CTENVIRONMENTAL
ECOSYSTEM MANAGEMENT AND MONITORING

December 2023 Biannual Aquatic Ecosystem Monitoring Report

Liverpool City Council

January 2024

Project	**Liverpool Aquatic Ecosystem Monitoring 2022 - 2023**
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Report Structure

This report presents the December Aquatic Ecosystem Monitoring Monthly Progress Report (Part 1) which is accompanied by the second biannual report (June 2023 to December 2023).

Part 1

Aquatic Ecosystem Monitoring Monthly Progress Report - December 2023

December 2023 aquatic ecosystem monitoring of the Georges River and South Creek catchments was conducted on December 28, 2023.

This report provides a summary of recreational water quality indicators (Cyanobacteria, *Enterococci* and *Faecal Coliforms*) at Georges River recreation monitoring sites and observations from freshwater monitoring sites.

Badgerys Creek weather monitoring station is expected to be representative of weather conditions in the Kemps Creek catchment and Holsworthy Aerodrome station is expected to be representative of conditions in the locale of the Georges River monitoring sites.

Weather conditions during December 2023 sampling were warm to hot with 28.4 mm rain recorded at Badgerys Creek monitoring station (Table 1) and 34.2 mm recorded at Holsworthy Aerodrome (Table 2) in the week prior to sampling.

Table 1: Weather observations for Badgerys Creek AWS, NSW (BOM 2023).

Date	Temp min (°C)	Temp max (°C)	Rainfall (mm)
22/12/2023	15.1	27.8	0.0
23/12/2023	14.4	28.2	0.0
24/12/2023	17.9	24	0.6
25/12/2023	17.6	29.1	20.8
26/12/2023	17.4	31.3	1.6
27/12/2023	18.8	26.2	0.6
28/12/2023	15.2	33.5	4.8

Table 2: Weather observations for Holsworthy Aerodrome (BOM 2023).

Date	Temp min (°C)	Temp max (°C)	Rainfall (mm)
22/12/2023	14.0	-	-

23/12/2023	14.8	25.2	-
24/12/2023	18.6	23.1	1
25/12/2023	16.9	27.6	31.4
26/12/2023	19.5	29.5	0.4
27/12/2023	18.7	26.4	0.0
28/12/2023	14.8	-	1.4

Blue Green Algae (Cyanobacteria) monitoring at recreation sites in the Georges River was undertaken on December 28, 2023, during low tide.

Results show that potentially toxic cyanobacteria Were not detected at any of the Georges River sites during sampling, and biovolume calculations indicate (Table 3):

- NHMRC Surveillance Mode (Green Level) was triggered at recreation monitoring sites GR1, GR3, GR5 in December 2023 (Table 3).
- NHMRC Alert Mode (Amber Level) was triggered at recreation monitoring site GR4 (Table 3).

Table 3: Results summary for recreation monitoring sites, December 2023.

Site	Sampled	Potentially Toxic Blue Green Algae	NHMRC Alert Level	Safety Issues
GR1	Yes	Not detected	**Green**	None
GR1.5	Yes	Not detected	-	None
GR2	Yes	Not detected	-	None
GR3	Yes	Not detected	**Green**	None
GR4	Yes	Not detected	**Amber**	None
GR5	Yes	Not detected	**Green**	None

Results show that GR1 recorded four species of cyanophytes including *Aphanocapsa* spp. (1420 cells/mL), *Merismopedia* spp. (100 cells/mL), *Pseudanabaena* spp. (850 cells/mL), and *Synechococcus* spp. (200 cells/mL). Due to the biovolume of these species, the NHMRC (2008) Surveillance Mode (Green Level) was triggered.

GR1.5 showed that no NHMRC (2008) responses were triggered as only low biovolumes of three non-toxic cyanobacteria species were recorded (*Aphanocapsa* spp. at 2320 cells/mL), *Merismopedia* spp. at 100 cells/mL, and *Pseudanabaena* spp. at 250 cells/mL).

Two species, *Aphanocapsa* spp. (2020 cells/mL) and *Cyanogranis libera* (1480 cells/mL), were recorded at GR2. Low biovolumes of these species were recorded, and no NHMRC (2008) response was triggered.

At GR3, seven species that are not known to be toxic were recorded, including *Anabaena* spp. (200 cells/mL), *Aphanocapsa* spp. (6200 cells/mL), *Cyanogranis libera* (3920 cells/mL), Cyanonephron spp. (600 cells/mL), *Merismopedia* spp. (200 cells/mL), *Pseudanabaena* spp. (10000 cells/mL), and *Romeria* spp. (475 cells/mL). This triggered the NHMRC (2008) Surveillance Mode (Green Level).

Results for GR4 recorded six species of cyanophytes *Anagnostidinema* spp. (280 cells/mL), Cyanonephron spp. (1200 cells/mL), *Merismopedia* spp. (3300 cells/mL), Picoplanktic Cyanophytes (32800 cells/mL), *Pseudanabaena* spp. (75 cells/mL), and *Romeria* spp. (475 cells/mL). This detection triggered the NHMRC Alert Mode (Amber Level). * it should be noted that the taxa 'Picoplanktic Cyanophytes' have not been previously detected and we are awaiting biovolume information from ALS. We have calculated this biovolume based on the '<2 cells/ml', and will amend this once the ALS have confirmed the biovolume information.

GR5 had five non-toxic species recorded, *Aphanocapsa* spp. (5100 cells/mL), *Glaucospira* spp. (75 cells/mL), *Merismopedia* spp. (900 cells/mL), *Pseudanabaena* spp. (800 cells/mL), and *Synechococcus* spp. (250 cells/mL). All of these detected cyanophytes are non-toxic, however due to the high biovolume of these readings, this detection had triggered the NHMRC (2008) Surveillance Mode (Green Level).

Due to the persistence of cyanobacteria, there is potential for future blooms to occur. NHMRC (2008) recommends weekly or fortnightly monitoring when 'Green' mode is triggered (Table 4).

Table 4: Recommended monitoring actions and corresponding NHMRC Alert Levels.

Blue Green Algae Alert Level	Recommended Actions
Surveillance Mode **(Green Level)**	• Weekly sampling and cell counts at representative locations in the water body where known toxigenic species are present. • Fortnightly for other types including regular visual inspection of water surface for scums.
Alert Mode **(Amber Level)**	• Increase sampling frequency to twice weekly at representative locations in the water body where toxigenic species are dominant within the alert level definition (i.e. total biovolume) to establish population growth and spatial variability in the water body. • Monitor weekly or fortnightly where other types are dominant. • Make regular visual inspections of water surface for scums. • Decide on requirement for toxicity assessment or toxin monitoring.
Action Mode **(Red Level)**	• Continue monitoring as for alert mode. • Immediately notify health authorities for advice on health risk. • Make toxicity assessment or toxin measurement of water if this has not already been done. • Health authorities warn of risk to public health (ie the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

Results of bacteria monitoring at recreation sites in December 2023 show that the ANZECC Primary Contact guidelines for *Faecal coliforms* was exceeded at GR1.5, GR3, and GR4 and the ANZECC Secondary Contact guidelines for *Faecal coliforms* was exceeded at GR5. The ANZECC Primary Contact guidelines for *Enterococci* were exceeded at GR1, GR1.5 and GR3. The ANZECC Secondary Contact guideline for *Enterococci* was exceeded at GR5 (Table 5). These results are likely due to the rainfall that was recorded earlier in the week prior to monitoring.

Table 5. Summary of conditions observed/recorded at each site during December 2023 monitoring. Orange indicates exceedance of the primary contact guideline; red indicates exceedance of the secondary contact guideline.

			Recreation sites			
SITE	**Sampled**	**Tide**	***Faecal coliforms*** **CFU/100 mL**	***Enterococci*** **CFU/100 mL**	**Safety Issues**	**Observations**
GR1	Yes	N/A	95	53	None	Clear
GR1.5	Yes	N/A	190	100	None	Clear
GR2	Yes	N/A	130	27	None	Clear
GR3	Yes	Mid	740	200	None	Turbid
GR4	Yes	Mid	670	22	None	Turbid
GR5	Yes	Mid	58000	2400	None	Turbid
Primary Contact	-	-	150	35	-	-
Secondary Contact	-	-	1000	230	-	-

Surface water samples were collected at all freshwater monitoring sites in December 2023, with the exception of KC11 (due to construction). During the December monitoring period, freshwater sites monitored by this program remained consistent with previous monitoring events.

Table 6. Summary of conditions observed/recorded at each site during December 2023 monitoring.

Site	Water quality	Aquatic Macroinvertebrates	Benthic Diatoms	Flow	Observations	Safety Issues
MC1	Yes	No	No	Normal	Clear	None
AC1	No	No	No	Normal	Clear	None
KC1	Yes	No	No	Normal	Clear	None
KC2	Yes	No	No	Normal	Turbid	None
KC3	Yes	No	No	Normal	Clear	None
KC5	Yes	No	No	Normal	Clear	None
KC6	Yes	No	No	Normal	Clear	None
KC8	Yes	No	No	Normal	Turbid	None
KC10	Yes	No	No	Normal	Turbid	None
KC11	Yes	No	No	No Access	No Access	No access due to construction
KC12	Yes	No	No	Normal	Clear	None
SC1	Yes	No	No	Normal	Clear	None
SC2	Yes	No	No	Normal	Turbid	None
BC1	Yes	No	No	Normal	Turbid	None
WG	Yes	No	No	Normal	Clear	None
HC	Yes	No	No	Normal	Clear	None

All data has been supplied in an Excel spreadsheet separate this report and no safety issues were recorded/observed during monitoring.

Part 2

Introduction

This report outlines results for the biannual report (June 2023 to December 2023) for the 2022-2023 monitoring period.

