged at eight sites: Hopwood, Windra Vale, Yaloke, Widgee 2, Tralee, Llanos Park, Barham Bridge, Noorong 2. The data from these loggers is not available instantaneously, and has to be manually downloaded.

Water samples:

- Dissolved Organic Carbon (DOC)
- Nutrients (Ammonia (NH_4^+), filtered reactive phosphorus (FRP), dissolved nitrate + nitrite (NO_x), Total Nitrogen (TN) and Total Phosphorus (TP))
- Absorbance and fluorescence spectroscopy for organic matter characterisation
- Total algae
- Chlorophyll-a

Results

Samples from weeks one and two are being processed. Some preliminary results are presented here.

The algal bloom was evident at most of the monitoring sites. It had not reached the upper Wakool River zone 2 site 4 on 3/3/16 (Figure 3) but it was very evident at Widgee on 8/3/16 (Figure 4). The algal bloom had not evident Gee Gee Bridge on 7/3/16 (Figure 5), but it was present in zone 4 upstream of Gee Gee Bridge, so appears to be working its way downstream.



Figure 3. No algae evident at the upper Wakool River at zone 2 'Widgee' 3/3/16 (Photo N. McCasker)



Figure 4. Algae very evident at the Upper Wakool River at zone 2 'Widgee' 8/3/16 (Photo R. Watts)



Figure 5. Mid Wakool River at Gee Gee Bridge 7/3/16 (Photo: R. Watts)

Spot water results are shown in table 1 and 2. Note that the time of day will greatly influence the temperature, dissolved oxygen and pH. So it is not reliable to compare results between the first week and second week of sampling due to effect of time of day on the results. However a key few points to note:

- The water temperatures were very high – as high as 30°C towards the end of the day at some sites on 7/3/16 and 8/3/16
- The concentration of dissolved oxygen was very high at all sites, and at some sites monitored at the end of the day the percent dissolved oxygen was as high as 160%. These values reflect the high production of oxygen during the day by the algae. Dissolved oxygen levels would be lower at night and in early morning before dusk. Dissolved oxygen levels that are either too low or too high can harm aquatic life.

Table 1. Spot water quality results from week one (1/3/16 to 3/3/16)

Zone	Zone name	Site	Name	Date	Time	Temp	pH	EC	Turb (NTU)	DO (mg/L)	DO %
1	Yallakool Ck	2	Hopwood	3/3/16	8:15	25.2	8.29	0.033	106.0	8.57	106.0
1	Yallakool Ck	7	Windra Vale	3/3/16	10:00	25.1	8.01	0.032	126.0	9.64	119.0
2	Upper Wakool	2	Yaloke	3/3/16	12:20	25.0	8.01	0.456	171.0	10.52	129.8
2	Upper Wakool	6	Widgee1	3/3/16	10:45	24.6	7.80	0.391	53.5	7.20	88.2
3	Mid Wakool R	2	Tralee	2/3/16	10:40	24.8	8.34	0.081	103.0	11.57	142.1
3	Mid Wakool R	5	Llanos Park	2/3/16	8:40	24.5	7.98	0.073	134.0	8.93	109.2
4	Mid Wakool R	1	Barham Brdge	1/3/16	8:45	23.2	8.10	0.068	83.9	7.76	92.9
4	Mid Wakool R	5	Noorong 2	1/3/16	10:10	24.3	7.59	0.063	73.9	8.54	104.0
5	Mid Wakool R	2	Gee Gee	1/3/16	11:45	25.2	7.51	0.062	56.6	8.95	85.5
8	Colligen Creek	1	Bowen Park	2/3/16	13:30	25.9	8.40	0.035	84.5	10.08	126.1
8	Colligen Creek	4	Werai Station	2/3/16	13:00	26.3	8.15	0.032	101.0	10.27	129.3
20	Edward River	2	Stevens Weir	2/3/16	13:50	27.4	9.03	0.038	78.0	9.93	127.1
21	Mulwala Canal	1	Canal	3/3/16	12:40	24.8	9.44	0.045	85.9	11.91	146.1

Table 2. Spot water quality results from week two (7/3/16 to 8/3/16)

