

MURKY WATERS

Water Quality Testing of Platypus Habitat in North Queensland



Yungaburra Landcare Group

August 2025

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We are grateful to Stan Perkowicz for permission to access his property to collect water samples near the source of Peterson Creek and for his warm hospitality during our monthly visits.

Thanks also to the team at Cairns Regional Council Laboratory for their efficient analysis and reporting of our water samples, and for their helpful support throughout this project.

Notwithstanding the many people who assisted us, we take responsibility for the information and interpretation of water quality data presented in this report.

Background

Part of the Barron River basin, Peterson Creek is a 9 km long waterway arising near Lake Eacham and flowing into Lake Tinaroo, on the Atherton Tableland of North Queensland.

The creek traverses agricultural land used for avocado plantations and cattle grazing, before running along the edge of Curtain Fig National Park and the western edge of Yungaburra township (elevation around 730 m), and then on to Lake Tinaroo (see map next page).

Yungaburra Landcare Group (YLG) is a local group of volunteers repairing and caring for Peterson Creek and its environs. We focus on tree planting, environmental protection including weed removal, and conservation of land, waterways and natural habitat to enhance biodiversity.

Peterson Creek is well known as a prime location for observing the platypus (*Ornithorhynchus anatinus*) and attracts over 60,000 local and international wildlife enthusiasts annually, many of whom are brought to Peterson Creek by commercial tourism operators.

Other aquatic animals living in Peterson Creek include Rakali (water rat), Eastern water dragon and saw-shelled turtle.

Several aquatic weeds, especially Amazonian Frogbit (*Limnobium laevigatum*), require monitoring and removal to prevent them from covering the creek surface and inhibiting platypus movement, as occurred several years ago. YLG volunteers remove aquatic weeds manually from a boat on the creek and sometimes by entering the water and dragging the plants onto the bank.

The sediment load in the creek water increases noticeably during and after heavy rain events, turning the creek a chocolate brown colour. In drier periods, patches of algal growth appear on the water surface. These changes to the appearance of the creek throughout the year led the YLG to question whether water quality conditions could impact the local platypus population, and/or the outbreaks of aquatic weeds. In response to these concerns, we applied for a Landcare Australia Community Grant to undertake water quality analysis of Peterson Creek.

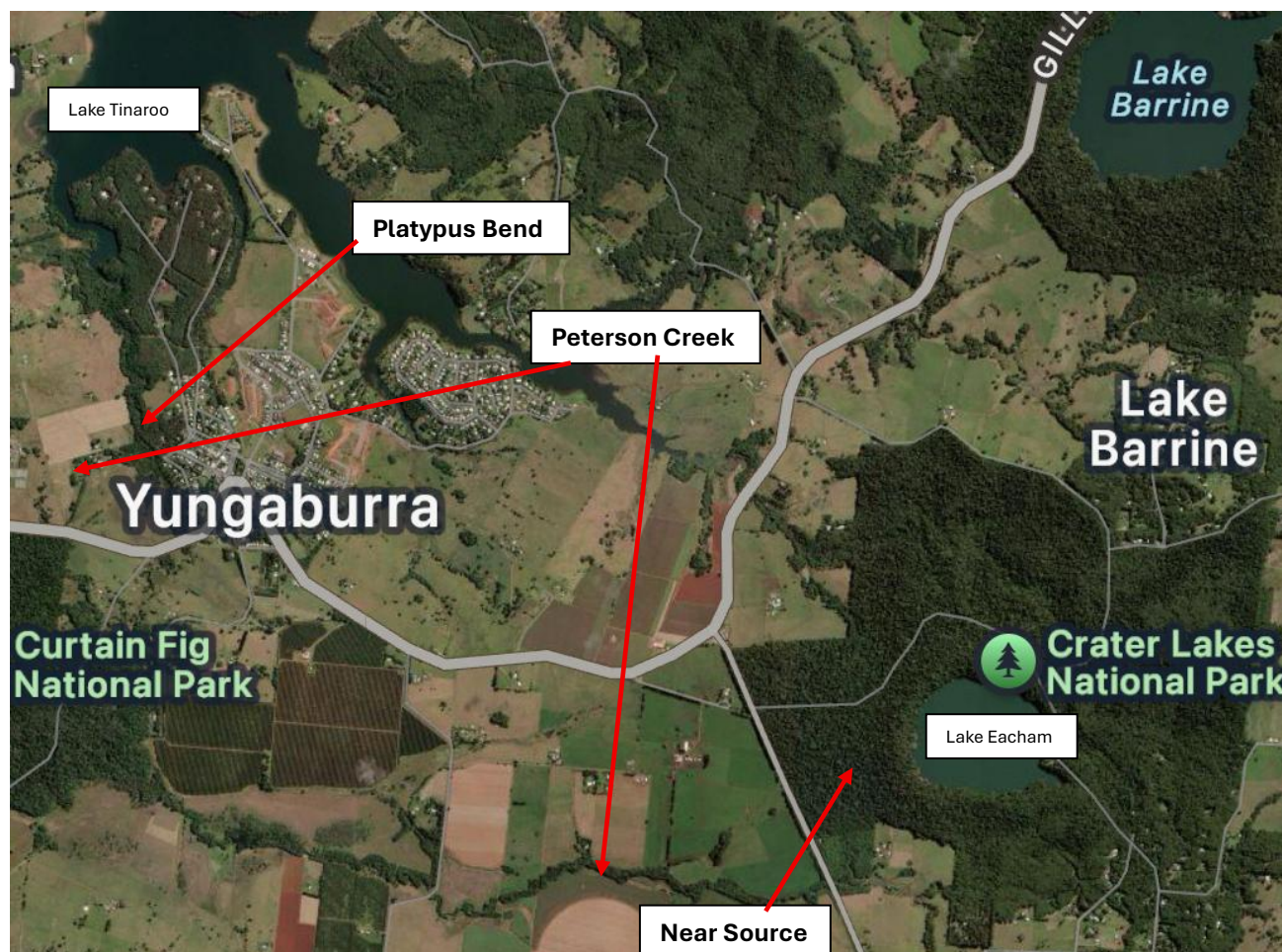
A Queensland Government publication focusing on environmental values and water quality objectives in the Barron River Basin (State of Queensland 2020) identifies the following environmental values specifically for Peterson Creek:

- Aquatic ecosystems
- Irrigation
- Farm supply
- Stock watering
- Human consumption
- Primary recreation (e.g. swimming)
- Secondary recreation (e.g. boating)
- Visual appreciation
- Cultural and Spiritual values

Water Quality Testing

The selection of water quality attributes to measure involved consultations with local Dulguburra Traditional Owners, advice from experts¹ in freshwater ecology, a review of attributes measured in a previous Peterson Creek water quality study commissioned by the Tableland Regional Council (GDH 2020), previous water quality testing undertaken by YLG and the constraints of available funding.

The initial proposal was to collect and analyse monthly water samples from three sites: near the source of Peterson Creek, midway between Lake Eacham and Yungaburra and at Platypus Bend (near Yungaburra) from October 2024 to June 2025. Following a delay in awarding the Community Grants, and inclusion of additional water quality attributes, the water samples were collected from near the source and from Platypus Bend from January to June 2025. The Near Source site (a shallow, narrow stream) and Platypus Bend collection site (a deep broad reach) are indicated on the map below.



The samples were collected from both sites in mid to late afternoon at three- to four-weekly intervals, stored in a refrigerator overnight, and transported in a cooled container to the Cairns Regional Council (CRC) Laboratory the following morning – consistent with the laboratory’s requirement for samples to be delivered within 24 hours of collection. The laboratory provided water quality analyses within 10 days of receipt of the water samples.