This report presents results of nutrient, turbidity, bacteria, and Blue Green Algae parameters which are typical indicators used to assess degradation of urban streams. Analysis of all parameters monitored by this program will be presented in the annual report.

Georges River catchment sites are reported as Recreation sites (GR1, GR1.5, GR2, GR3, GR4 and GR5) and Georges River Tributaries (AC1, MC1, HC and WG). South Creek catchment sites are reported as South Creek (SC1 and SC2), Badgerys Creek (BC1), Kemps Creek (KC1, KC5, KC8, KC10, KC11 and KC12) and Kemps Creek Tributaries (KC2, KC3 and KC6).

Rainfall

Rainfall recorded at Badgerys Creek AWS (Liverpool) (BOM 2023) was above average for two months during the sampling period (August and December 2023). The lowest rainfall was recorded in September (4.4 mm compared to the long-term average of 34.6 mm). The highest rainfall was recorded in December 2023 (104.6mm; Figure 1). As a result, flow across freshwater monitoring sites was variable throughout the six-month period, ranging from low at some sites in July and September 2023, to elevated during the December sampling period.

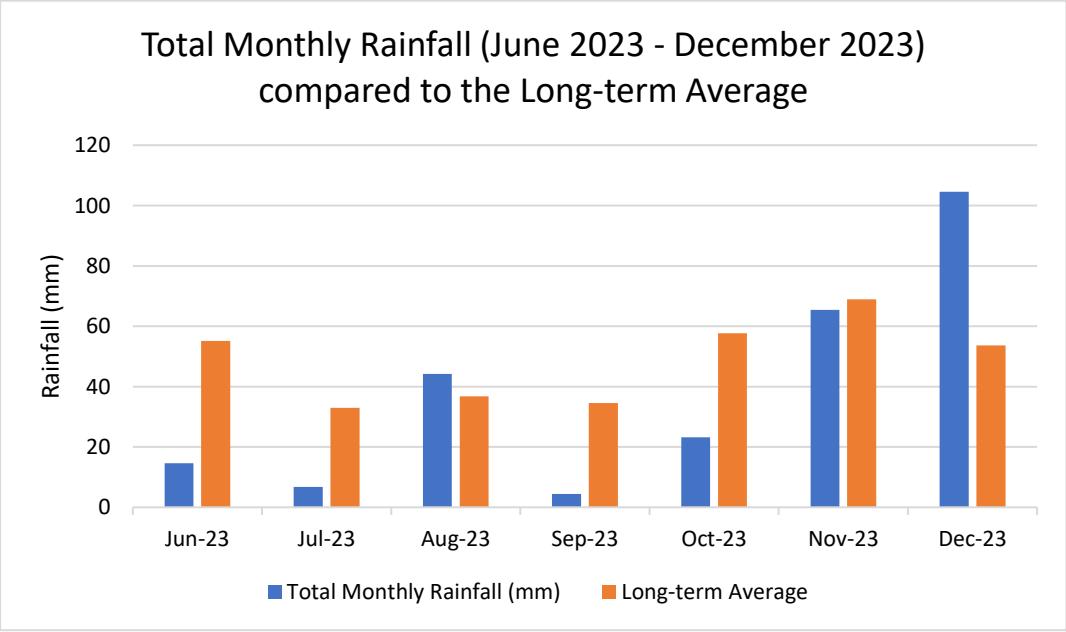

Figure 1: Rainfall recorded at Badgerys Creek AWS June 2023 – December 2023 compared to the long-term average.

Freshwater monitoring sites

Water quality was variable across all freshwater monitoring sites and all sites recorded degraded water quality and impairment typical of urban streams. The phrase 'urban stream syndrome' (Walsh et al. 2005) was coined to describe the multiple common symptoms occurring in urban streams, including degraded water quality, geomorphology, hydrology, and biodiversity. All freshwater sites frequently recorded nutrient levels (phosphorous and nitrogen) that exceeded the Australian and New Zealand Environment Conservation Council (ANZECC) guidelines for fresh and marine water quality (2000). Other parameters, including turbidity, dissolved oxygen, pH and electrical conductivity, were also recorded to be outside the ANZECC 2000 water quality guidelines at the majority of sites throughout the six-month monitoring period.

Total Nitrogen

Total nitrogen (TN) was variable across the Kemps Creek sites for the June 2023 - December 2023 period (Figure 2). Results show that all sites recorded non-compliance to the ANZECC lowland river guideline for southeast Australia (0.35 mg/L). The highest concentration, 74.8 mg/L, was recorded at KC1 in June 2023, which is approximately 210 times greater than the ANZECC guideline. TN concentrations dropped at most sites in August 2023, when rainfall was above average. There was a spatial trend where sites in the upper catchment (KC1, KC5) had increased TN concentrations than the sites further downstream (KC10, KC11 and KC12). In September 2023, KC1 was not sampled, as rainfall was below average, and the creek was dry.

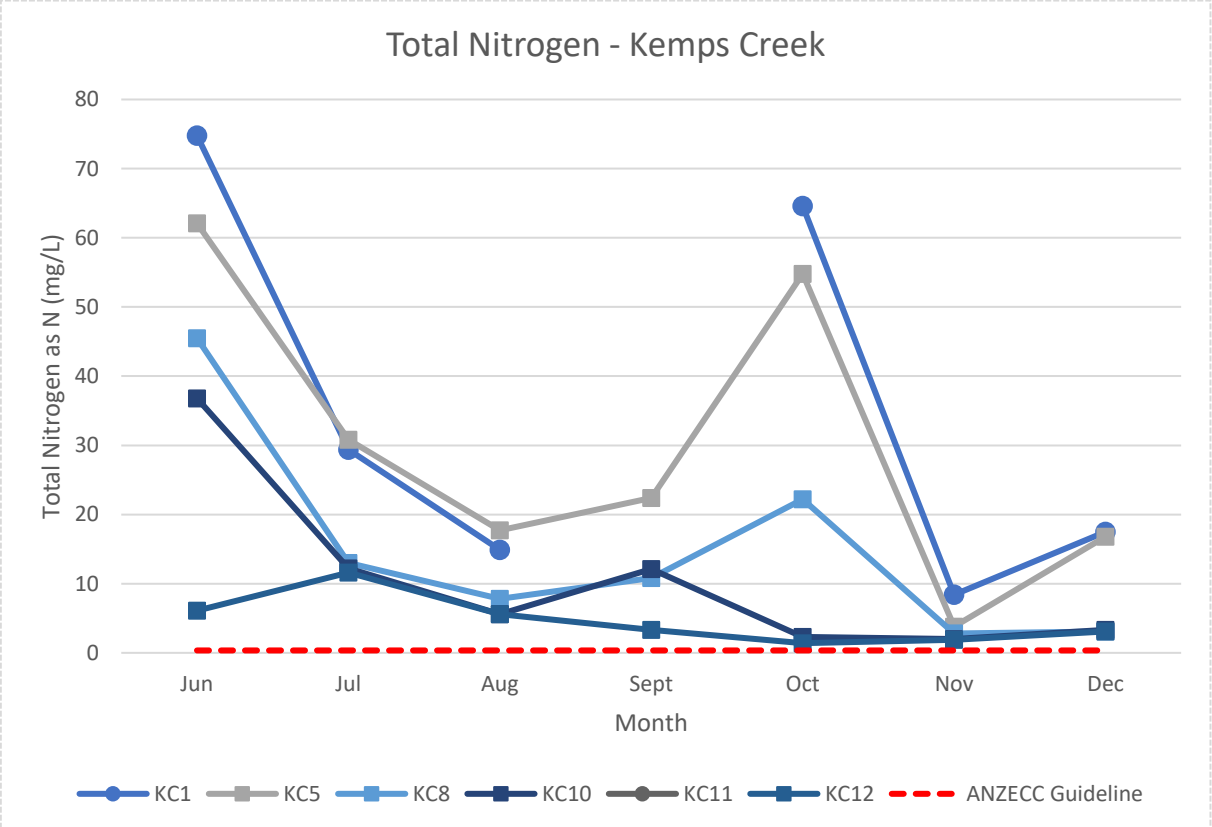

Figure 2: Total Nitrogen concentration at Kemps Creek monitoring sites June 2023 – December 2023.

Total nitrogen was variable across Kemps Creek tributary sites. All sites (except for KC2 in October 2023) recorded non-compliance to the ANZECC lowland river guideline for southeast Australia (0.35 mg/L). KC6 recorded the highest TN concentration of 60.7 mg/L in June 2023 (Figure). These results are approximately 170 times higher than the recommended ANZECC guideline. TN remained at similar concentrations throughout the monitoring periods at KC2 and KC3 and was variable at KC6 where it spiked in June and October 2023. This temporal trend aligns with the Kemps Creek total nitrogen results.

