MARY RIVER CATCHMENT COORDINATING COMMITTEE

WATERWATCH Mary River Catchment

Communities Caring for Catchments

Mary River Catchment Crawl

4th and 5th October 2016

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Introduction

During the Mary River Month celebrations, the Mary River Catchment Coordinating Committee once again conducted its 8th annual Catchment Crawl on October 4th and 5th, 2016. The Catchment Crawls are designed to provide a snapshot of water quality along the Mary River. Water quality parameters are measured in an effort to gain insight to trends associated with cumulative effects and any other changes along the catchment area. On day one, testing begins in the upper reaches of the catchment, followed by a second day of testing in the lower reaches of the river and its tributaries, right out to the river mouth.

A total of 14 freshwater sites were sampled along the main trunk of the Mary River, along with seven sites in several upper and lower tributaries for a total of 21 sites. The tributaries sampled include Six Mile Creek, Widgee Creek, Wide Bay Creek, Munna Creek and Tinana Creek. Sampling occurred across all three local government areas in the catchment. Figure 1 shows a map of all sites sampled during the 2016 catchment crawl. Creek junctions with the Mary River were targeted for sampling in order to gather information on the effects of tributaries flowing into the river.

At each sampling site, a standard water test encompassing temperature, dissolved oxygen, electrical conductivity, pH and turbidity was performed. In addition, a sample was taken at each site in accordance with DSITI protocol to be tested for nutrients and total suspended solids. Samples to be tested for the presence of *E. coli* were also taken at some sites.

Figure 1 Sampling sites for the Mary River Catchment Crawl 2016

Table 1 below describes the location of each testing site shown in Figure 1.

Table 1 Site codes and their corresponding location descriptions

Site Code	Description
MAR009	Causeway on McCrae Lane, Conondale
MAR050	Grigor Bridge, Conondale
MAR125	Little Yabba Picnic Area, Cambroon
MAR170	Charles St River Park, Kenilworth
MAR300	Walker Rd bridge, Moy Pocket
MAR425	Mary River Park, Traveston Crossing
MAR499	Gympie weir, Gympie
MAR510	Widgee Crossing @ Eel Ck junction
MAR605	Dickabram Bridge, Miva
MAR640	Bauple Woolooga Road Bridge
MAR660	Emerys Bridge Road, Gundiah
MAR670	Home Park, Deborah Road, Netherby
MAR743	Petrie Park, boat ramp, Tiaro
MAR763	Riverside Park, Grevillea St, Owanyilla
MUN990	Birt Rd bridge, Munna Creek
SIX505	Victor Giles bridge, Cooran
SIX775	Woondum Rd bridge, Woondum
TIN550	Missings Crossing, Bauple
TIN800	Teddington Weir, Magnolia
WID399	Webb Park, Widgee
WIB950	Wilson Bridge, Carmyle Rd, Sexton

Weather Conditions

Tuesday October 4th 2016 was warm, fine and sunny and Wednesday October 5th 2016 was also warm, fine and sunny.

The maximum temperature recorded at Nambour on the 4th of October was 26.3°C (the closest weather station to the upper Mary sites), whilst at Gympie the maximum was 26.7°C. On the 5th of October, when testing was performed in the lower catchment area, Maryborough recorded a maximum temperature of 29.5 °C. Over the catchment crawl period, 4.2mm rainfall was recorded at Nambour, 5.8mm at Gympie and 8.0mm at Maryborough on the 4th of October. No other rain fell in the several days before or after the 4th of October.

River flow on sampling days

Table 2 shows the river heights and flow rates at several gauging stations in the catchment. This data was sourced from the online Water Monitoring Information Portal, which is provided by the Queensland Government's Department of Natural Resources and Mines. These river heights and discharge rates are similar to 2015 results.

Table 2 Gauging station locations, river heights and flow rates

Gauging station location	River height (m)	Discharge	Notes
Mary River, above Kenilworth (Bellbird station)	0.553m (<20% flow)	39 megalitres/day	Discharge decreased from 53 meg/day on 27 September
Mary River, Moy Pocket station	0.802m (<20% flow)	62 megalitres/day	Discharge decreased from 94 meg/day on 30 September
Mary River, below Gympie (Fishermans Pkt station)	1.654m (<20% flow)	116 megalitres/day	Discharge decreased from 143 meg/day on 3 October
Mary River, Miva station	1.649m (20-50% flow)	74 megalitres/day	Discharge increased from 50 meg/day on 3 October
Mary River, above Tiaro (Home Park station)	1.228m (20-50% flow)	155 megalitres/day	Discharge decreased from 315 meg/day on 27 September

Equipment

1. FLT 90 multi probe to measure pH, conductivity, salinity, temperature, dissolved oxygen and turbidity (and spare equipment).
2. DSITI sample bottles and sampling equipment
3. Esky and portable freezer
4. E. coli sample bottles
5. Digital camera
6. Garmin hand held GPS unit
7. Turbidity (clarity) tube
8. 10L bucket
9. Catchment map
10. Hat, sunscreen, first aid kit
11. Folder, data sheets, equipment instructions, itinerary and site hazard analysis assessment sheets

Results

The graphs and information shown below document the results of water quality for 2008, 2015 and this year's catchment crawl results (2016) for sites tested in the Mary River. The green shaded area on each graph demonstrates the optimal range for that parameter according to the MRCCC Water Quality Guideline Values. These values have been adapted by the MRCCC from the guidelines for fresh water given in the Queensland Water Quality Guidelines. The MRCCC guidelines are specific to each water type found in the catchment. On all graphs, the sites are arranged left to right, from furthest upstream to furthest downstream within the catchment.

