



CTENVIRONMENTAL

ECOSYSTEM MANAGEMENT AND MONITORING



September 2024 Quarterly Aquatic Ecosystem Monitoring Report

Liverpool City Council

September 2024

PROJECT	LIVERPOOL CITY COUNCIL AQUATIC ECOSYSTEM MONITORING 2024
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Report Structure

This report presents the September Aquatic Ecosystem Monitoring Monthly Progress Report (Part 1) which is accompanied by the quarterly report (July 2024 to September 2024).

Part 1

Aquatic Ecosystem Monitoring Monthly Progress Report - September 2024

Monthly aquatic ecosystem monitoring of the Georges River and South Creek catchments was undertaken on 5 September 2024.

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

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

Weather conditions for the week prior to sampling were cool to warm. Rainfall was recorded at both Badgerys Creek AWS (Table 1) and Holsworthy Aerodrome (Table 2), with 11.4mm recorded at both sites.

Table 1. Weather observations for Badgerys Creek AWS NSW (BOM 2024) in the week prior to sampling

DATE	TEMPERATURE MIN (°C)	TEMPERATURE MAX (°C)	RAINFALL (MM)
30/08/2024	6.5	25.8	0.2
31/08/2024	7.0	21.5	11.2
01/09/2024	6.3	15.7	0
02/09/2024	12.7	24.0	0
03/09/2024	8.2	19.7	0
04/09/2024	2.3	23.0	0
05/09/2024	4.4	27.7	0

Table 2. Weather observations for Holsworthy Aerodrome NSW (BOM 2024) in the week prior to sampling

DATE	TEMPERATURE MIN (°C)	TEMPERATURE MAX (°C)	RAINFALL (MM)
30/08/2024	7.3	26.1	0
31/08/2024	8.1	19.8	11.2
01/09/2024	7.3	26.5	0
02/09/2024	13.4	24.3	0
03/09/2024	7.9	18.8	0
04/09/2024	2.3	22.9	0
05/09/2024	5.5	27.2	0.2

Cyanobacteria (blue-green algae) monitoring at recreation sites in the Georges River was undertaken on 5 September 2024 from high-tide to low-tide.

Results show potentially toxic cyanobacteria was detected at GR3 during sampling however biovolume calculations indicate that only Green NHMRC Alert Levels were triggered at GR1.5, GR2, GR3, and GR5 during the September sampling event (Table 3).

Table 3. Results summary for recreation monitoring sites, September 2024. Less than 5 cells/mL represent a 'not detected' result

SITE	SAMPLED	POTENTIALLY TOXIC CYANOBACTERIA (CELLS/ML)	NHMRC (2008) ALERT LEVEL	SAFETY ISSUES
GR1	Yes	<5	-	None
GR1.5	Yes	<5	Green (Surveillance)	None
GR2	Yes	<5	Green (Surveillance)	None
GR3	Yes	590	Green (Surveillance)	None
GR4	Yes	<5	-	None
GR5	Yes	<5	Green (Surveillance)	None

No NHMRC Alert Level was triggered for GR1 or GR4 for this round of sampling. Results for GR1 showed three cyanophytes – *Aphanocapsa* spp. (400 cells/mL), *Pseudanabaena* spp. (325 cells/mL), and *Rhabdoderma* spp. (275 cells/mL). For GR4, *Aphanocapsa* spp. (15200 cells/mL), *Pseudanabaena* spp. (100 cells/mL), and *Romeria* spp. (350 cells/mL) were detected.

The Green Level Surveillance Mode was triggered for all other sites (GR1.5, GR2, GR3, and GR5). GR1.5 testing detected *Aphanocapsa* spp. (200 cells/mL), *Cyanogranis libera* (875 cells/mL), and *Romeria* spp. (1780 cells/mL). *Aphanocapsa* spp. (1350 cells/mL) and *Romeria* spp. (2000 cells/mL) were detected at GR2.