¹ See Acknowledgements section for names of experts consulted

The selected water quality attributes and their potential health and ecological implications are summarised in the table below:

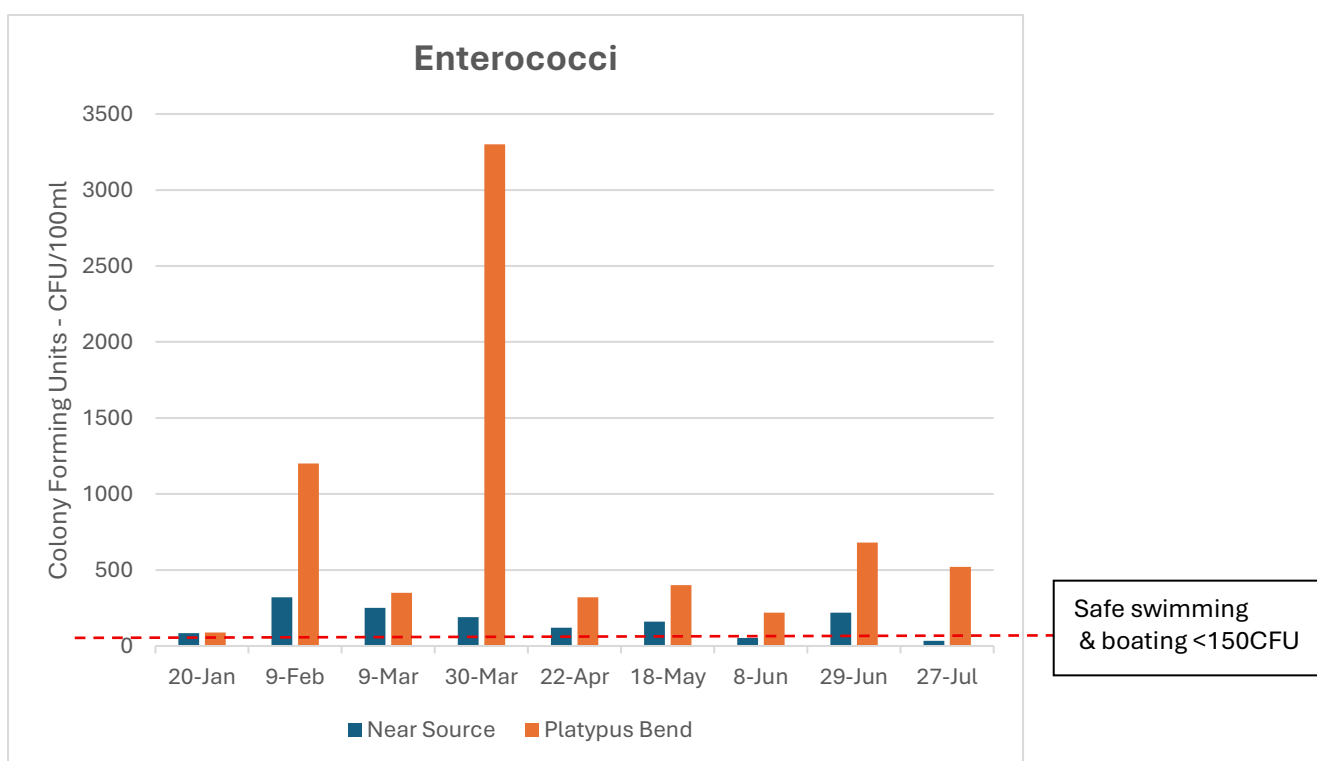
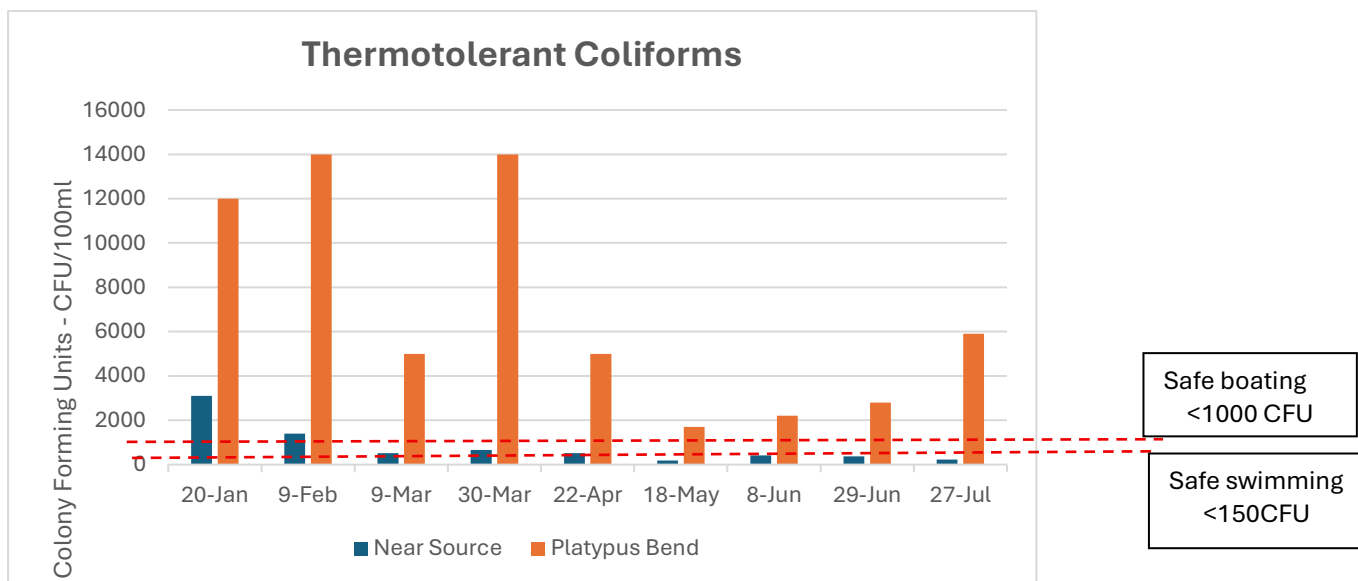
Water Quality Attributes	Potential Health and Ecological Implications
Thermotolerant Coliforms	Indicates potential faecal contamination and presence of pathogenic bacteria; used for assessing water safety for recreation and human contact.
Enterococci	Similar to coliforms; indicates faecal contamination, especially relevant for assessing risks to human health at recreational sites.
Total Suspended Solids	Measures particulate matter; affects water clarity, sedimentation, and habitat quality; elevated levels can indicate erosion or runoff.
Turbidity	Assesses water clarity; high turbidity can reduce light penetration, affect aquatic life, and may carry pollutants.
pH	Measures acidity or alkalinity; influences chemical behavior of pollutants and biological activity; deviations may harm aquatic life.
Electrical Conductance	Indicates total dissolved salts and mineral content; high conductance can suggest pollution or mineral runoff.
Total Phosphorus	Key nutrient; excess can lead to eutrophication, algal blooms, and oxygen depletion, impacting aquatic ecosystems.
Total Nitrogen	Indicates nutrient levels; elevated nitrogen can cause eutrophication and algal proliferation.
Ammonia	Toxic at high concentrations; indicates organic pollution and nitrogen cycling; important for assessing water toxicity.
Total Oxidised Nitrogen	Reflects nitrate, nitrite, and other oxidized nitrogen forms; vital for understanding nitrogen dynamics and pollution sources.
Ortho Phosphate	Easily measurable form of phosphate; excess promotes algal growth and eutrophication.
Nitrate	A form of oxidized nitrogen; high levels can cause health issues and contribute to eutrophication.
Nitrite	A reduced form of nitrogen; can be toxic at high levels and indicates ongoing nitrogen cycling or pollution.
Chlorophyll-a	Proxy for phytoplankton (algae) biomass; used as an indicator of trophic status (nutrient enrichment) in aquatic ecosystems.