Temperature

Water temperatures are considerably influenced by weather conditions and the degree to which the river is shaded by riparian vegetation. Tuesday October 4th 2016 had a minimum air temperature of 12.3°C and a maximum air temperature of 26.3°C, with 4.2mm of rain recorded at the Bureau of Meteorology's Nambour weather station. Wednesday October 5th 2016 had a minimum air temperature of 10.1°C and a maximum air temperature of 28.8°C, with zero rainfall recorded at Nambour.

Following the trend observed during previous catchment crawl events, the highest water temperature was recorded at Kenilworth on the Mary River at 29.9°C in 2008, 26.2°C in 2015 and 27.6°C in 2016 (Nambour's maximum air temperature on 4th October 2016 was 26.3°C). The results show a slightly lower overall water temperature profile in the main trunk of the river between 2008 and 2016.

This time of year coincides with the spawning of the Mary River Cod. Cod require cooler water temperatures which are often provided when waterways are well-shaded. Cod spawning is triggered when water temperatures rise from approximately 12°C to 18-20°C at the end of winter to the beginning of spring. Only two sites on the Mary River would be suitable for spawning, which was the Policeman Spur Road, Conondale site and the Widgee Crossing at Eel Creek Junction site. At the tributary sites tested, the two Six Mile Creek sites (Cooran and Woondum Road), the Tagigan Road site on Tinana Creek and the site at Webb Park on Widgee Creek are also suitable for cod spawning. There was an increase in the number of suitable sites for cod spawning from 3 sites in 2015, to 4 sites in 2016.

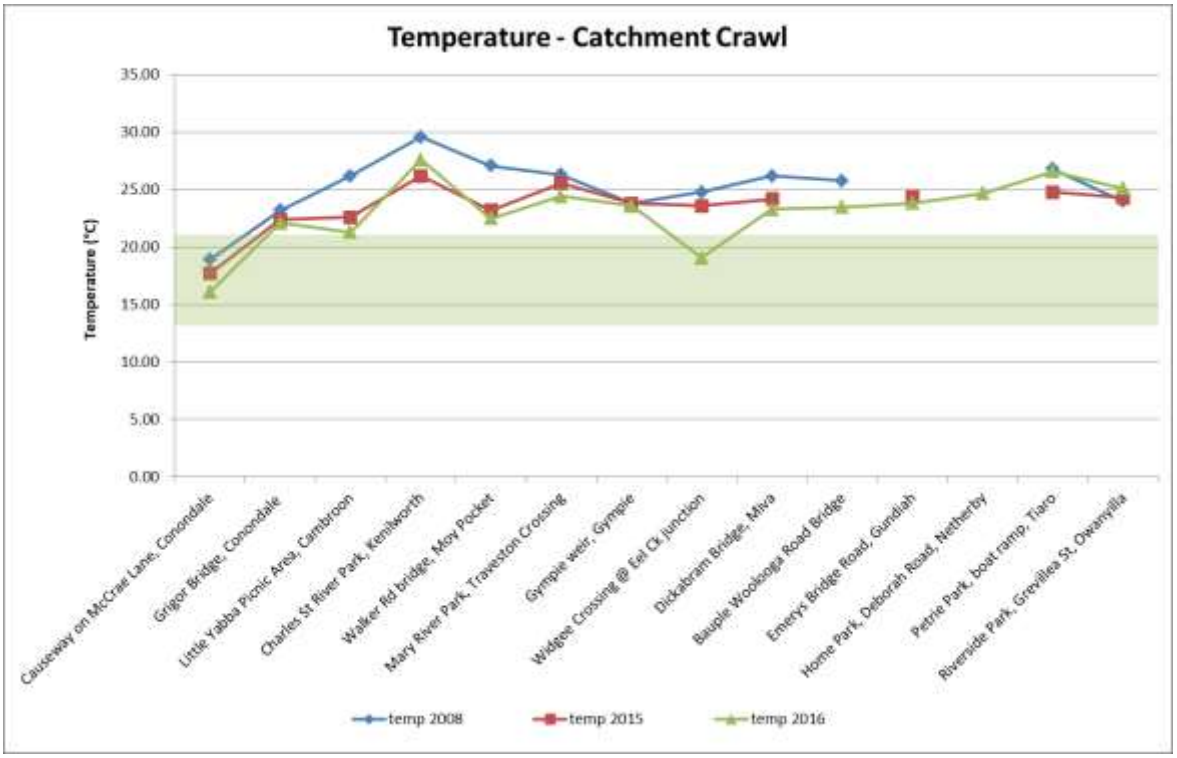

Figure 2 Temperature results for Mary River catchment crawl sites – 2008, 2015 and 2016

pH

In comparison to previous years, the 2016 pH levels at certain sites have increased to exceed the upper limit of the guidelines. The trend in pH results from 2015 to 2016 show a slight overall increase in pH levels. Higher than expected pH values were recorded during the 2002 and 2006 catchment crawls.

There is a close link between water temperature and pH. Temperature is directly associated with sunlight intensity. Increased sunlight increases temperature which stimulates photosynthetic activity of aquatic plants and algae. Rapid algae growth efficiently dissolves carbon dioxide in the water, lowering carbonic acid and increases the alkalinity of the water. This process promotes the higher pH readings, particularly in the afternoon.

The maximum peaks in pH were recorded in 2002 and 2006 which coincided on average with consistently higher temperatures by comparison to the somewhat lower water temperatures measured in both 2008 and 2015. The overall drop in recorded water temperatures in 2015 again coincides with the lower pH levels to within the MRCCC guidelines (maximum 8.2 to 8.0 and minimum 6.5). However, although temperature levels at most sites were consistent with 2015 temperatures, the pH readings were higher at 13 of the 18 sites (including tributary sites) where pH data had been recorded previously. This contradicts the link between water temperature and pH, suggesting there may be other factors influencing pH.