A potentially toxic cyanophyte, *Dolichospermum circinale* (590 cells/mL) was detected at GR3, along with *Aphanocapsa* spp. (74200 cells/mL), *Pseudanabaena* spp. (850 cells/mL), *Romeria* spp. (475 cells/mL), and *cf. Synechococcus* spp. (50 cells/mL).

Five cyanophytes were detected at GR5 – *Aphanocapsa* spp. (1120 cells/mL), *Merismopedia* spp. (200 cells/mL), *Planktothrix* spp. (2600 cells/mL), *Pseudanabaena* spp. (150 cells/mL), and *Romeria* spp. (50 cells/mL).

Due to the persistence of cyanobacteria at the recreation monitoring sites, there is potential for future blooms to occur and NHMRC (2008) recommends weekly or fortnightly monitoring when the 'Green Level Surveillance Mode' is triggered (Table 4)

Table 4. Recommended monitoring actions and corresponding NHMRC (2008) Alert Levels.

CYANOBACTERIAL ALERT LEVEL	RECOMMENDED ACTIONS
GREEN LEVEL SURVEILLANCE MODE	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.
AMBER LEVEL ALERT MODE	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.
RED LEVEL ACTION MODE	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 (i.e. the authorities make a health risk assessment considering toxin monitoring data, sample type and variability).

Results of bacteria monitoring at recreation sites in September 2024 show that the ANZECC Primary and Contact Guidelines for *Thermotolerant coliforms* was exceeded at GR1 and GR3 (Table 5). The Secondary Contact Guidelines were not exceeded at any of the Georges River recreational sites.

For *Enterococci*, the ANZECC Primary Contact Guidelines were exceeded at GR1.5 and GR5. Secondary Contact Guidelines were exceeded at GR1 and GR3.

Table 5. Summary of conditions observed/recorded at each site during September 2024 monitoring. Orange indicates exceedance of the primary contact guideline; red indicates exceedance of the secondary contact guideline

SITE	SAMPLED	TIDE	THERMOTOLERANT COLIFORMS CFU/100 ML	ENTEROCOCCI CFU/100 ML	OBSERVATIONS
GR1	Yes	Low	400	910	Clear
GR1.5	Yes	Low	68	45	Clear
GR2	Yes	Low	97	16	Clear
GR3	Yes	Low	910	300	Clear, surface scum
GR4	Yes	Low	33	23	Clear
GR5	Yes	Low	29	87	Clear
PRIMARY CONTACT GUIDELINES			150	35	
SECONDARY CONTACT GUIDELINES			1000	230	

Surface water samples were collected at all freshwater monitoring sites in September 2024, except for KC11 (due to construction works). During the September monitoring period, freshwater sites sampled overall were found to have high electrical conductivity at majority of sites, and all sites bar KC10 and HC having a healthy dissolved oxygen percentage greater than 80.

Table 6. Summary of conditions observed/recorded at each site during September 2024

SITE	WATER QUALITY SAMPLED	AQUATIC MACRO- INVERTEBRATES	BENTHIC DIATOMS	FLOW	OBSERVATIONS	SAFETY ISSUES
MC1	Yes	No	Yes	Normal	Clear	None
AC1	Yes	No	Yes	Normal	Clear	None
KC1	Yes	No	Yes	Normal	Clear	None
KC2	Yes	No	Yes	Normal	Clear, surface scum	None
KC3	Yes	No	Yes	Normal	Clear, oil	None
KC5	Yes	No	Yes	Normal	Clear	None
KC6	Yes	No	Yes	Normal	Clear	None
KC8	Yes	No	Yes	Normal	Clear	None
KC10	Yes	No	Yes	Normal	Turbid, surface scum	None
KC11	No	No	No	-	-	No access
KC12	Yes	No	Yes	Normal	Turbid, surface scum	None
SC1	Yes	No	Yes	Normal	Turbid	None
SC2	Yes	No	Yes	Normal	Clear	None
BC1	Yes	No	Yes	Normal	Clear	None
WG	Yes	No	Yes	Normal	Turbid	None
HC	Yes	No	Yes	Normal	Clear	None

Part 2

Introduction

This report outlines results for the quarter (July to September 2024) for the 2024-2025 monitoring period.