Zone	Zone name	Site	Name	Date	Time	Temp	pH	EC	Turb (NTU)	DO (mg/L)	DO %
1	Yallakool Ck	2	Hopwood	8/3/16	12:30	28.4	8.01	0.034	95.6	8.40	109.0
1	Yallakool Ck	7	Windra Vale	8/3/16	11:45	28.2	8.49	0.035	118.0	10.03	129.8
2	Upper Wakool	2	Yaloke	8/3/16	8:45	26.3	7.83	0.445	158.0	7.16	90.1
2	Wakool R	6	Widgee1	8/3/16	10:00	26.8	7.90	0.345	173.0	8.42	106.7
3	Mid Wakool R	2	Tralee	8/3/16	10:30	28.5	8.61	0.073	92.4	10.49	136.4
3	Mid Wakool R	5	Llanos Park	7/3/16	19:30	29.4	9.09	0.074	114.0	11.19	147.4
4	Mid Wakool R	1	Barham Brdge	7/3/16	18:20	30.5	9.32	0.078	140.0	13.02	174.1
4	Mid Wakool R	5	Noorong 2	7/3/16	17:00	31.0	7.91	0.073	69.9	9.34	125.7
5	Mid Wakool R	2	Gee Gee	7/3/16	16:00	30.4	7.84	0.057	50.7	9.32	124.5
8	Colligen Creek	1	Bowen Park	8/3/16	14:00	28.9	8.48	0.036	87.4	10.32	134.9
8	Colligen Creek	4	Werai Station	8/3/16	15:00	30.3	9.08	0.038	109.0	12.31	164.1
20	Edward River	2	Stevens Weir	8/3/16	13:00	31.0	8.90	0.039	59.2	10.32	139.0
21	Mulwala Canal	1	Canal	8/3/16	8:00	25.0	9.46	0.039	166.0	10.17	125.3

Algal concentration

Samples collected from week two onwards will be analysed for total algal counts, including a count of the blue green algal family Cyanophyta. These samples take a few days to process after each trip.

Results processed to date (Table 3) show that the algal counts are extremely high and the dominant family present at all sites is blue green algae (Cyanophyta) contributing between 97% and 99% of all algae present in these samples.

Stevens Weir is the source of water for Yallakool Creek, Wakool River and Colligen-Niemur system. The algal count in Stevens Weir was extremely high (Table 3). The algal count was lower in Yallakool Creek (zone 1) than in Stevens Weir. The discharge in Yallakool Creek on 8/3/2016 was 332 ML/day, and the flow in this system may disadvantage the algae that are favoured by still or slow flowing water, such as is present in Stevens Weir and in the upper Wakool River. Even though the source of water for these rivers is the same, the algal count in Yallakool Creek was much lower than in the upper Wakool River which has very low discharge (49 ML/day on 8/3/16).

The algal count in the Mulwala canal at the Wakool Road was higher than in Stevens Weir. On the day the water sample was collected in the canal there was no flow through the regulator, so the water in the canal was still where the sample was collected. On future sampling dates if the canal is flowing it is possible the algal count would be lower when the water is flowing.

Table 3. Total algal count in water samples from four sites in the Edward-Wakool system sampled on 7/3/16 and 8/3/16. Counts are in number/mL

Family	Zone 1 Yallakool Ck Windra Vale 8/3/16	Zone 2 Upper Wakool River Widgee 8/3/16	Stevens Weir 8/3/16	Mulwala Canal at Wakool Rd 7/3/16
Cyanophyta (Blue green algae)	212,870	326,515	349,375	433,934
Chlorophyta (Green algae)	3,863	4,804	3,865	1,413
Bacillariophyceae	1,695	2,637	2,034	1,884
Euglenophyta	283	377	271	471
Total	219,000	335,000	356,000	438,000

Visual assessment of water (Figure 6) confirms these findings. The water at sites with higher velocity and turnover of water (Yallakool, Colligen Creek, and Stevens Weir) tend to have a lighter green colour in the water sample than the sites where discharge is very low and water velocity was low.