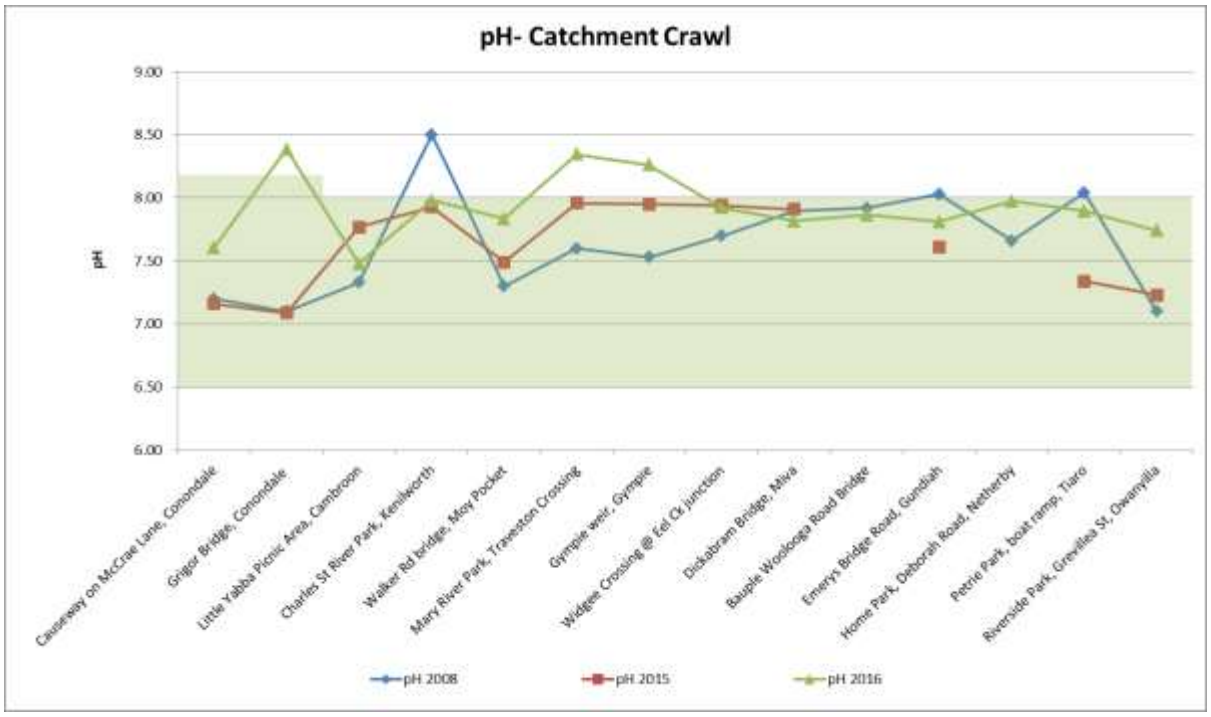

Figure 3 pH results for Mary River catchment crawl sites – 2008, 2015 and 2016

Electrical conductivity

Electrical Conductivity (EC) is a measure of water's ability to conduct electricity. The EC value is derived from the amount of dissolved salt content in the water. As dissolved salt increases so does the EC. Salt levels also tend to accumulate downstream in a catchment, which is reflected in increasing EC levels from left to right across the graph in Figure 4.

In 2016, EC began to increase downstream from Moy Pocket, peaking at Dickabram Bridge (562us/cm) and Woolooga Road, Bauple (563 us/cm). EC levels plateau at this point before dropping off to 452 us/cm at Owanyilla. This result is in contrast with the 2015 result which saw EC increase at Owanyilla, but in line with the 2008 result which also saw EC decrease here.

In 2008 all EC values were compliant, with the exception of the Dickabram Bridge and Emery's Bridge Road sampling sites. In 2016, all Mary River sites were compliant with MRCCC guidelines. Only three of the tributaries sampled, Munna Creek, Widgee Creek and Wide Bay Creek, were above the guidelines' upper limit.