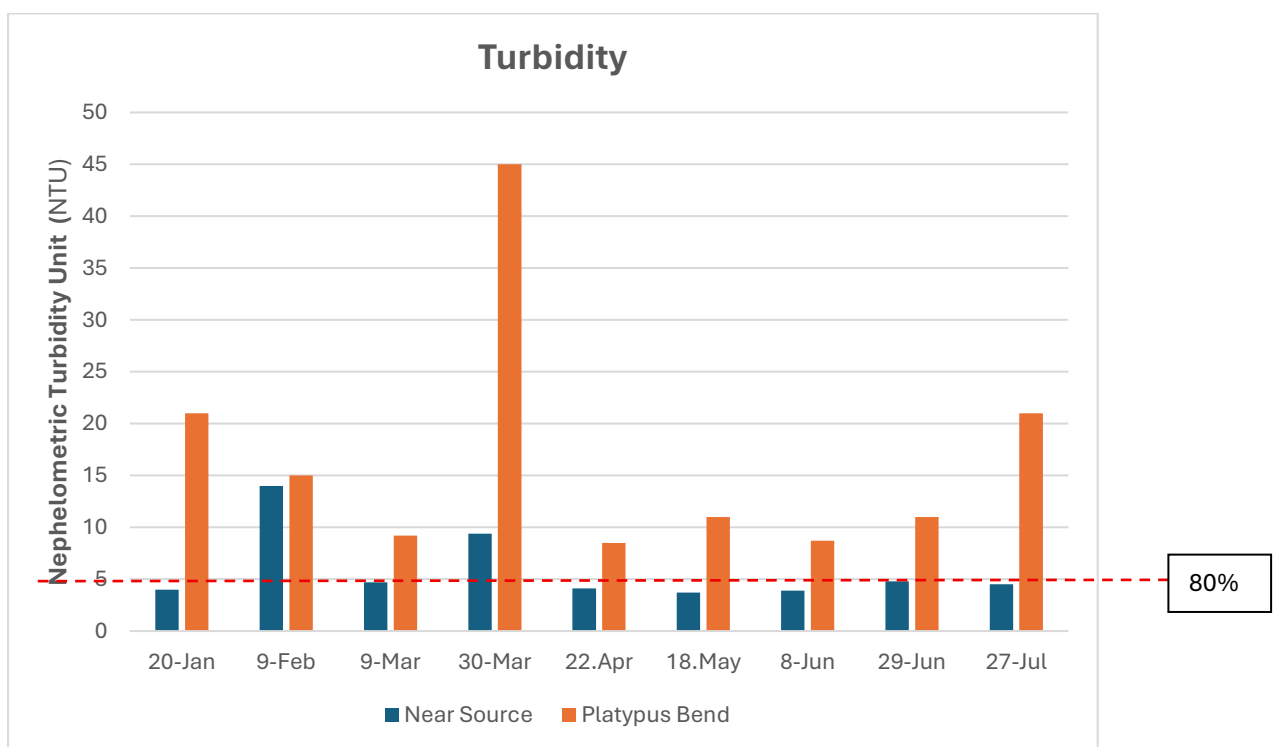
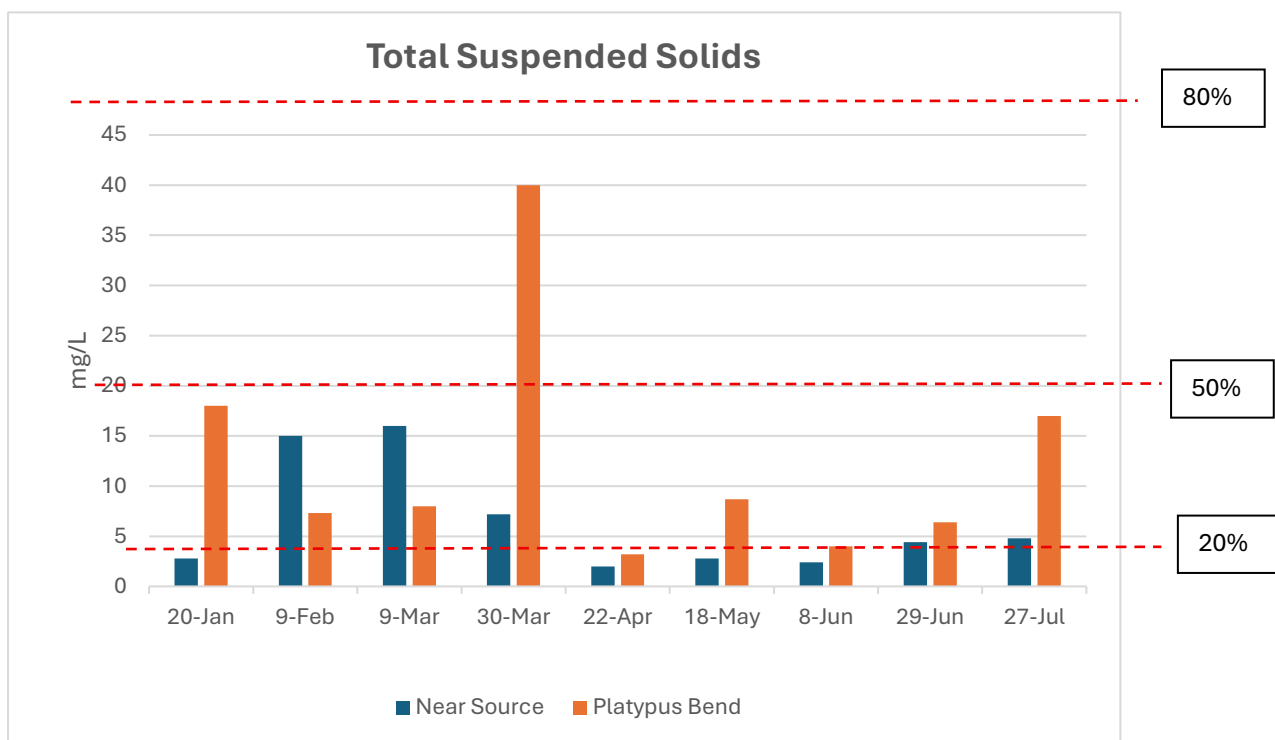
Water Quality Analysis