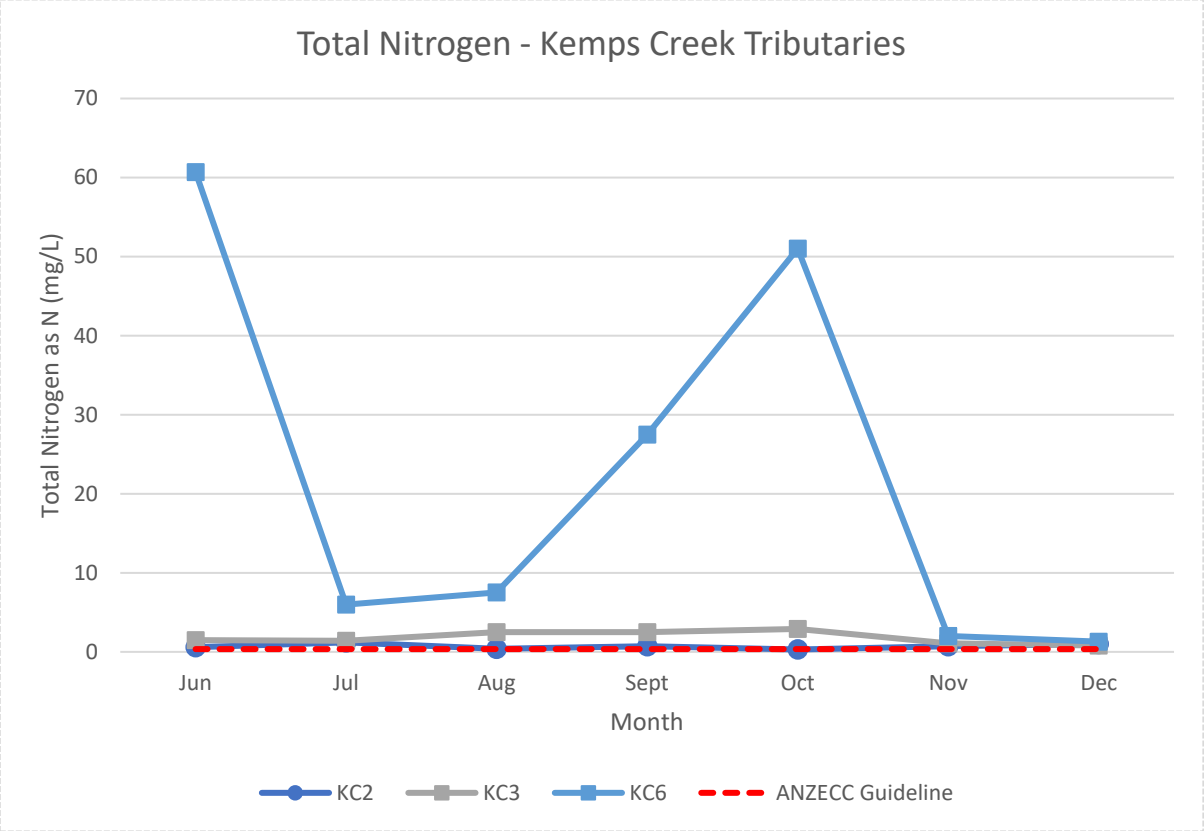

Figure 3: Total Nitrogen concentration at Kemps Creek tributary monitoring sites June 2023 – December 2023.

With the exception of AC1 in November 2023, total nitrogen within all sites of Georges River tributaries was fairly stable, apart from a spike At MC1 in September, and did not comply with the ANZECC lowland river guideline for southeast Australia. The highest reading of TN was recorded at the spike at MC1 in September 2023, at 39.6 mg/L. TN recorded at AC1, HC, and WG1 were generally lower than the MC1 readings, however, besides AC1 in November, were still non-compliant with the ANZECC guideline during all sampling events within this biannual report (Figure 4).

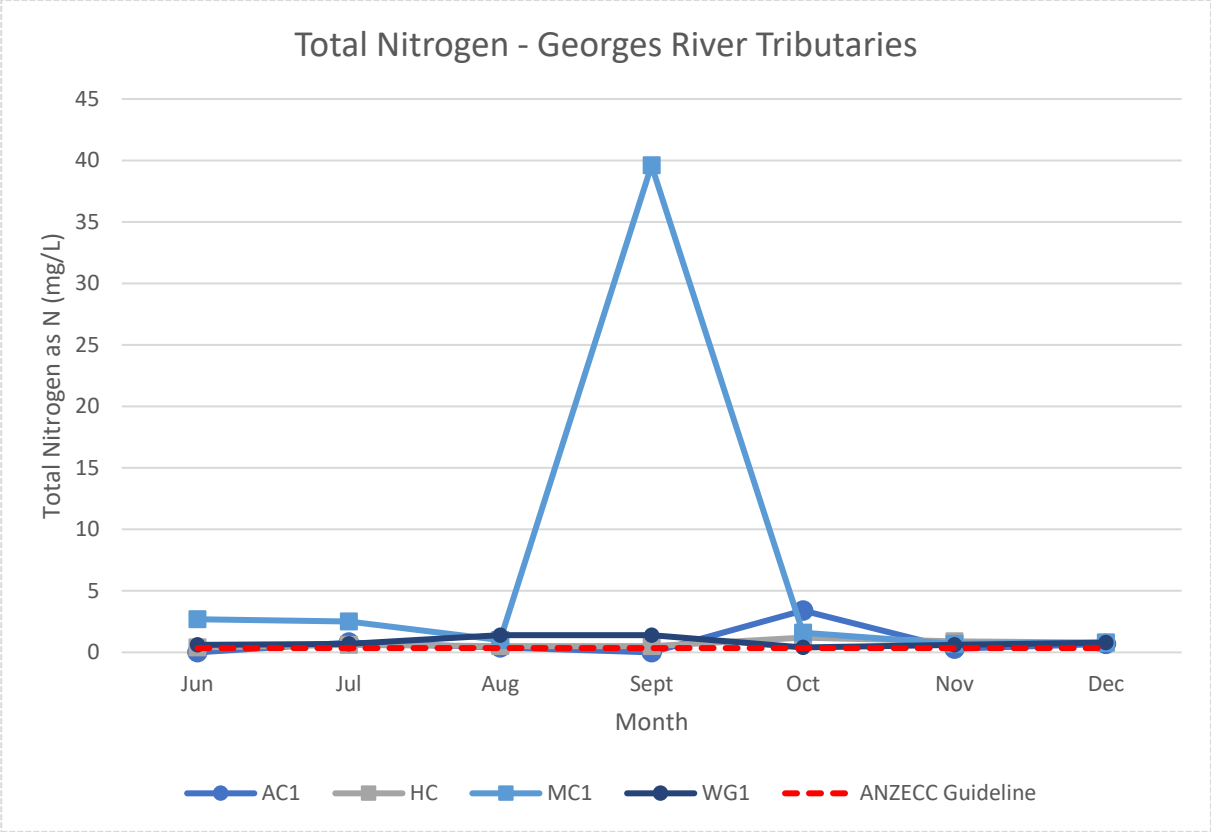

Figure 4: Total Nitrogen concentration at Georges River tributary monitoring sites June 2023 – December 2023.

Total nitrogen levels in sites within the South Creek catchment were variable and did not comply with the ANZECC guideline value of 0.35 mg/L during the monitoring period (Figure 5). TN concentration was highest at SC1 in August 2023 reaching 9.4 mg/L, followed by SC1 in June reaching 7.6 mg/L. BC1 was generally lower than SC1 and SC2.

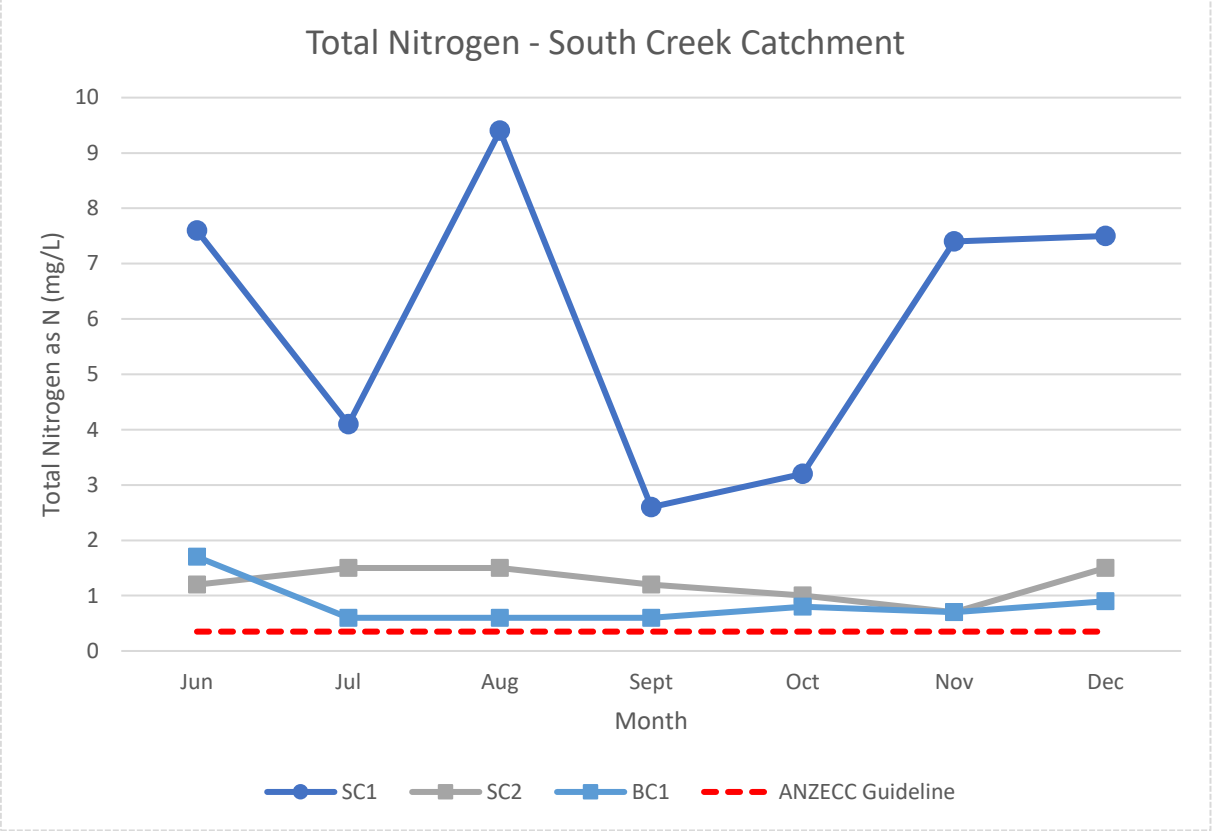

Figure 5: Total Nitrogen concentrations at South Creek catchment monitoring sites June 2023 – December 2023.