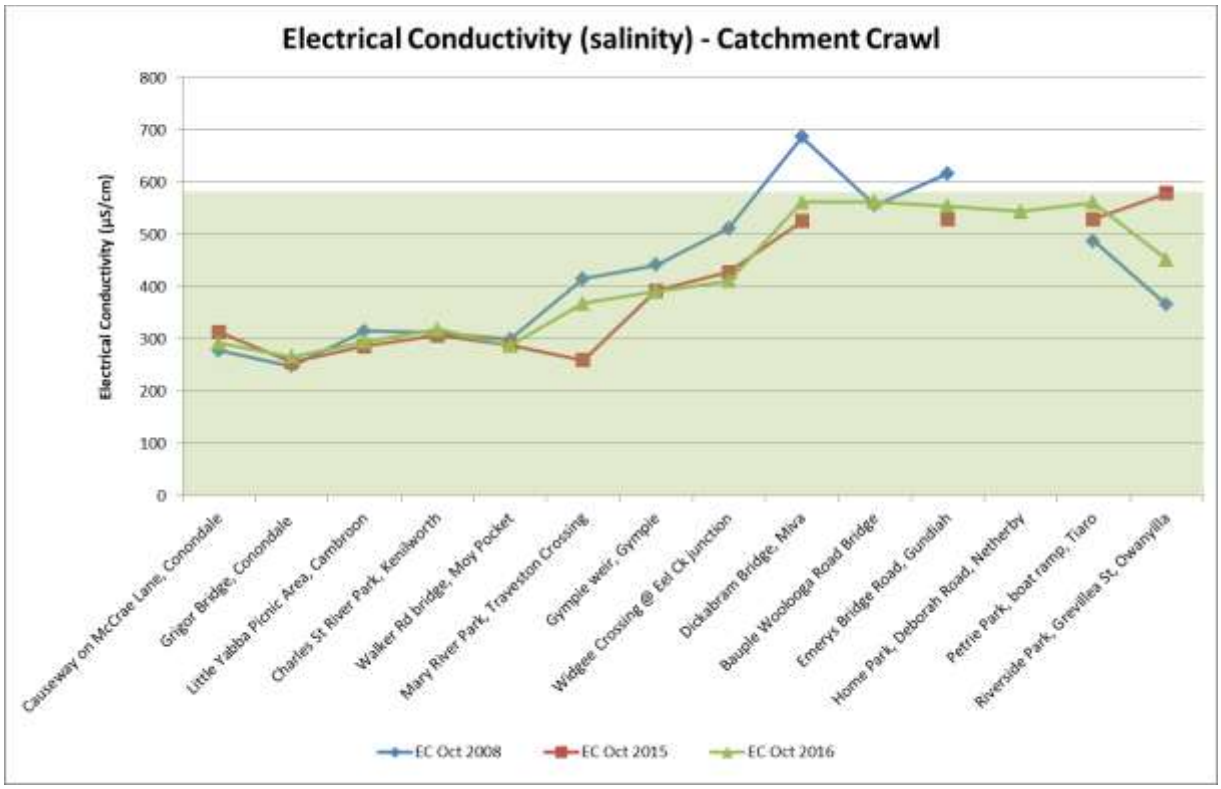

Figure 4 Electrical conductivity results for Mary River catchment crawl sites – 2008, 2015 and 2016

Dissolved oxygen

Of note, is the vast change between 2008 and 2015 levels of DO saturation at certain sites. Firstly, the Charles Street Kenilworth site in 2008 tested well over the guideline level (140% saturation) recommended by the EPA of 110% saturation. In 2015 while still not completely compliant, the drop in DO saturation at the same site is a notable trend in the desired direction. The 2016 DO saturation results hover around the compliant range according to MRCCC guidelines, but the majority of readings are either just above or just below the range limits for compliance (See Figure 5). Since 2008, the Charles St. Park site DO saturation result has fallen significantly to sit comfortably within the compliant range.

Similar to 2015 results, a spike in DO is evident at the Traveston Crossing site, unfortunately peaking well above the MRCCC guideline of 110% saturation.

When comparing the levels recorded in 2016 to 2008 there is still large variability in dissolved oxygen levels along the Mary River, with all Mary River sites downstream of Gympie recording DO saturation levels just below guideline (85% saturation). The Six Mile, Tinana Creek and Widgee Creek sites recorded well below guideline levels. Only one tributary site, Munna Creek, was within the guideline range of 85-110% saturation.

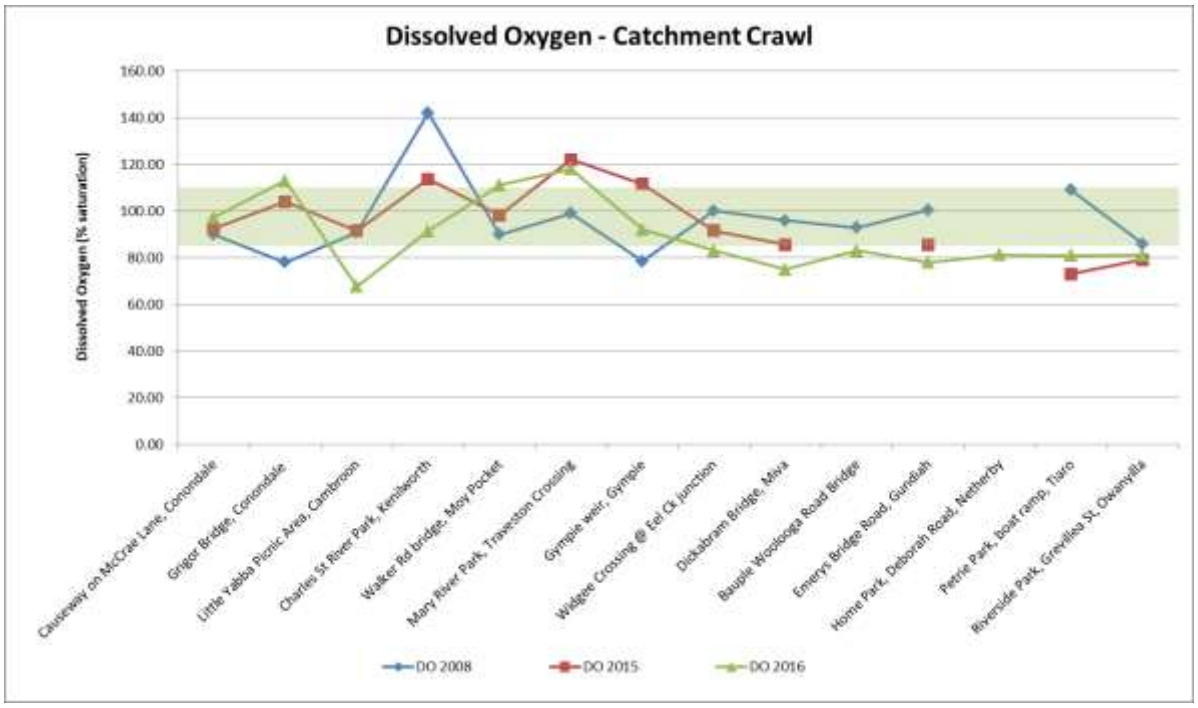

Figure 5 Dissolved oxygen results for Mary River catchment crawl sites – 2008, 2015 and 2016

Turbidity (NTU)

Turbidity is the measure of suspended sediments within the water, predominately from erosion within the catchment and stream banks. All sites complied with the MRCCC guideline of <50NTU, with the highest result of 12.5NTU recorded at Teddington Weir on Tinana Creek. Overall, turbidity values were significantly lower than the 2008 and 2015 results. In fact, 13 of the 18 sites (including tributary sites) with previous turbidity data recorded a decrease in turbidity.