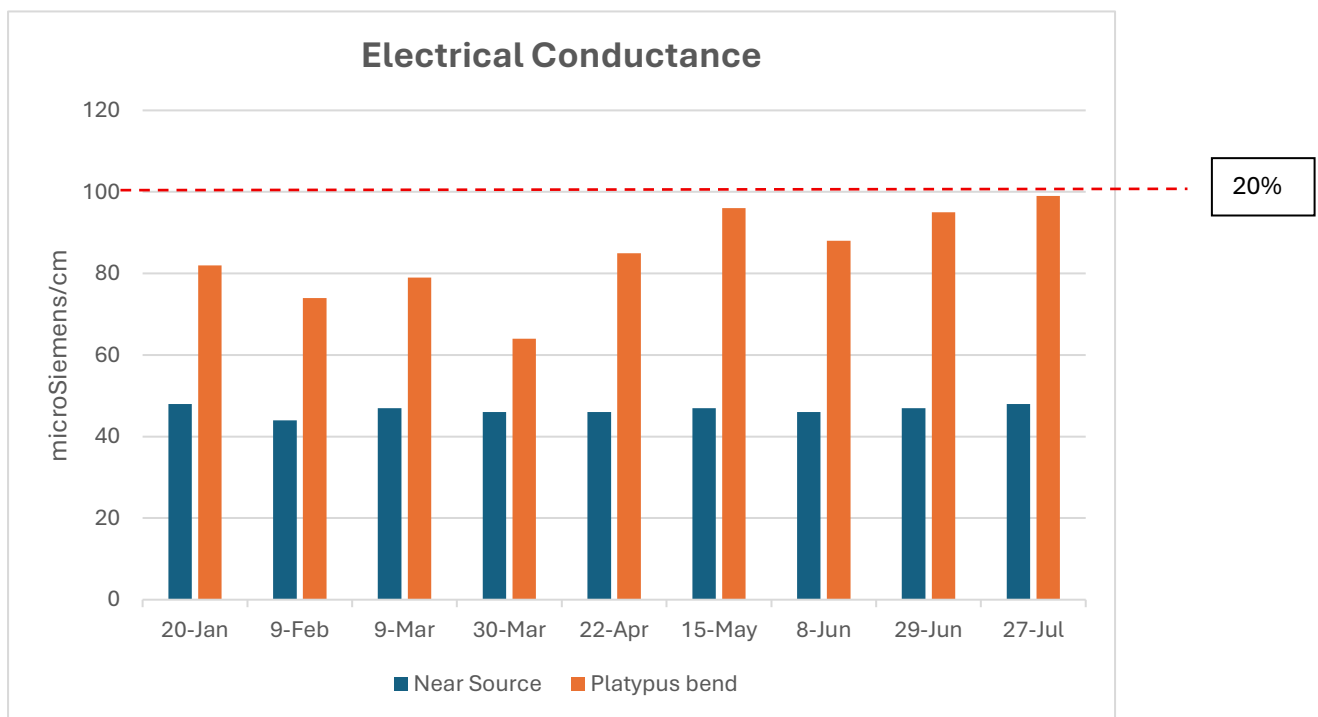
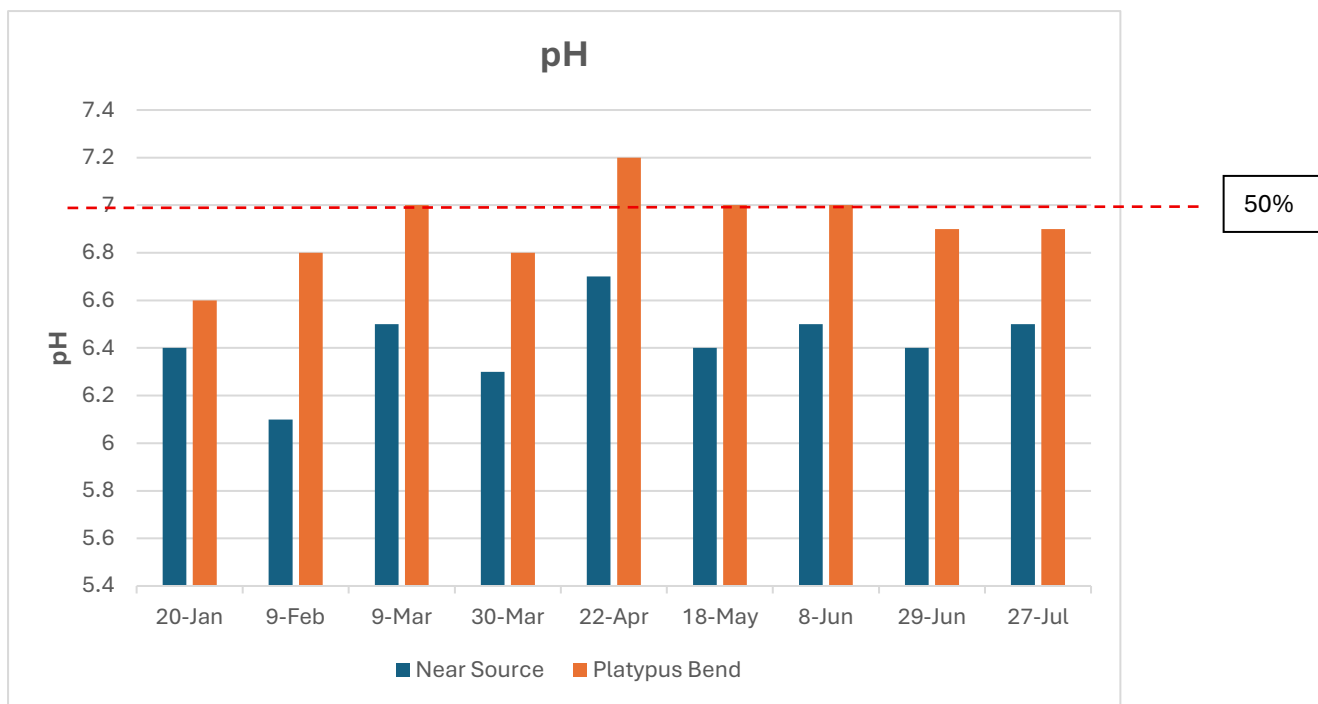
The results of the analysis of samples collected from Near Source and Platypus Bend from January to June 2025 are shown in the bar charts below for all values, except Nitrite and Chlorophyll-a which are shown as tables. Additional analyses of samples collected in July 2025 will be sent to Landcare Australia as an addendum to this report when they are received from CRC Laboratory, expected in mid-August.

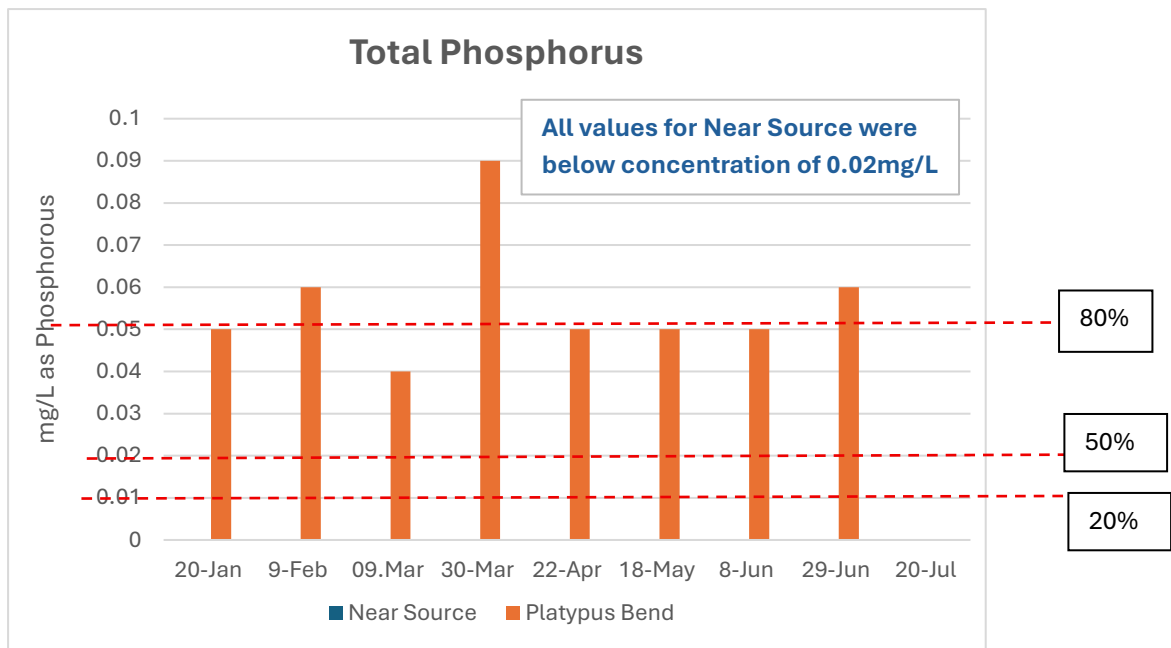
In the charts on the following pages, the relevant concentrations at the Near Source are displayed as blue columns; the concentrations at Platypus Bend are displayed as orange columns. The charts include relevant Water Quality Objectives (WQOs) for each attribute, based on information provided in a Queensland Government Barron River Basin policy document (State of Queensland, 2020).

For Thermotolerant Coliforms and Enterococci, the WQOs are threshold guidelines focused on recreational use of waterways set by the National Health and Medical Research Council (NHMRC, 2008). The WQOs for the other attributes are expressed as percentile thresholds that take into account variability in water flow and condition throughout the year. For example, the 80th percentile threshold means that 80% of measured concentrations should be below this threshold over the year. Similarly, the 20th percentile threshold means that 20% of measured concentrations should be below this threshold over a 12-month period.