Total phosphorous

Total phosphorous (TP) was consistently high across Kemps Creek sites, with a clear decline in concentrations at most sites in August and September 2023 (Figure 6). All sites recorded non-compliance to the ANZECC lowland river guideline for southeast Australia of 0.025 mg/L. KC1 recorded the highest TP concentration of 7.83 mg/L in October 2023, approximately 315 times the guideline limit.

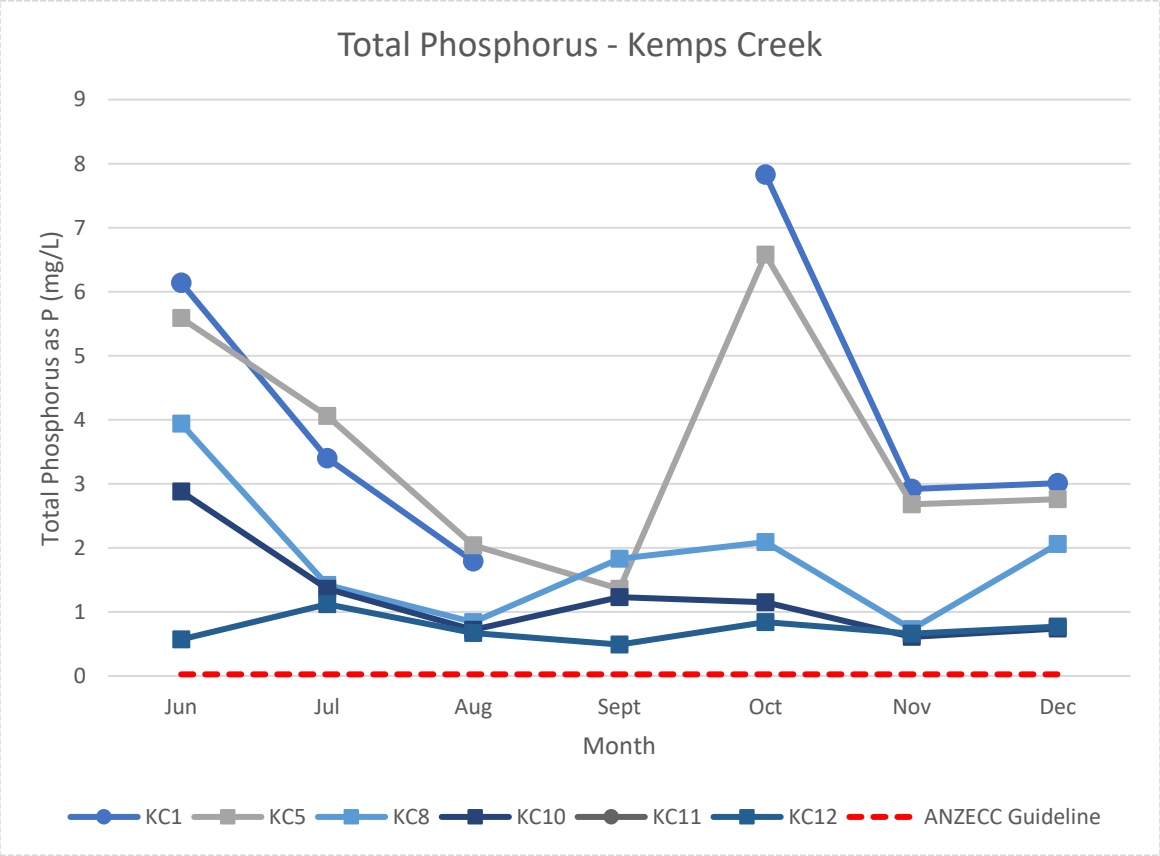

Figure 6: Total Phosphorus concentrations at Kemps Creek monitoring sites June 2023 – December 2023.

Kemps Creek tributary sites had elevated TP and, apart from KC2 in October, and KC6 in December 2023, did not comply to the ANZECC guideline. KC6 recorded the highest concentration of TP (6.96 mg/L) in October 2023, followed by 5.11 mg/L at KC6 in June 2023 (Figure 7). KC2 and KC3 readings were relatively constant.

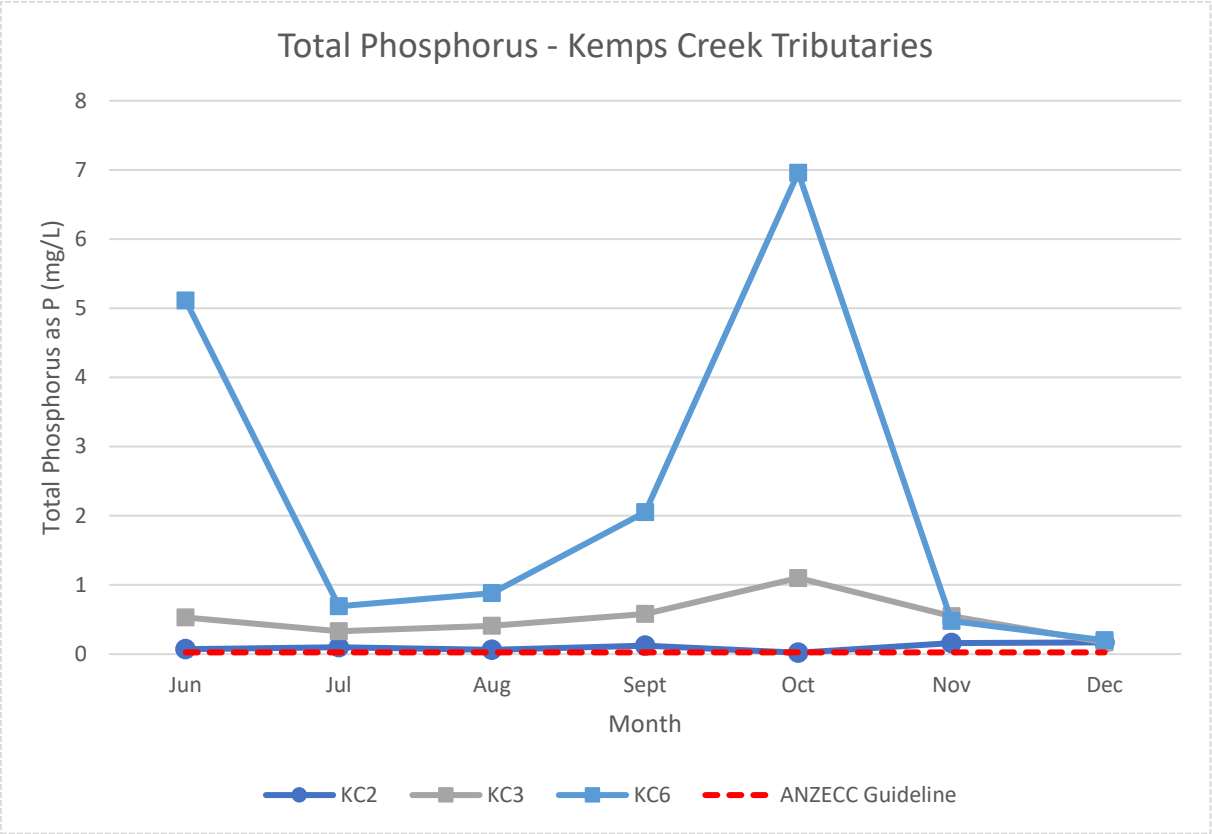

Figure 7: Total Phosphorus concentrations at Kemps Creek tributary monitoring sites June 2023 – December 2023.

Georges River tributary sites had variable TP. All sites were non-compliant to the ANZECC guideline of 0.025 mg/L on all but two occasions (including HC in July and WG in October). Maximum TP was recorded at AC (0.44 mg/L) in December 2023. The maximum TP concentration recorded at AC is 18 times the guideline limit (Figure 8).