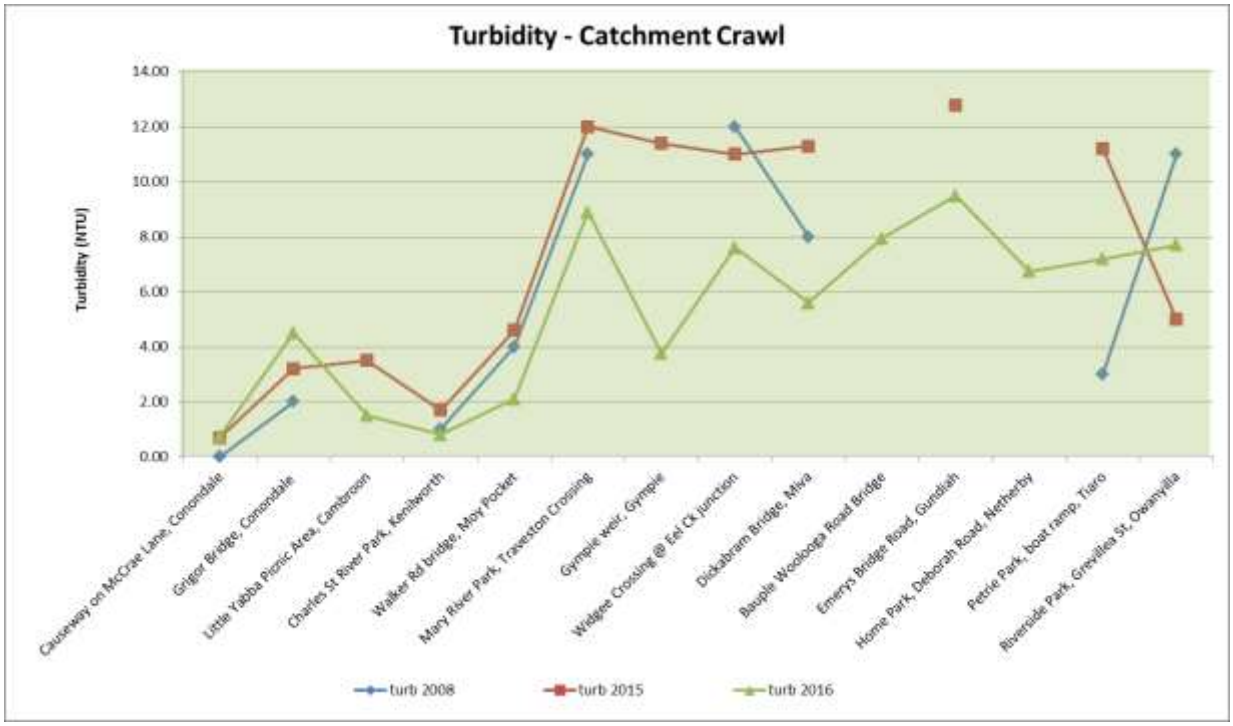

Figure 6 Turbidity results for Mary River catchment crawl sites – 2008, 2015 and 2016

E. Coli

Escherichia coli (*E. coli*) is a bacterium that is commonly found in the gut of humans and warm-blooded animals. E. coli levels are used as indicators of the presence of faecal material in drinking and recreational waters. Both indicate the possible presence of disease-causing bacteria, viruses, and protozoans. Sources of bacteria include improperly functioning wastewater treatment plants, leaking septic systems, storm water runoff, animal carcasses, and runoff from animal manure and manure storage areas. Figure 7 displays the *E. coli* levels from samples collected during the 2016 catchment crawl. The green shaded area depicts a guideline value of 150mpn/100mL. Widgee Crossing at Eel Creek junction which is located approximately 2km downstream of the Gympie sewage treatment plant was the only site to exceed guideline values (190mpn/100mL). All other sites displayed low levels of *E. coli*.