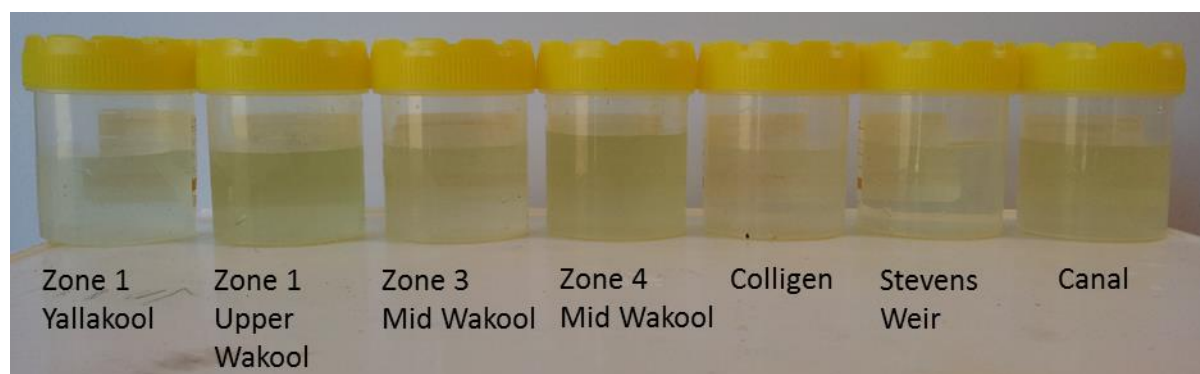


Figure 6. Water samples from 7 sites in the Edward-Wakool system collected on 7/6/16 and 8/6/16

A very preliminary analysis of the absorbance data for the study sites in February and March suggests that the algal bloom has not resulted in substantial increases in dissolved organic carbon at this time (Figure 7). Profiles for all sites in March were similar to those in February prior to the algal bloom. Fluorescence analysis is more sensitive to changes in carbon composition and analysis of this data is ongoing. Data for Stevens Weir (Figure 8) suggests a very slight increase in carbon on 8/3/16 but the overall signal remains low and within the expected range for this system at this time of year.