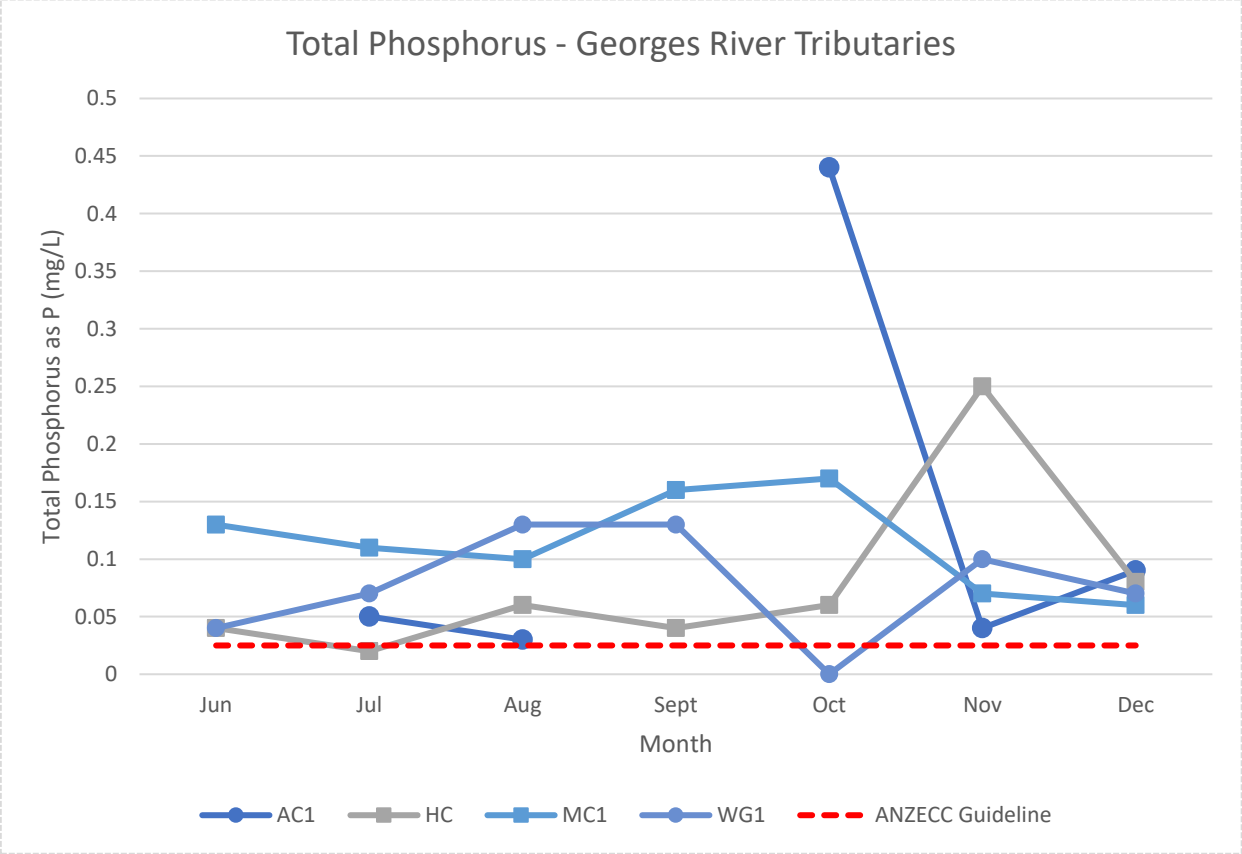

Figure 8: Total Phosphorus concentrations at Georges River tributary monitoring sites June 2023 – December 2023.

Total phosphorus concentrations at all South Creek catchment sites (SC1, SC2 and BC1) were variable and exceeded the ANZECC guideline for all monitoring events. TP was highest at SC1 in November 2023, with a value of 0.77 mg/L, which is approximately 30 times higher than the ANZECC guideline. This was followed by SC1 in August 2023, with a value of 0.45 mg/L.times (Figure 9). BC1 was generally lower than SC1 and SC2.

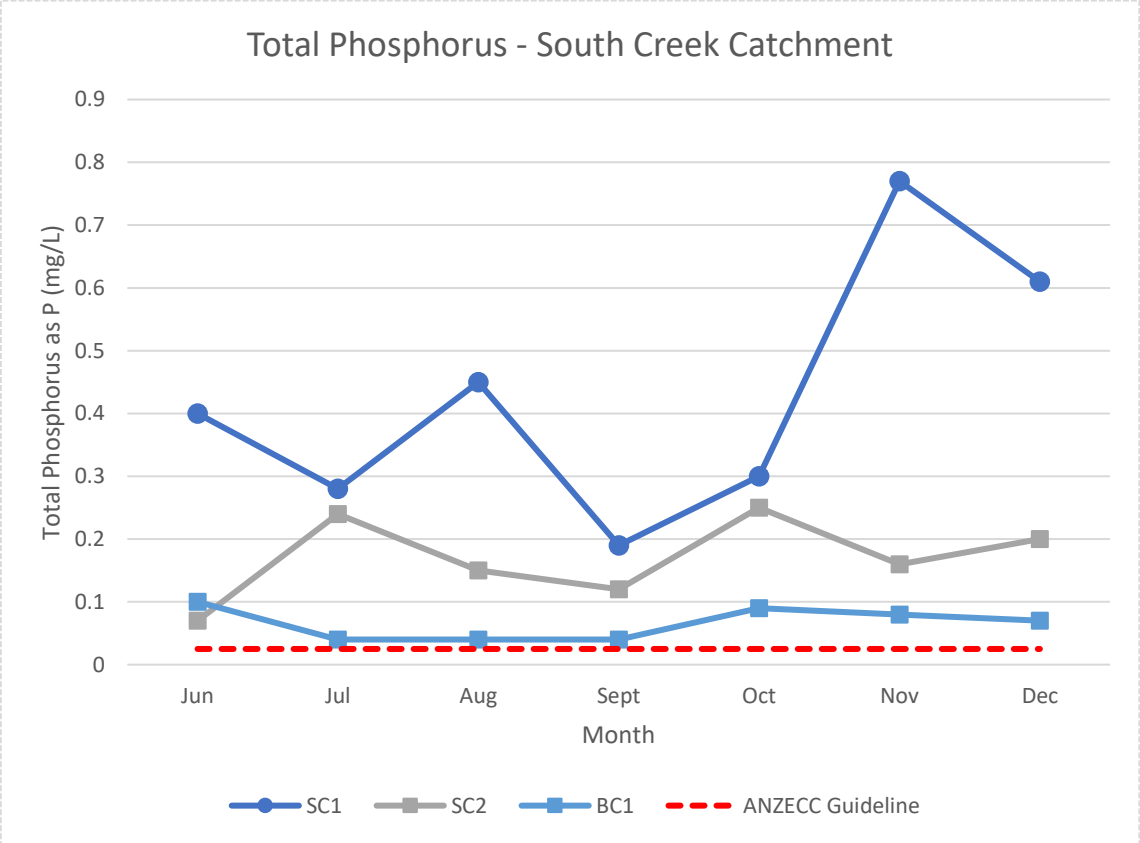

Figure 9: Total Phosphorus concentrations at South Creek catchment monitoring sites June 2023 – December 2023.

Turbidity

During the six-month monitoring period, turbidity at Kemps Creek sites was relatively consistent and complied with the ANZECC guideline of between 6 and 50 NTU. The highest turbidity recorded was 24.7 NTU at KC1 in August 2023, followed by 22.2 NTU at KC5 in December 2023 (Figure 10). A spike in NTU was recorded at all sites in August 2023, when rainfall was above the long-term average. Results below the ANZECC guideline of 6 NTU should be viewed with caution as it is normal for streams with minimally disturbed catchments across the Sydney basin to have turbidity less than 6 NTU and interpreting results below this level as "non-compliant" may lead to misdiagnosis of an impact.

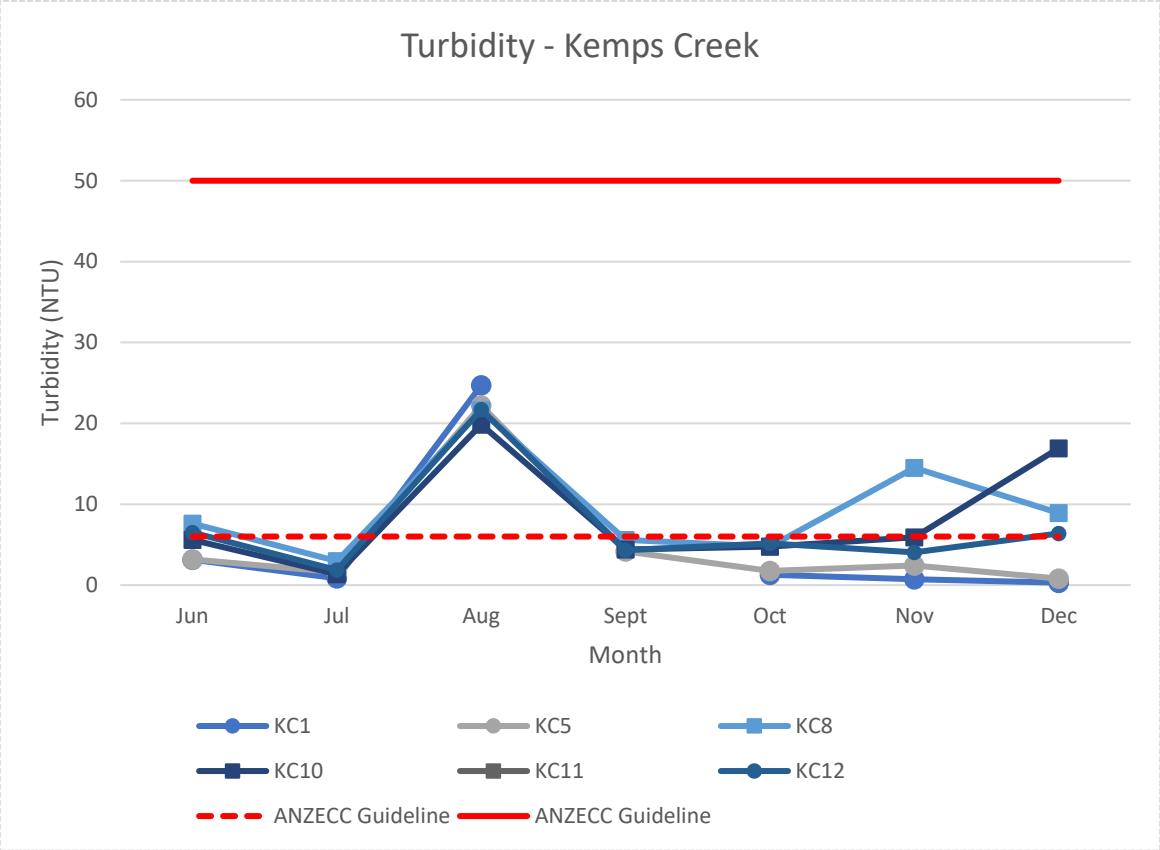

Figure 10: Turbidity at Kemps Creek monitoring sites June 2023 – December 2023.