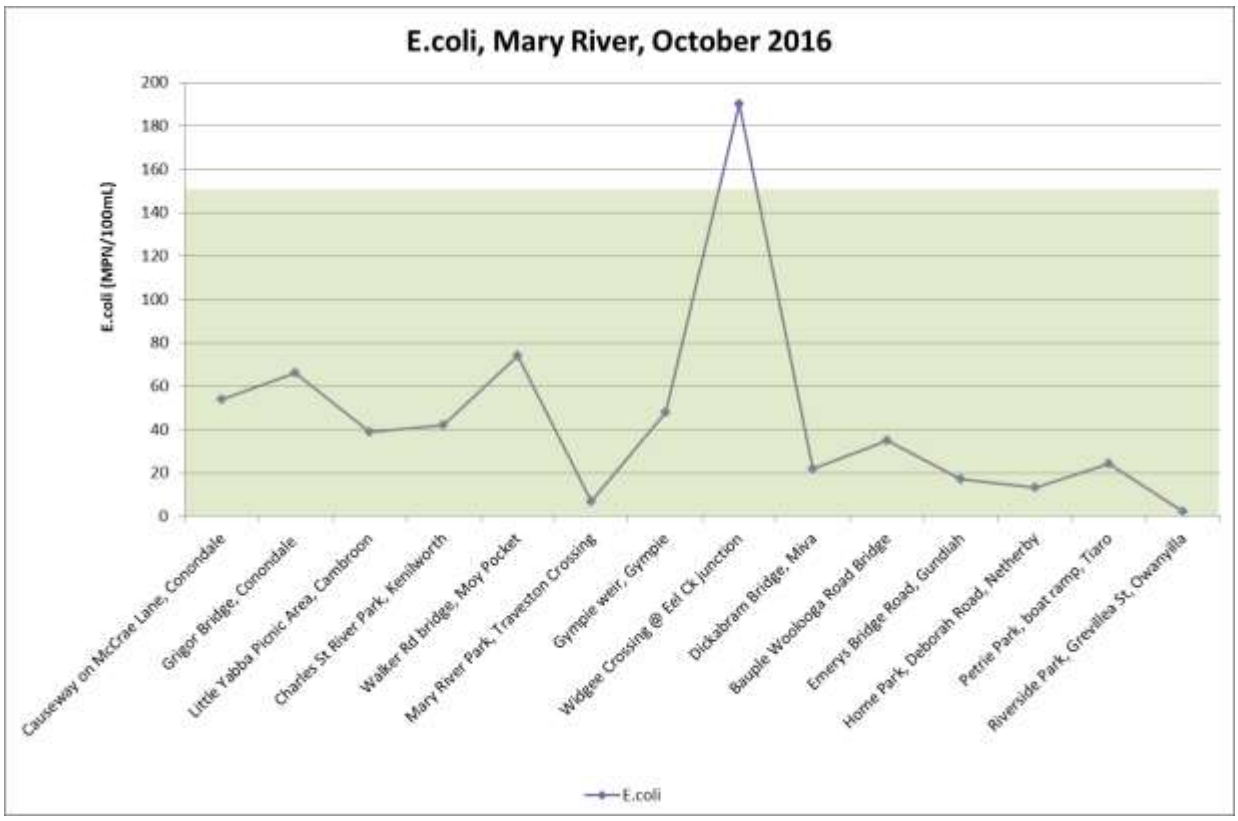

Figure 7 E. coli results for Mary River catchment crawl sites in 2016

Aquatic weeds

Aquatic weeds which were sighted on the catchment crawl and their approximate coverage are displayed in Table 3 Approximate coverage of water weeds observed during the 2016 catchment crawl. Less than 20% coverage of filamentous algae was present at a number of sites. Teddington Weir (TIN800) had large amounts of Salvinia trapped by the road crossing with some Water Hyacinth present. Fraser Coast Regional Council had also observed a severe infestation of Salvinia further downstream of the sampling site.

Table 3 Approximate coverage of water weeds observed during the 2016 catchment crawl

Site	Salvinia	Water Hyacinth	Dense Water Weed	Cambomba	Filamentous Algae	Other
MAR009						
MAR050					<20%	
MAR125						
MAR170			<20%		<20%	
MAR300					<20%	
MAR425						
MAR499	<20%		<20%		<20%	
MAR510	<20%				<20%	Duck weed <20%
MAR605					<20%	Duck weed <20%
MAR640						
MAR660					<20%	
MAR670					<20%	
MAR743						
MAR763					<20%	
MUN990					<20%	<20% Unknown
SIX505						
SIX755						
TIN550					<20%	
TIN800	20 - 80%	<20%				
WIB950					<20%	<20% Unknown
WID399						<20% Unknown

Nutrients

At each Catchment Crawl site, a water sample was taken in accordance with the Department of Science, Information Technology and Innovation (DSITI) sampling protocol. These samples were sent to the DSITI Chemistry Centre in Brisbane for nutrient testing. Tests performed on each sample included total suspended solids (TSS), and determining the proportions of different forms of nitrogen and phosphorus.

The Queensland Water Quality Guidelines set out recommended nutrient values for different water types in Queensland. The guideline limits for total oxidised nitrogen as N is 0.06mg/L (for lowland streams <150m) or 0.04mg/L (for upland streams >150m), and the guideline used for total Kjeldahl nitrogen is 0.42mg/L (lowland) or 0.2mg/L (upland). The guideline for TSS is 6mg/L for both lowland and upland streams. The guideline for phosphate phosphorus is 0.02mg/L (lowland) or 0.012mg/L (upland).

Total suspended solids test measures the particulate matter that is suspended within the water column. In high concentrations, particulate matter can smother fish eggs when it settles out, and interfere with water treatment processes. It can also increase turbidity which restricts sunlight penetration, hindering photosynthetic activity. Construction activities, forestry harvesting, urban developments and mining activities can all contribute to higher suspended solid readings.

The importance of nitrogen in aquatic environments varies according to what forms the nitrogen takes, and the amount of each form. Total oxidised nitrogen is a measure of the type of nitrogen (nitrite and nitrate) that is available in the water. These are forms of nitrogen that can be readily taken up by plants, and therefore provides a useful indicator of whether a waterbody can support an algal bloom. Kjeldahl nitrogen is a measure of both the ammonia and organic forms of nitrogen. Excess ammonia contributes to the eutrophication of water bodies, which results in algal blooms that negatively impact other aquatic life, decrease drinking water quality and affect recreational activities. At high concentrations, ammonia is toxic to aquatic life. Organic nitrogen is not able to be used directly by aquatic life for biological activity, so it does not contribute to plant proliferation until it decomposes into usable forms.

Total phosphorus is a measure of both the organic and inorganic forms of phosphorus. Phosphorus can be present in water as dissolved or particulate matter. It is an essential plant nutrient which is often the most limiting nutrient to plant growth in fresh water. It is uncommon to find it in significant concentrations in surface waters. Therefore, if significant concentrations of phosphorus do enter a freshwater system, extreme algal blooms can occur. Phosphorus inputs are the main contributing factor in the eutrophication of freshwater systems.