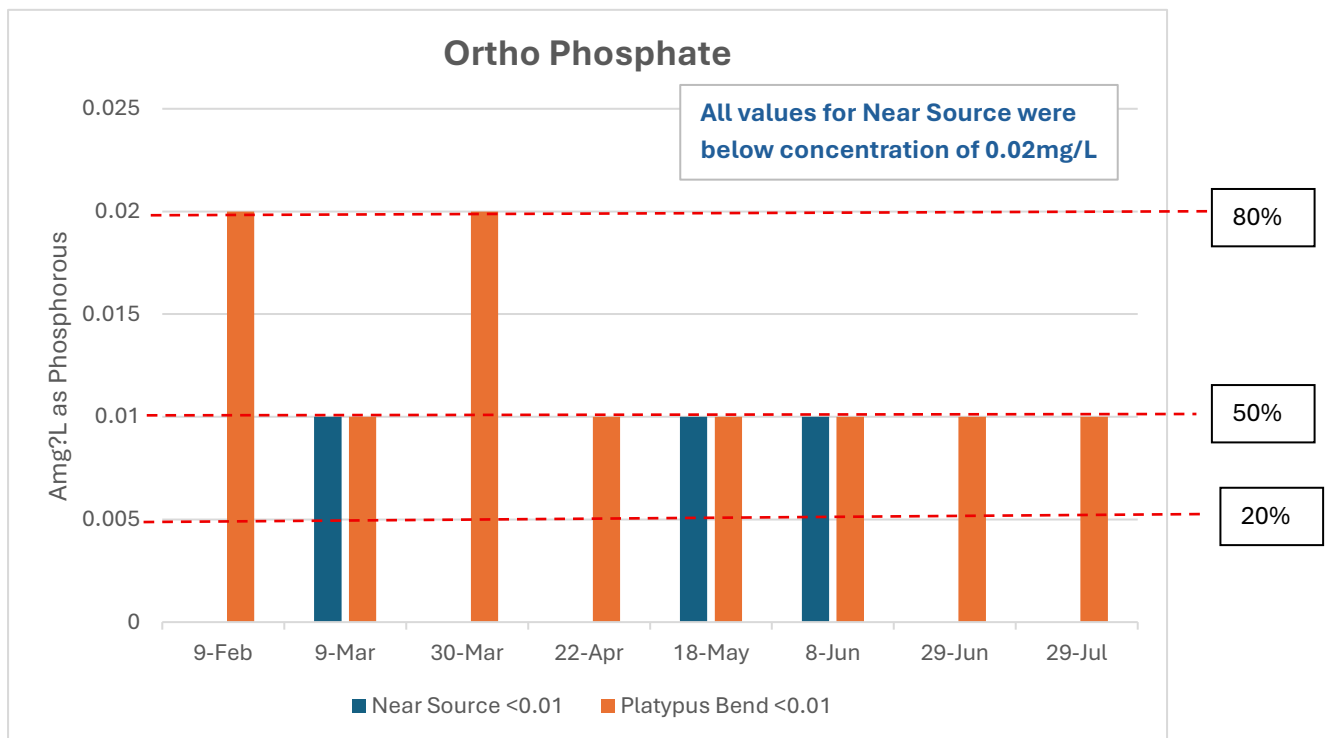


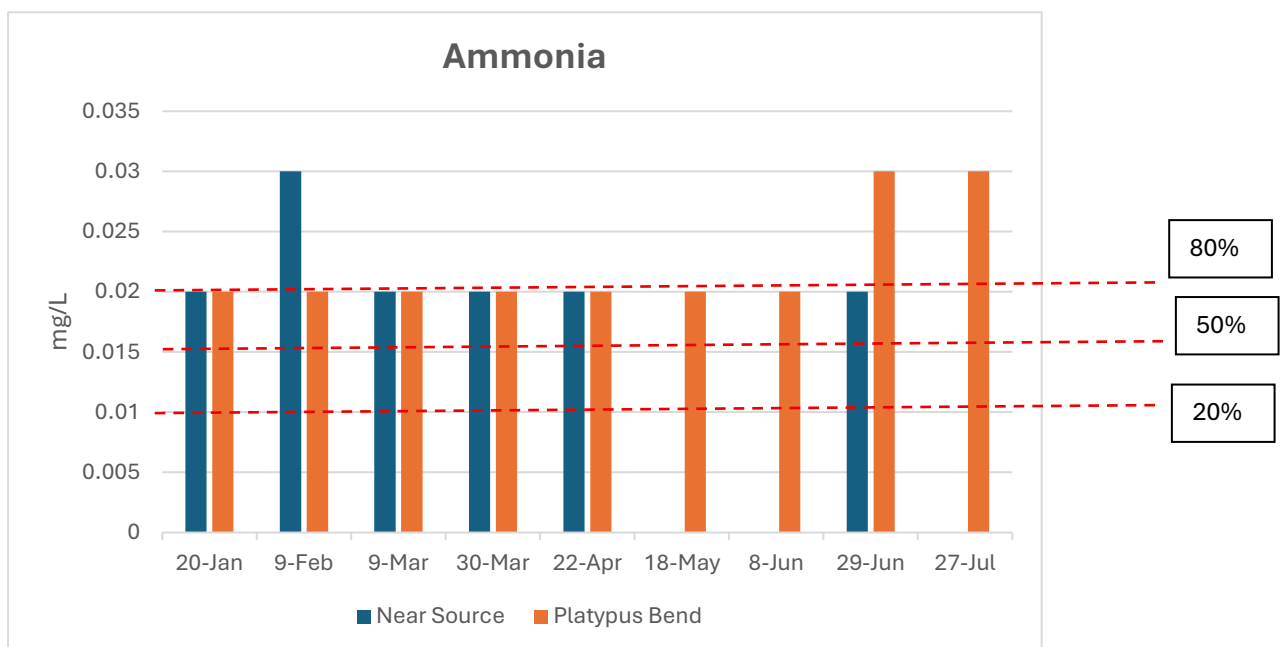
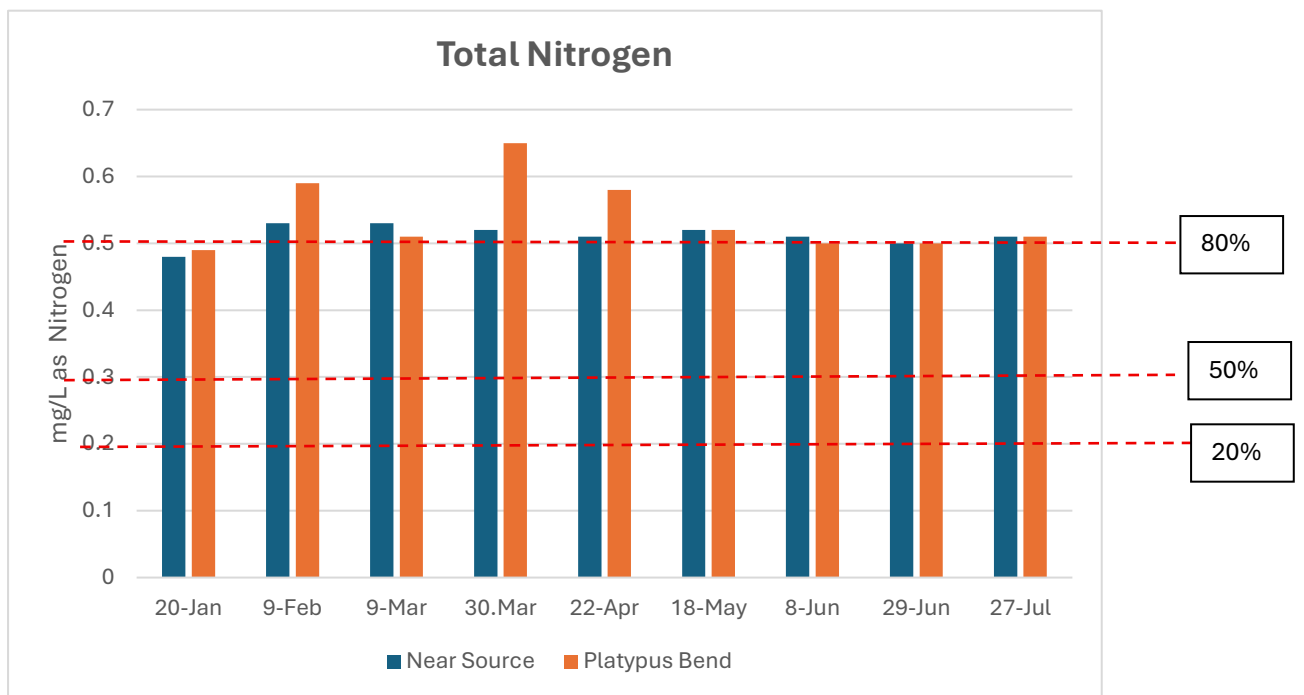