During the six-month monitoring period, turbidity at Kemps Creek tributary sites was within ANZECC guideline range of 6 to 50 NTU (Figure 11). The highest value, 23.1 NTU, was recorded at KC6 in August 2023. This was followed by 21.3 NTU at KC2 in August 2023. A similar trend to the Kemps Creek sites was recorded, showing a spike in NTU in August 2023. As stated above, comparison with this guideline should be viewed with caution and interpreting results below this level as "non-compliant" may lead to misdiagnosis of an impact.

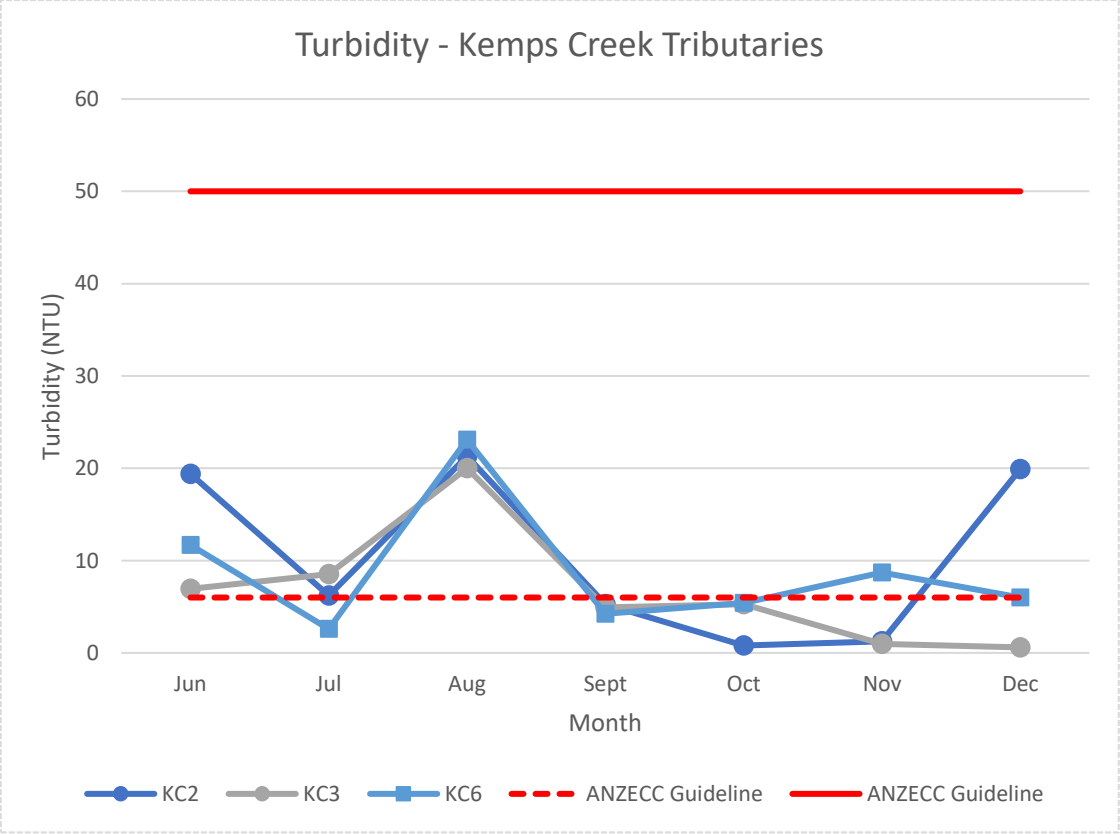

Figure 11: Turbidity at Kemps Creek tributary monitoring sites June 2023 – December 2023.

Results for Georges River tributary sites show turbidity at all sites were within or below ANZECC guideline limits from June 2023 – December 2023 on all occasions. The highest turbidity reading observed was at HC, which occurred in August 2023 at 23.4 NTU, which was followed by 22.5, which was recorded at MC1 in August 2023 (Figure 12). Over the sampling period twenty-one of the twenty-six samples recorded were under the ANZECC guideline minimum limit of 6 NTU.

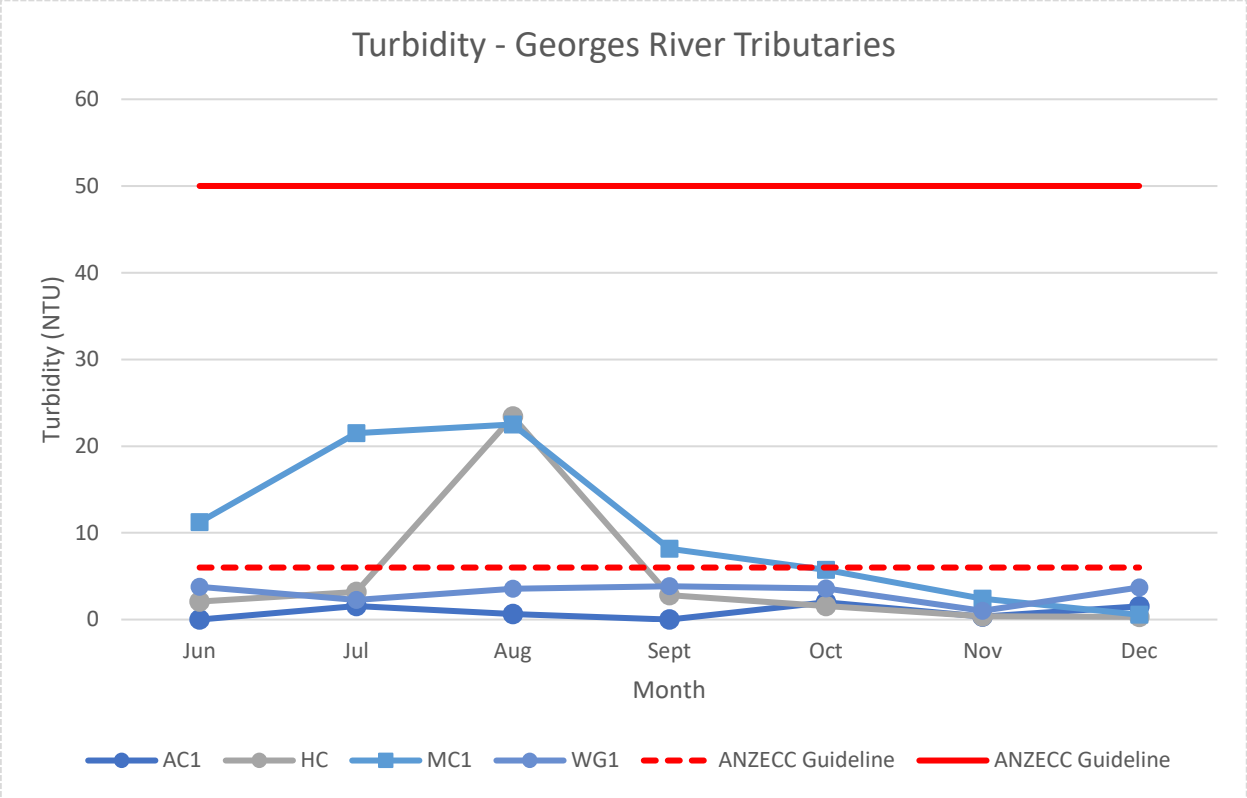

Figure 12: Turbidity at Georges River tributary monitoring sites June 2023 – December 2023.

Turbidity of the three sites within the South Creek catchment exceeded the upper ANZECC guideline on one occasion. BC1 results were above the ANZECC guidelines upper range of 50 NTU in June, with a reading of 89.6 NTU, which was the highest reading of the recording period. Apart from this instance, all other sampling occasions recorded an NTU below the upper limits of the ANZECC guidelines. A similar trend to the Kemps Creek, and Kemps Creek tributaries sites was recorded, showing a small spike in NTU in August 2023.

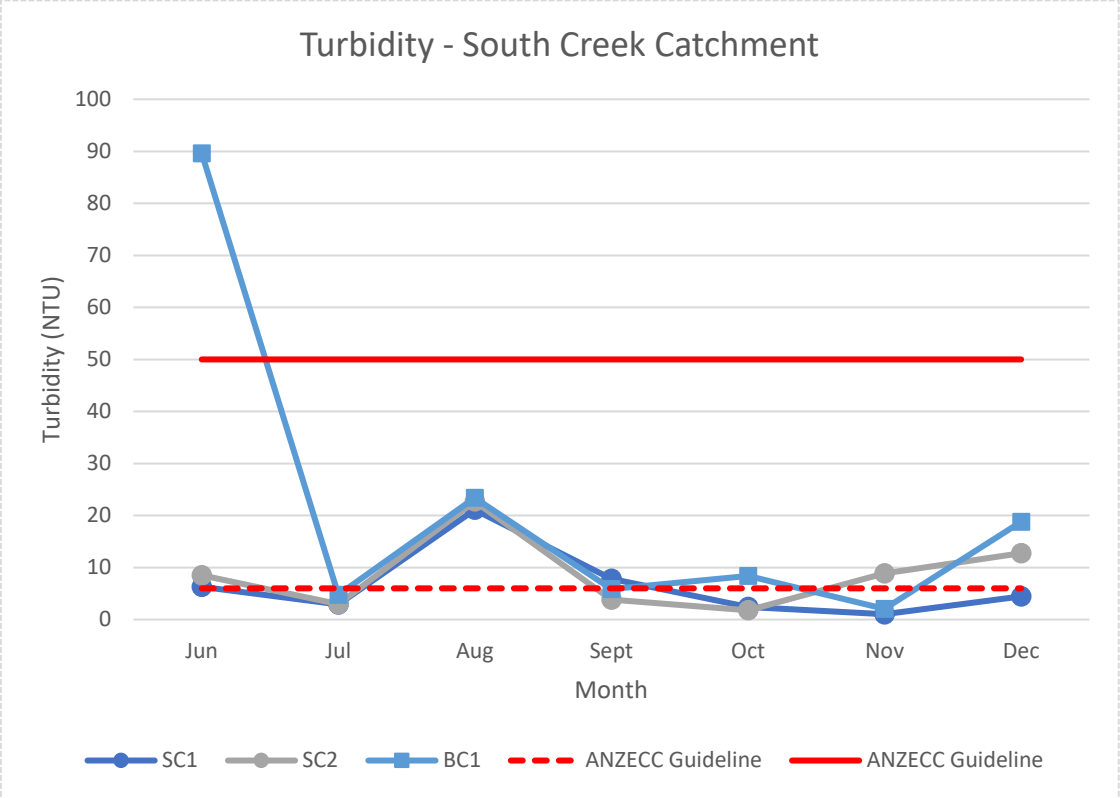

Figure 13: Turbidity at South Creek catchment monitoring sites June 2023 – December 2023.