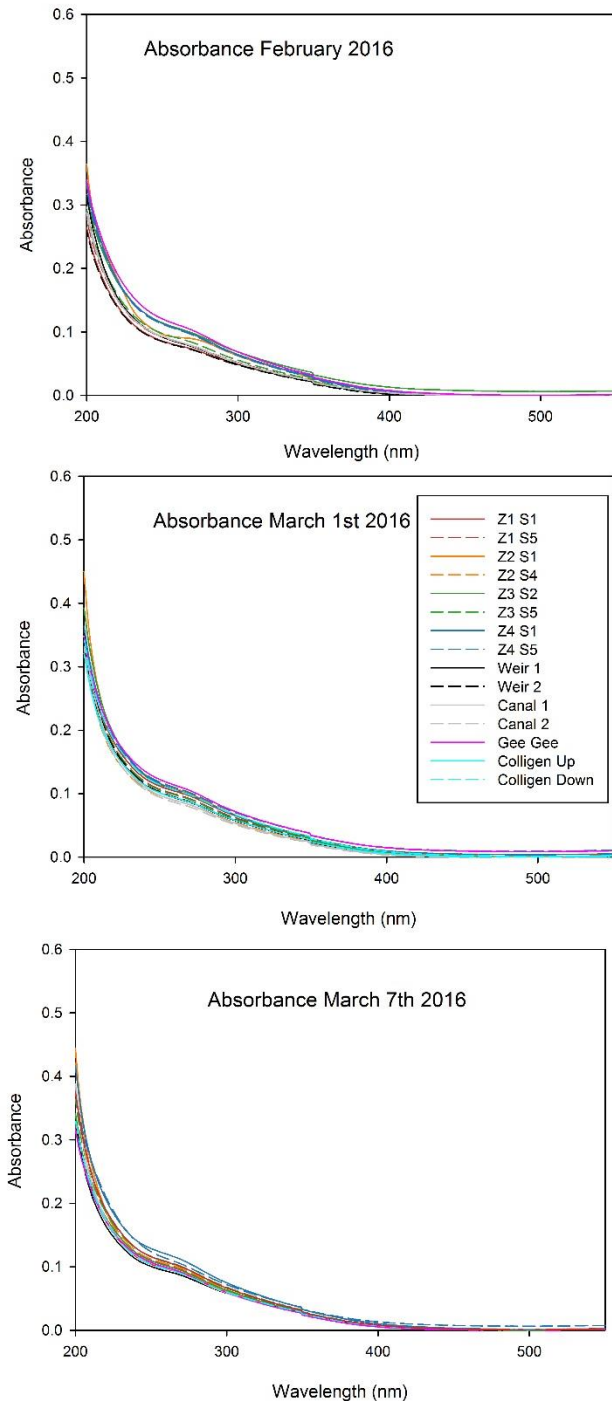


Figure 7. Absorbance scans representing two study sites in each zone, plus source waters in February and March 2016.

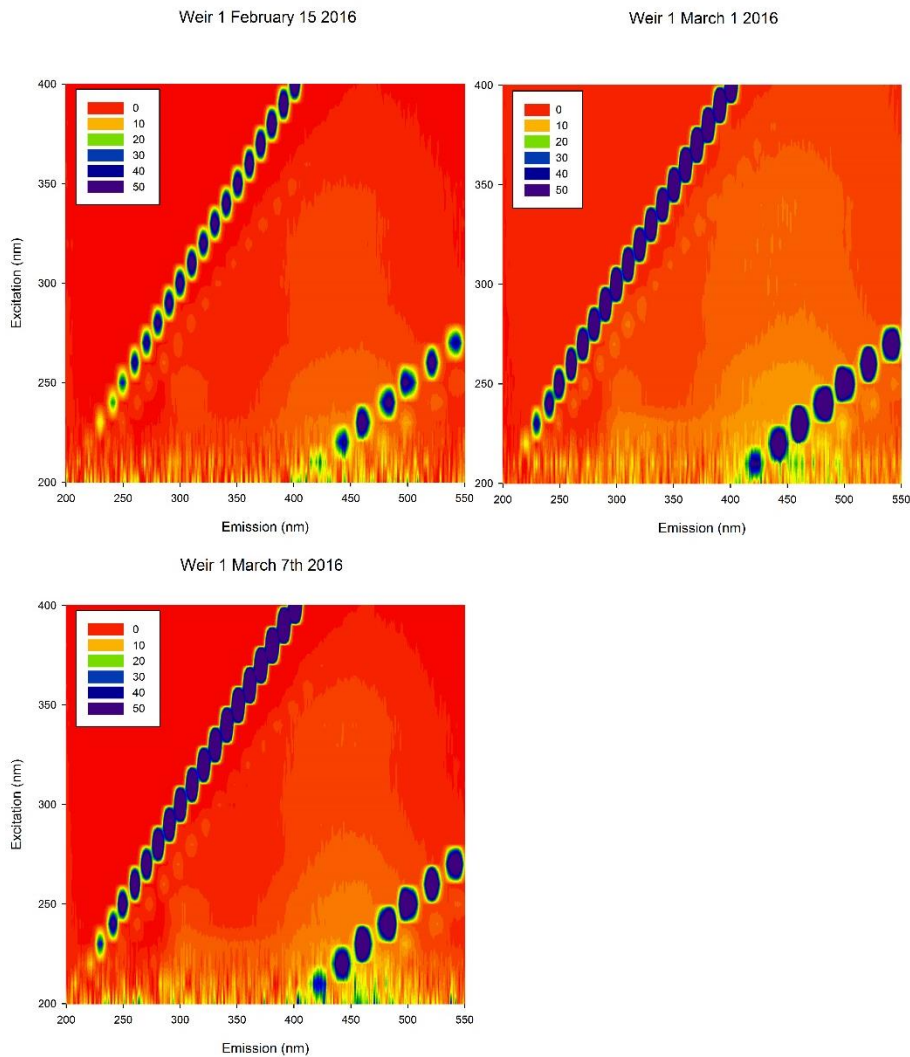


Figure 8 Fluorescence spectra for water samples from Stevens Weir in February and March 2016.

Acknowledgements

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