Anthropogenic sources of nitrogen and phosphorus include sewage treatment plant effluent, agriculture, urban development and industrial effluents (mining, recreation etc.).

The oxidised nitrogen results (Figure 8) show a large spike at the Widgee Crossing site at the Eel Creek junction with the Mary River. This site is located approximately 2km downstream of the Gympie sewage treatment plant. *E. coli* results also showed a spike above guideline levels at this site. All other sites tested were well within the guidelines, apart from the causeway on McCrae Lane, Conondale.

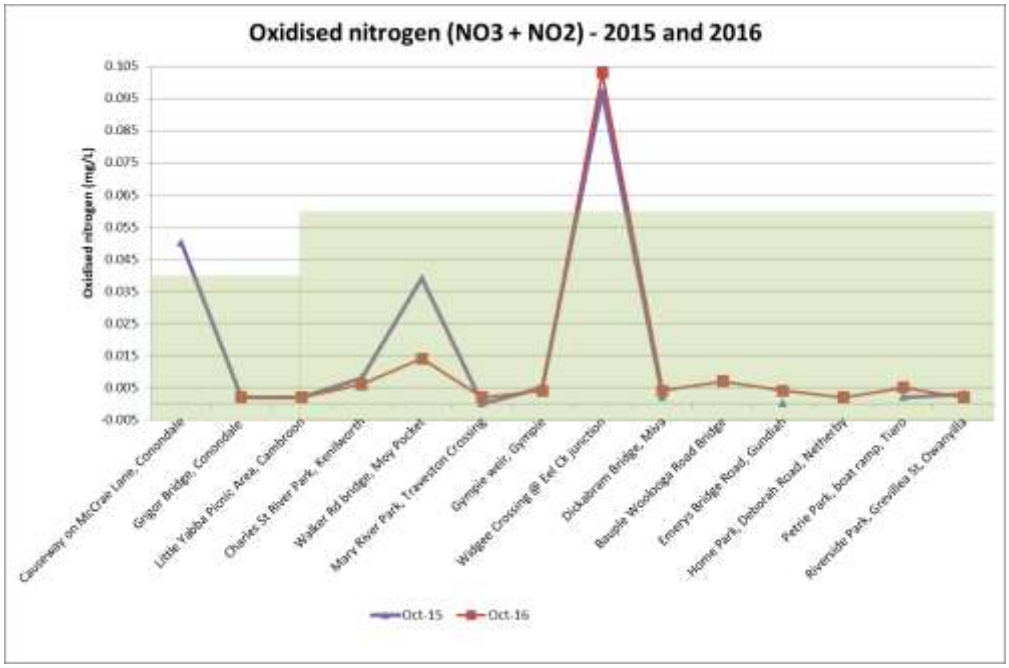

Figure 8 Oxidised nitrogen results for Mary River catchment crawl sites – 2015 and 2016

Kjedahl nitrogen results (Figure 9) were all within guideline levels with the exception of the Grigor Bridge site at Conondale. The results from the sites from Moy Pocket to Widgee Crossing were all lower in 2016 than in 2015. The sites at Miva and Owanyilla were higher in 2016 than in 2015.

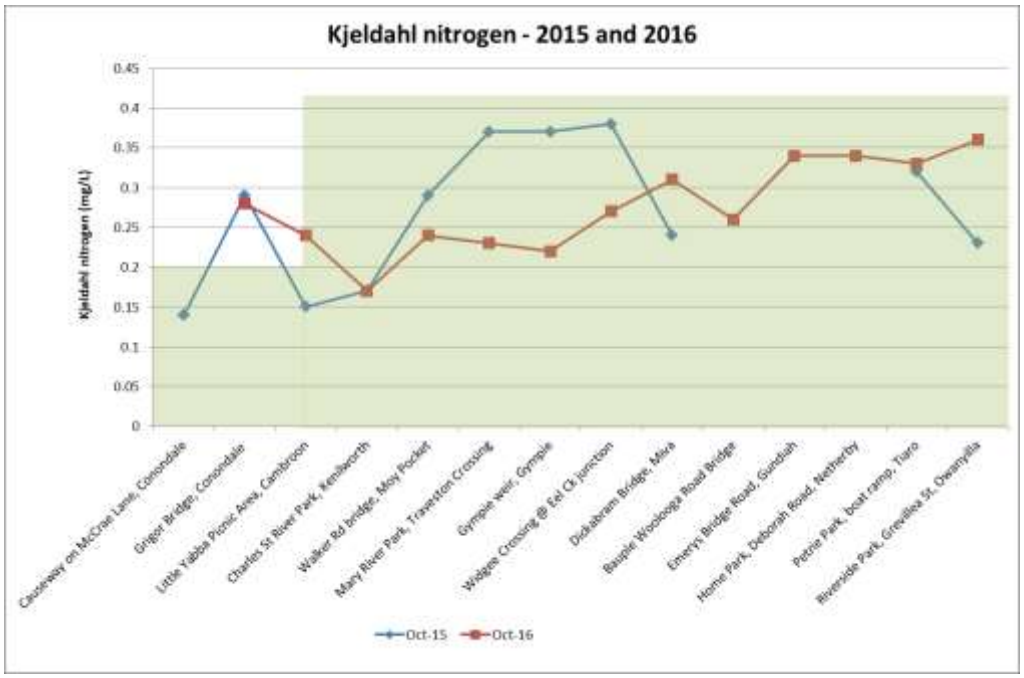

Figure 9 Kjedahl nitrogen results for Mary River catchment crawl sites – 2015 and 2016

Phosphate phosphorus results (Figure 10) once again showed a spike which exceeded guideline levels at the Widgee Crossing site downstream of the Gympie sewage treatment plant. However, the 2016 result was considerably lower than the 2015 result. There was another, smaller spike at the Moy Pocket site in 2015, but this had decreased considerably by 2016.