Recreation Monitoring Sites

Turbidity

Turbidity at freshwater sites was frequently above the ANZECC primary contact guidelines (apart from GR1 (0.3 NTU) and GR1.5 (0.31 NTU) in December 2023) and were consistently within the ANZECC secondary contact guidelines (10 NTU) during this sampling period. At the estuary sites, there was no compliance with the primary contact guideline of 0.5 NTU, and all estuary sites were within the secondary contact guideline of 10 NTU during the monitoring period.

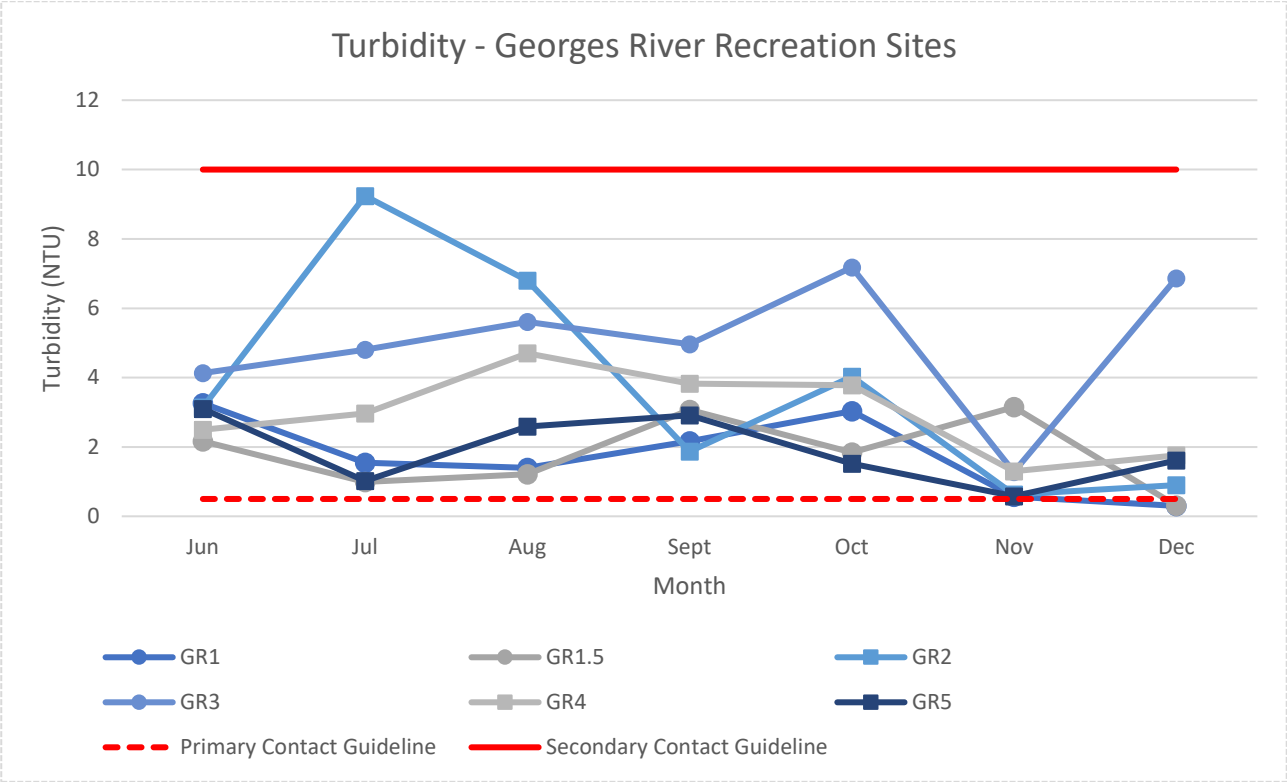

Figure 14: Turbidity at Georges River Recreation monitoring sites June 2023 – December 2023.

Faecal coliforms and *Enterococci*

Results of bacteria monitoring at the Georges River Recreation sites shows that breaches of the ANZECC primary contact guidelines for *Faecal coliforms* occurred within in all months of this sampling period excluding August 2023 and breaches of ANZECC secondary contact guidelines for *Faecal coliforms* occurred in July, October, and December 2023. Breaches of the ANZECC primary contact guidelines for *Enterococci* occurred within all months of sampling (high enough to breach the secondary contact guidelines in June 2023), and breaches of the secondary contact guidelines for *Enterococci* occurred in June, July, August, November, and December 2023 (Figure 15, Figure 16).

Results for GR1 show that the ANZECC primary contact guidelines for *Faecal coliforms* was breached in June 2023 and the ANZECC secondary contact guideline was exceeded in October 2023. GR1 exceeded the ANZECC primary contact guidelines for *Enterococci* in July, August and December 2023. The secondary contact guideline for Enterococci was exceeded in June and October at GR1 (Figure 15, Figure 16).

GR1.5 breached the ANZECC primary contact guidelines for *Faecal coliforms* on three occasions in October, November, and December 2023, and the ANZECC secondary contact guideline was not exceeded. The ANZECC primary contact guidelines for *Enterococci* was exceeded at GR1.5 in July, October, and December 2023, and the secondary contact guideline was exceeded in November 2023 (Figure 15, Figure 16).

The ANZECC primary contact guidelines for *Faecal coliforms* was exceeded at GR2 in July and October, and ANZECC secondary contact guideline for *Faecal coliforms* was not exceeded. GR2 exceeded the ANZECC

primary contact guidelines for *Enterococci* in August and October 2023, and exceeded the secondary contact guideline for Enterococci in July 2023 (Figure 15, Figure 16).

GR3 breached the ANZECC primary contact guidelines for *Faecal coliforms* on three occasions, which were in September, November, and December 2023, and breached the ANZECC secondary contact guideline for *Faecal coliforms* on one occasion in July 2023. The ANZECC primary contact guidelines for *Enterococci* was breached at GR3 in September, November, and December 2023 and the secondary contact guideline was exceeded in July 2023 (Figure 15, Figure 16).

Results for GR4 show a breach of the ANZECC primary contact guideline for *Faecal coliforms* in November and December 2023, and no breach of the secondary contact guideline within the sampling period (Figure 15, Figure 16). GR4 exceeded the ANZECC primary contact guidelines for *Enterococci* in October 2023, and the ANZECC secondary contact guidelines was exceeded in June, July, August, and November (Figure 15, Figure 16).

The ANZECC primary contact guidelines for *Faecal coliforms* were breached at GR5 in November 2023, and the ANZECC secondary contact guidelines were exceeded at GR5 in December 2023. GR5 exceeded the ANZECC primary contact guideline for *Enterococci* on one occasion in October 2023 and exceeded the ANZECC secondary contact guidelines in November and December 2023 (Figure 15, Figure 16).

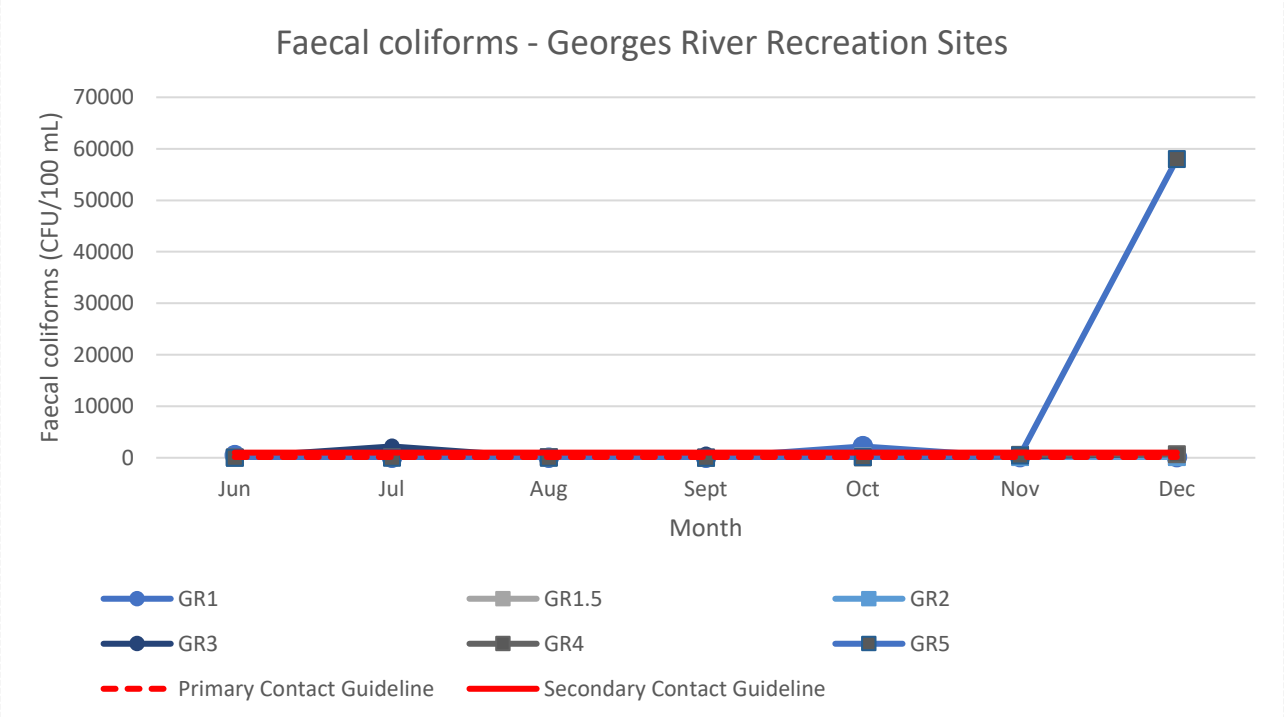

Figure 15: *Faecal coliforms* at Georges River Recreation monitoring sites June 2023 – December 2023.