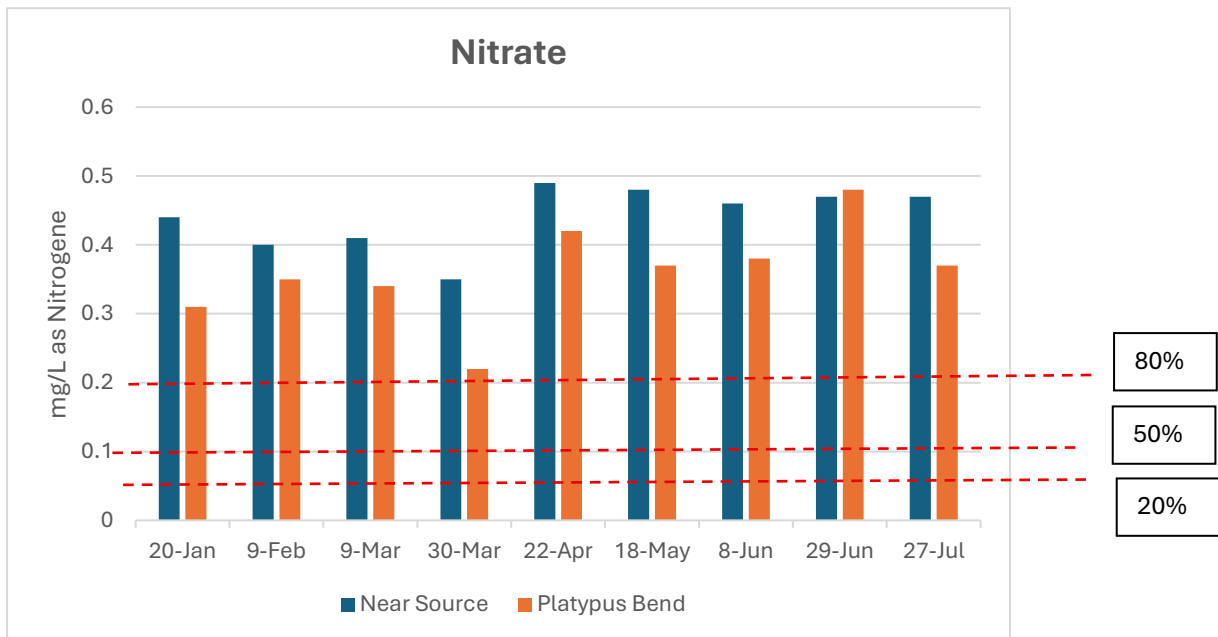
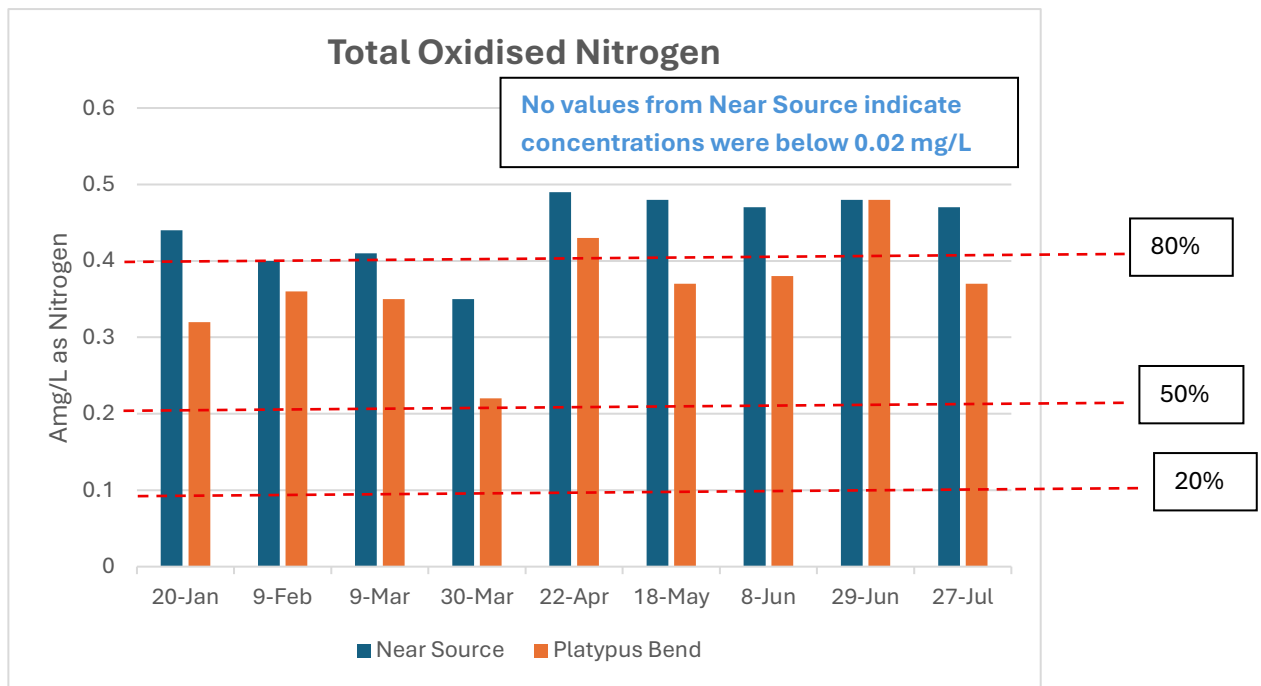




Surveys in Victoria found mean maximum phosphorus concentrations of 0.06 mg/L in creeks with platypus populations. No platypuses were found in creeks with phosphorus concentrations above 0.09 mg/L.







Nitrite (mg/L as Nitrogen)									
Collection	20-Jan	9-Feb	9-Mar	30-Mar	22-Apr	18-May	8-Jun	29-Jun	27-Jul
Near Source	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Platypus Bend	0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01
Values are too low or indeterminate to create a bar chart									

Chlorophyll-a (µg/L)

Collection	20-Jan	9-Feb	9-Mar	30-Mar	23-Apr	18-May	8-Jun	30-Jun
Near Source	<1	<1	<2	<2	<2	<2	<2	<2
Platypus Bend	5.6	<1	<2	<2	<2	<2	<2	<2
Values are too low or indeterminate to create a bar chart								

Discussion of Water Quality Data

Thermotolerant Coliforms and Enterococci

While the concentrations of these faecal bacteria at the Near Source site exceed the WQOs for safe swimming and recreational use to some extent in some samples (probably from animal or human sources further upstream), the concentration at Platypus Bend far exceed these WQOs in every sample (NHMRC, 2008). In February and March 2025, the concentration of coliforms at Platypus Bend was over 90 times greater than the threshold for safe swimming and 14 times greater than the threshold for safe boating. In March 2025 the concentration of enterococci was over 80 times the threshold for safe swimming and boating.

Specific coliforms and enterococci measured in the water sample analysis may not pose direct health threats to human or animals; however, they are indicators of a broader range of potentially harmful faecal bacteria in the water.

These data raise significant concerns regarding the potential health risk to YLG volunteers involved in manual removal of aquatic weeds, and indicate the need to avoid contact with the creek water during these activities. There are similar concerns for recreational users of the creek, including recreational fishers, swimmers in a pool several hundred metres downstream of Platypus Bend, and visitors taking part in commercial kayaking spotlight tours at night.