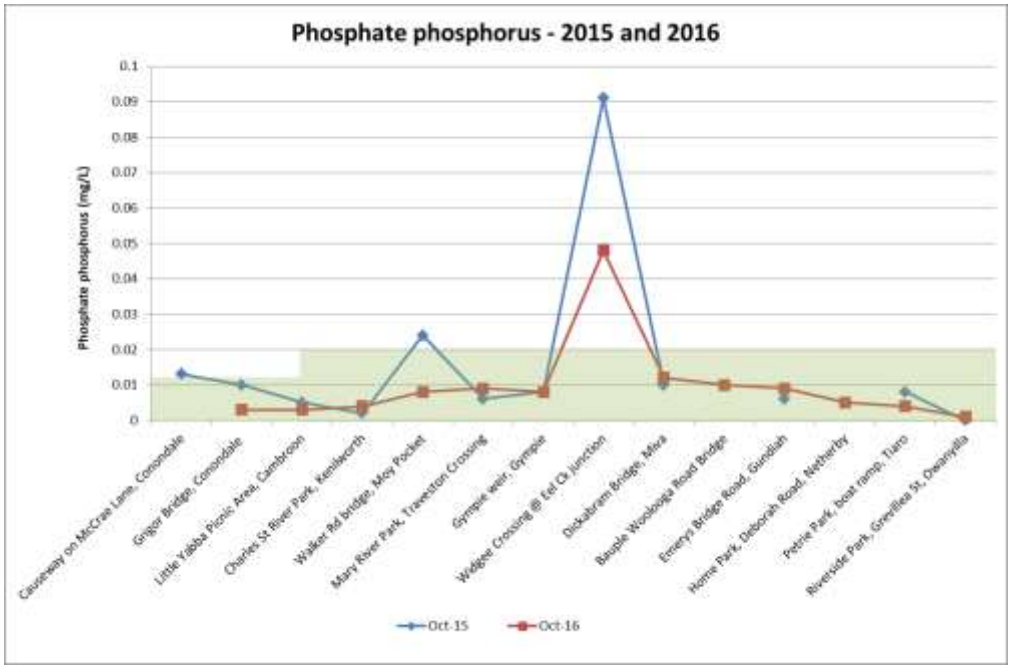

Figure 10 Phosphate phosphorus results for Mary River catchment crawl sites – 2015 and 2016

The TSS results (Figure 11) were mostly within guideline values, with the exception of the Emerys Bridge Road site at Gundiah. This result more than doubled the recommended guideline values, and showed a considerable increase from 2015 to 2016. All other results were within or just above guideline values.

Figure 11 Total Suspended Solids results for Mary River catchment crawl sites – 2015 and 2016

Appendices

Appendix 1: MRCCC Water Quality Guideline Values

Quality Guideline Title & Description	Guideline Values	
G1 – Artificial Water Bodies eg. Settling ponds, farm dams, drains, bores and wells.	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	
G2 – Estuarine & Marine Waters As mapped on the scheduled Mary Basin Water Quality Guidelines	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	
G3 – Southern Upland Acid Waters Upland (>150m) freshwaters draining acid red soils of the Maleny/Mapleton plateau	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	0 – 580 µS/cm 6.0 – 8.0 90 – 110 % saturation 0 – 25 NTU 18 – 28 °C 13 – 21 °C
G4 – Southern Upland Waters Upland (>150m) freshwaters in the main trunk of the Mary River and all tributaries which drain into the Mary River upstream of Deep Creek except for Southern Upland Acid Waters.	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	0 – 580 µS/cm 6.5 – 8.2 90 – 110 % saturation 0 – 25 NTU 18 – 28 °C 13 – 21 °C
G5 – Southern Lowland Waters Lowland (<150m) freshwaters in the main trunk of the Mary River and all tributaries which drain into the Mary River upstream of Deep Creek	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	0 – 580 µS/cm 6.5 – 8.0 85 – 110 % saturation 0 – 50 NTU 18 – 28 °C 13 – 21 °C
G6 – North Western Lowland Waters Lowland freshwaters (<150m) in all western tributaries which drain into the Mary River downstream of Six Mile Creek. As well as Gutchy Creek and its tributaries.	Electrical Conductivity pH Dissolved Oxygen Turbidity Summer Temperature Winter Temperature	0 – 1200 µS/cm 6.5 – 8.0 85 – 110 % saturation 0 – 50 NTU 22 – 30 °C 16 – 24 °C
G7 – Eastern Sandplain Tannin Stained Waters Tannin stained waters of the eastern tributaries of Tinana Creek *from footnotes in Mary WQO document for water bodies in the	Electrical Conductivity pH Dissolved Oxygen Turbidity	0 – 580 µS/cm 3.6 – 6.0* 85 – 110 % saturation 0 – 50 NTU

natural state	Summer Temperature	22 – 30 °C
	Winter Temperature	16 – 24 °C
G8 – North Eastern Lowland Waters Lowland freshwaters (<150m) in the main trunk of the Mary River and all Eastern tributaries which drain into the Mary River downstream of Six Mile Creek, except for Eastern Sandplain Tannin Stained Waters.	Electrical Conductivity	0 – 580 µS/cm
	pH	6.5 – 8.0
	Dissolved Oxygen	85 – 110 % saturation
	Turbidity	0 – 50 NTU
	Summer Temperature	22 – 30 °C
	Winter Temperature	16 – 24 °C