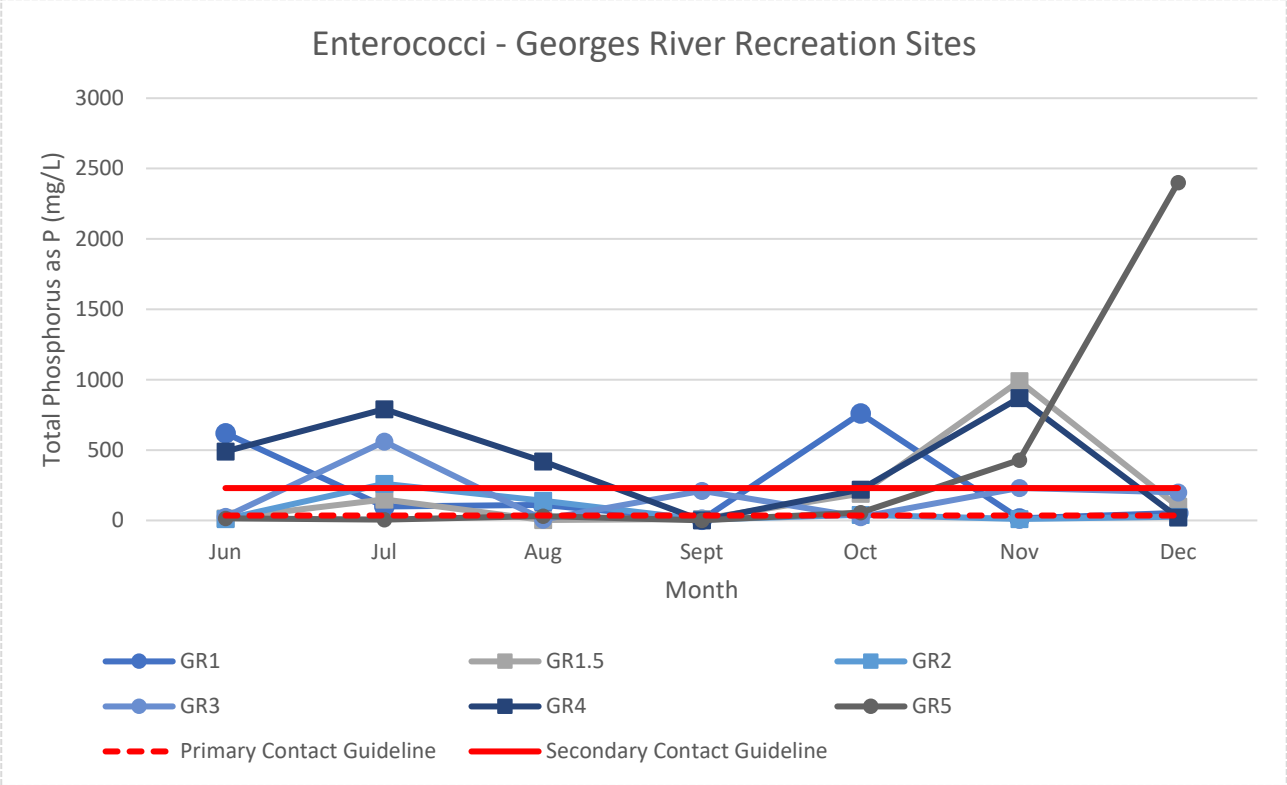

Figure 16: *Enterococci* at Georges River Recreation monitoring sites June 2023 – December 2023.

Cyanobacteria (Blue Green Algae)

Monitoring of Cyanobacteria (Blue Green Algae) show that all recreation sites are susceptible to Blue Green Algae blooms, and potentially toxic species of Blue Green Algae are commonly detected (Table 7). The highest NHMRC monitoring level is 'Red Level Action Mode' followed by the 'Amber Level Alert Mode' with 'Green Level Surveillance Mode' being the lowest level in the NHMRC (2008). Each monitoring level has a recommended response (Table 8).

Apart from the August sampling event, Blue Green Algae Biovolume levels recorded across Georges River Estuary monitoring sites triggered NHMRC (2008) monitoring level 'Green Level Surveillance Mode' (NHMRC 2008) on all sampling occasions at all six sites. The NHMRC (2008) 'Amber Level Alert Mode' was triggered a total of three times, this occurred at two sites (GR3 and GR4) during the June sampling event, and at GR4 during the December event.

GR1 triggered the 'Green Level Surveillance Mode' in June, September, and December 2023. GR1.5 triggered the 'Green Level Surveillance Mode' in June and November, GR2 triggered the 'Green Level Surveillance Mode' in November, GR3 triggered the "Amber Level Alert Mode' in June and the 'Green Level Surveillance Mode' in October, November, and December, GR4 triggered the "Amber Level Alert Mode' in June and December and the 'Green Level Surveillance Mode' in July, September, October, and November, and GR5 triggered the 'Green Level Surveillance Mode' in June, November, and December 2023. The 'Red Level Action Mode' was not triggered in this sampling event.

Table 7: NHMRC Blue Green Algae monitoring levels for Georges River Estuary monitoring sites June 2023 – December 2023.

	GR1	GR1.5	GR2	GR3	GR4	GR5
JUNE 2023	Green	Green	-	Amber	Amber	Green
JULY 2023	-	-	-	-	Green	-
AUGUST 2023	-	-	-	-	-	-
SEPTEMBER 2023	Green	-	-	-	Green	-
OCTOBER 2023	-	-	-	Green	Green	-
NOVEMBER 2023	-	Green	Green	Green	Green	Green
DECEMBER 2023	Green	-	-	Green	Amber	Green

Table 8: NHMRC Blue Green Algae Levels and recommended response (NHMRC 2008).

NHMRC MONITORING LEVEL	RECOMMENDED RESPONSE
SURVEILLANCE MODE (GREEN LEVEL)	This level involves routine sampling to measure contaminants (e.g. physical, microbial, cyanobacterial and algal).
ALERT MODE (AMBER LEVEL)	This level requires investigation into the causes of elevated contaminant levels, and increased sampling to enable a more accurate assessment of the risks to recreational users.
ACTION MODE (RED LEVEL)	This level requires the local government authority and health authorities to warn the public that the water body is considered unsuitable for recreational use.

Conclusion

It is evident that most freshwater sites across the Liverpool LGA have elevated nutrient levels, often at orders of magnitude higher than the recommended ANZECC guidelines. Elevated nutrients in the urban and peri-urban setting are commonly sourced from stormwater run-off, sewer leakage or other wastewater sources, fertiliser contamination and decay of organic material. This program cannot quantify the source of the elevated results continually recorded across the Kemps Creek sites; however, likely drivers include the combination of low/no flow conditions associated with below average rainfall, the decay of organic matter, and increased stormwater runoff due to high rainfall and flooding events.

Turbidity at freshwater sites was observed to be similar compared to results from the previous bi-annual report. However, turbidity was variable between sites and sampling events, with elevated turbidity observed likely in response to high rainfall and flooding events. It should be noted that sites with turbidity levels less than the ANZECC water quality guidelines for lowland rivers of south-eastern Australia represent the 'natural state' of creeks within the Sydney Basin.

Results of monitoring at Kemps Creek, Kemps Creek tributaries, South Creek, and Georges River tributary sites shows elevated nutrient concentrations were apparent for most of the monitoring period, the source of which is likely elevated stormwater runoff.

Turbidity at Georges River Recreation sites was within the secondary contact guidelines on all sampling occasions, however, was largely non-compliant with the ANZECC primary contact guideline upper limit of 0.5 NTU for estuarine and marine waters. Turbidity was also variable over time, which may be associated with high rainfall events.

Monitoring of the Georges River estuary sites show bacteria levels were frequently elevated above the ANZECC (2000) Primary Contact levels, and at times above Secondary Contact levels.

Elevated levels of bacteria and Blue Green Algae are typical of urban estuaries which receive sewer overflow and nutrient enriched stormwater, which when combined with warm days can create ideal conditions for algae blooms which may include potentially toxic Blue Green Algae, as seen in the Georges River Estuary.

The 'Green Level Surveillance Mode' (NHMRC 2008) was triggered on all sampling occasions (with the exception for August 2023), and the Amber Level Alert Mode' (NHMRC 2008) was triggered during two sampling occasion (June and December 2023) at a total of three sites, however, the 'Red Level Action Mode' (NHMRC 2008) were not triggered within this six-month period. This represents a decrease in algal blooms compared with the previous six-monthly report.

Statistical analysis of data collected by the monitoring program will be undertaken and presented in the annual report and program recommendations will be made.

All data has been supplied in an Excel spreadsheet separate this report and no safety issues were recorded/observed during monitoring.

If you have any questions, please get in touch.

Kind regards,

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