High concentrations of coliforms and enterococci may also indicate a risk to aquatic animals which ingest creek water and are potentially exposed to bacterial infections via their eyes or wounds.

Total Suspended Solids and Turbidity

As expected, analysis of the water samples revealed elevated levels of suspended solids and turbidity. These elevated levels were more pronounced in the Platypus Bend samples, but were also evident in Near Source samples, some of which were equal to or exceeded the Platypus Bend concentrations – probably the result of localised rain events near the sources. Concentrations of total suspended solids, even at their peak in March 2025, fell within the 80th percentile threshold WQO. Turbidity measurements at Platypus Bend, however, exceeded the

80th percentile threshold in every month sampled, and were significantly higher than measurements at Near Source, most of which fell below the 80th percentile threshold.

Potential ecological impacts of elevated suspended solids and turbidity include:

- smothering macroinvertebrates - which are important food for platypus;
- filling interstitial spaces in gravel beds, thereby reducing macroinvertebrate and fish-breeding habitats;
- absorbing more heat than clearer water, thereby raising water temperature;
- reducing dissolved oxygen concentration;

pH

pH levels are consistently higher (more alkaline) in the Platypus Bend samples than in the Near Source samples. The elevated pH at Platypus Bend could result from chemicals washing into the creek or may reflect changes in substrate geology as the creek flows downstream (e.g. more calcareous). However, except for March 2025, all the Platypus Bend samples fall below the 50th percentile threshold for pH, indicating the pH levels within the sampling period are unlikely to threaten the environmental values of Peterson Creek.

Electrical Conductance

Electrical conductance measurements in the Platypus Bend samples are significantly and consistently higher than for the Near Source samples. However, electrical conductance measurements for both sites all fall below the 20th percentile threshold, suggesting that this attribute does not indicate a threat to ecological values of the creek.

Total Phosphorus

There are several notable features in the chart of phosphorus concentrations:

1. There are no blue bars on the chart, meaning that concentrations of phosphorus at Near Source were consistently below the detectable level of 0.02 mg/L for all sampling months for this site.
2. By contrast, concentrations of phosphorus at Platypus Bend were at or near the 80% WQO threshold, except for March when phosphorus concentrations were 1.8 times higher than the 80% WQO threshold.
3. Based on platypus surveys in Victoria (Serena and Pettigrove, 2005), which found that the average maximum phosphorus concentrations in creeks inhabited by platypus was 0.06 mg/L and that no platypus were found in creeks with platypus concentrations above 0.09 mg/L, it is possible that phosphorus concentrations in Peterson Creek are at or near the tolerance levels for platypus. As a significant nutrient source, it is possible that high levels of phosphorus reduce dissolved oxygen concentrations sufficiently (by promoting plant productivity) to reduce macroinvertebrate populations on which platypus feed (Serena and Pettigrove, 2005).

Ortho Phosphate

As another indicator of phosphorus availability in the water column, ortho phosphate concentration was below detectable levels at Near Source in February, April and 29 June samples, and at or below concentrations found at Platypus Bend in other samples. Ortho phosphate concentrations at Platypus Bend reached the 80th percentile WQO threshold in February and on 30 March.

Total Nitrogen

In marked contrast to phosphorus, high concentrations of nitrogen were present at or above the 80% percentile WQO threshold at both the Near Source and Platypus Bend sampling sites. The March measurement for Platypus Bend showed a nitrogen concentration 30% higher than the 80th percentile WQO threshold.

These data indicate a high level of background nitrogen entering Peterson Creek, probably from Lake Eacham through seepage or springs, and only a relatively modest increase further downstream on occasions – possibly associated with higher rainfall.

Ammonia, Total Oxidised Nitrogen, Nitrate and Nitrite

These water quality attributes are alternative indicators of nitrogen availability in the water column. The respective analyses for ammonia, total oxidised nitrogen and nitrate share some characteristics with the Total Nitrogen chart discussed above. Nitrite concentrations at both sampling site were at or below the detectable level of 0.01 mg/L.

Ammonia: Relatively high ammonia concentrations occurred at both sites for six of the eight sampling events, with higher concentrations (50% higher than the 80th percentile WQO threshold) for Near Source in February and for Platypus Bend in June. Ammonia concentrations at Near Source were below the 0.02 mg/L detectable level in May and 29 June, indicating a high degree of variability in ammonia concentrations in water entering Peterson Creek on occasions.

Total Oxidised Nitrogen: Concentrations of total oxidised nitrogen approaching or slightly exceeding the 80th percentile WQO threshold occurred throughout the sampling period, with concentrations at Near Source exceeding concentrations at Platypus Bend in several months. The elevated concentrations are only slightly higher than typically found in streams in the Wet Tropics Region (Pearson and Connolly, 2000), with some variability month to month.

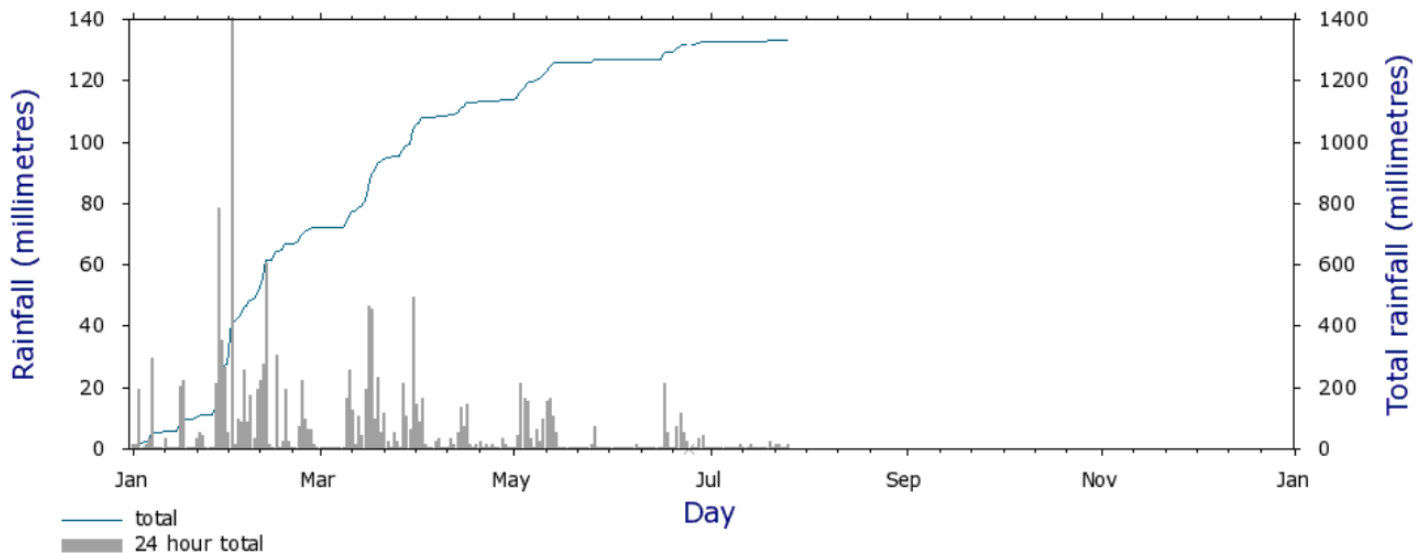
Nitrate: Nitrate concentrations were higher at Near Source than at Platypus Bend for all but the 29 June sample, and every sample at both sites revealed nitrate concentrations higher (up to 1.4 times) than the 80th percentile WQO threshold for this attribute – though only slightly higher than typically found in streams in the Wet Tropics Region (Pearson and Connolly, 2000).

Chlorophyll-a

Chlorophyll-a concentration of 5.6 µg/L in January 2025 may indicate a short-term algal bloom or eutrophic event, which would consume nitrate, reduce dissolved oxygen and lower pH (more acidic) – consistent with the January measurement shown in pH chart. High water temperatures, reduced flow and relatively low rainfall in January, combined with high nutrient phosphorus levels could explain the short-term eutrophic event. The remaining chlorophyll-a measurements were all <2 µg/L, and may be due to low light levels caused by forest cover near the source and turbidity at Platypus Bend.

Water Quality and Rainfall

The graph below shows daily and accumulated weekly rainfall from January to July 2025 as measured at Malanda, the closest weather station to Peterson Creek (Bureau of Meteorology 2025), 9km from Yungaburra.



By comparing this graph with bar charts of water quality measurements, there appears to be a clear association between high rainfall and elevated levels of several attributes, including coliforms, enterococci, total suspended solids, turbidity, phosphorus and nitrogen.

Previous Water Quality Testing of Peterson Creek

Tablelands Regional Council 2019/2020 Consultant's Report (GDH, 2020)

GHD Pty Ltd was commissioned by Tablelands Regional Council to undertake monthly water quality monitoring of two sites approximately 200 and 400 metres downstream of Platypus Bend from July 2019 to June 2020. The sites were either side of a disused outflow pipe from the nearby Yungaburra Sewerage Treatment Plant. The study also included macroinvertebrate and stream sediment sampling in November 2019 and June 2020, both during periods of low rainfall. The water quality attributes tested in this study are shown in the table below.

Physicochemical parameters	Total suspended solids (TSS)
Major ions	Free residual chlorine, total residual chlorine, chloride, sodium
Metals (dissolved and total)	Aluminium, boron, cadmium, chromium, copper, iron, lead, mercury, nickel, zinc
Nutrients	Ammonia, nitrate, nitrite (NO ₂), Total Oxidisable Nitrogen (NO _x), total Kjeldahl nitrogen (TKN), total nitrogen (TN), total phosphorus (TP), reactive phosphorus (RP).
Algal	Cyanophytes (Blue Green Algae), Chlorophyll-a,
Bacteriological	Faecal coliforms, E. coli, Enterococci

Concentrations of all the measured attributes exceeded the WQOs² used in the GDH study for all or some of the sampling period. Comparisons of key attributes with our current study are summarised below:

- Faecal bacteria concentrations (coliforms and enterococci) in the GDH study exceeded WQOs in every monthly sample, with the maximum concentrations occurring in May and July, in contrast to the maximum concentrations occurring January, February and March in our current project. The GDH study measured faecal bacteria as MPNs (Most Probable Numbers), in comparison to CFUs (Colony Forming Units) in our study, so the raw data from the two studies are not directly comparable – though comparison of the monthly variation within each study is valid. MPNs are a statistical estimate of bacterial concentration that can be measured in the field, whereas CFUs are an actual bacterial count undertaken in a laboratory. Both are regarded as legitimate methods of measuring bacterial concentration in freshwater.
- Peak phosphorus concentrations occurred from January to March, reaching a maximum of 0.15 mg/L, significantly higher than the maximum of 0.09 mg/L in our study, and of levels of phosphorus in platypus habitat observed in Victorian waterways (Serena and Pettigrove, 2005).
- Maximum Total Suspended Solids occurred in January, reaching almost 100 mg/L, more than twice the concentration measured in our study.
- The GDH study did not measure turbidity.
- The GDH study provided information on the diversity of macroinvertebrates in Peterson Creek water and substrate, including a comparison between the two sampling sites. However, no macroinvertebrate sampling occurred during periods of high sediment load during and after significant rain events.

Of the WQO “exceedances” referred to in the GDH study, the consultant considered dissolved aluminium to be the most likely to have an ecotoxic effect on aquatic species and suggested that the elevated dissolved aluminium may be caused by natural geological influences or impacts from land use practices further upstream in the catchment, such as runoff from Yungaburra town. However, a James Cook University study of water quality and macroinvertebrates in pristine Wet Tropics streams (Pearson *et al.* 2017) reported that elevated levels of dissolved metals were not implicated in any effects on the biota.

YLG Water Quality Analysis, September 2024

In September 2024, YLG volunteers collected water samples from three sites along Peterson Creek (Near Source, Platypus Bend, and midway between Lake Eacham and Yungaburra). With financial assistance provided by James Cook University’s College of Science and Engineering, these samples were analysed for many of the attributes measured in the current YLG study, though not including coliforms, enterococci, turbidity or chlorophyll-a.

² WQOs used in the GDH study were based on national and regional guidelines that have since been updated in the State of Queensland (2020) policy document used in our current study.

These measurements were similar to the attribute concentrations obtained in the current YLG study during periods of low rainfall. Of note, however, is the phosphorus concentration of 0.05 mg/L at the midway site, suggesting that elevated phosphorus levels commence upstream of that site. This observation could assist in determining the source of elevated phosphorus in future water quality testing projects.

Conclusions

Recognising that this study of water quality in Peterson creek was limited to two sampling sites, five months' duration and conducted by volunteers without expertise in this field, YLG has drawn the following conclusions for consideration by our government and non-government partners to provide guidance for the better management of the waterway and its biodiversity, including platypus:

1. Very high concentrations of thermotolerant coliforms and enterococci, far exceeding National Health and Medical Research Council guidelines for safe swimming and boating, were found in Peterson Creek throughout the period January to June 2025, and especially during periods of high rainfall. These observations confirm similar findings in a 2019/2020 study of water quality in Peterson Creek commissioned by the Tablelands Regional Council.
2. These high concentration of faecal bacteria in Peterson Creek raise health and safety concerns for YLG's volunteers engaged in manual removal of aquatic weeds from the creek, and for other people interacting with creek water, including recreational fishers and participants in commercial kayaking tours.
3. High faecal bacterial concentrations may also impact other identified environmental values of Peterson Creek, including aquatic ecosystems, irrigation, farm supply, stock watering, human consumption, and cultural and spiritual values.
4. High levels of turbidity, which at Platypus Bend exceeded the 80th percentile WQO threshold for every sampling event and especially during periods of high rainfall, potentially impact macroinvertebrate habitats and populations, which in turn may limit availability of food for platypus and other aquatic fauna.
5. Elevation of total suspended solids, especially associated with high rainfall events, may also impact normal ecological function, including viability of macroinvertebrate populations.
6. Elevated levels of phosphorus at Platypus Bend, especially associated with high rainfall events, and in stark contrast to the negligible concentrations at the Near Source site, may be close to or at the phosphorus concentrations compatible with a viable platypus habitat – based on platypus and water quality surveys undertaken in Victoria. High levels of phosphorus (a known nutrient for plant growth) may also be associated with infestations of aquatic weeds, including Amazonian frogbit. This finding suggests the need for undertaking measures to reduce phosphorus from entering Peterson Creek, and ongoing monitoring of phosphorus concentrations.

WHERE TO FROM HERE?

YLG is reviewing the concerns this study raised about the use and values of the water in Petersons Creek and exploring opportunities to leverage action by local government, non-government organisations and individuals to enable on-going study of the Creek and initiate responses to mitigate the risks to biota and water users.

After we shared the outcomes of this project with Tablelands Regional Council, YLG was awarded a \$2,000 grant to continue monitoring key water quality attributes of Peterson Creek for the remainder of 2025. Council has also offered to seek funding to engage with local cattle graziers to support exclusion of cattle from Peterson Creek and supporting off stream water points.

YLG has immediately adopted personal protection initiatives to reduce risks to volunteers removing aquatic weeds from the Creek. The water quality results and their implications will be incorporated into YLG's *Peterson Creek Strategic Plan* currently being developed. The results of water quality data from Peterson Creek will be shared with government and non-government organisations, tourism enterprises, local community and neighbouring landholders with a focus on collaborative opportunities to address the water quality, health and ecological issues raised by this project.

Outcomes of the current project study has raised the question as to whether the water quality issues are unique to Peterson Creek, or characteristic of the environmental condition of other water bodies in the Barron River Catchment. To resolve this question, YLG recommends on-going and longer-term studies across the Atherton Tablelands.

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