This report presents results of nutrient, turbidity, bacteria, and cyanobacteria 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.

Freshwater Monitoring Sites comprises of the South Creek catchment sites – 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) – and the Georges River tributaries (AC1, MC1, HC, and WG).

Georges River Recreation Monitoring Sites comprises of the Georges River catchment sites (GR1, GR1.5, GR2, GR3, GR4, and GR5).

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) describes the multiple common symptoms occurring in urban streams, including degraded water quality, geomorphology, hydrology, and biodiversity. All freshwater sites frequently recorded nutrient levels (total phosphorous and total nitrogen) that exceeded either the Wianamatta-South Creek Stormwater Management Targets (WQO for South Creek), relevant to South Creek catchments sites, or the Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000), relevant to the Georges River tributaries. Other parameters, including turbidity, dissolved oxygen, pH, and electrical conductivity, were also recorded to be outside the WQO for South Creek and/or the ANZECC water quality trigger values at majority of sites throughout the three-month monitoring period.

Total Nitrogen

Total nitrogen (TN) variations were constant across the Kemps Creek sites for the July - September 2024 period (Appendix 1). Results show that all sites exceed the TN WQO for South Creek (1.72 mg/L). The highest concentration, 29.3 mg/L, was recorded at KC1 in September 2024, which is approximately 17 times greater than the TN objective. TN remained at similar concentrations throughout the monitoring period. There was a spatial trend where sites in the upper catchment (KC1, KC5 and KC8) had increased TN concentrations than the sites further downstream (KC10, and KC12)

Total nitrogen levels in sites along South Creek were relatively constant however did not comply with the WQO for South Creek value of 1.72 mg/L during the monitoring period (Appendix 1). TN concentration was highest at SC1 in August reaching 6 mg/L, followed by a 3.6 mg/L in July, which are similar than the previous quarter’s highest reading of 6.5 mg/L in May 2024.

Badgerys Creek sampling showed a slow decline in TN across the three-month period, with a high of 1.9 mg/L in July and 0.6 mg/L in September, indicating only a marginal exceedance of the TN WQO for South Creek of 1.72 mg/L.

Total nitrogen within all sites of Georges River tributaries was stable with TN between 0.02 and 1.7 mg/L across the four sites, showing similar results to the previous quarter. Total nitrogen did not comply with the ANZECC lowland river trigger value for south-east Australia (0.35 mg/L) during any sample event within the three-month period for HC, MC1, or WG. On all three sampling occasions, TN was compliant at AC1 (ranging from 0.02 – 0.06 mg/L). This is significantly lower than the previous quarter’s AC1 TN concentration of 1.4 mg/L in May.

Total Phosphorous

Total phosphorous (TP) was variable across Kemps Creek sites, and like previously recorded, there was an evident temporal trend of higher TP at sites KC1 and KC5 (Appendix 1). All sites recorded non-compliance to the TP WQO for South Creek of 0.14 mg/L. KC1 recorded the highest TP concentration of 3.04 mg/L in September, approximately 22 times the objective.

Kemps Creek tributary sites (KC2, KC3, and KC6) had similar TP ranging between 0.03 mg/L at KC6 in August, and 0.77 mg/L at KC3 in September. All sites exceeded the 0.14 mg/L objective in July, however KC2 and KC6 remained within the objective for August and September.

Total phosphorus concentrations at all South Creek and Badgerys Creek sites (SC1, SC2, and BC1) were consistent and exceeded the TP WQO for South Creek (0.14 mg/L) on multiple monitoring events (Appendix 1). TP was highest at SC1 in July, with a value of 0.42 mg/L, lower than the 0.76 mg/L recorded in May.

Georges River tributary sites had relatively consistent readings of TP (Appendix 1). Four samples during this quarter were compliant with the ANZECC trigger value of 0.025 mg/L at AC1, HC, and MC1, however all others exceeded the trigger value. The highest record of TP (0.14 mg/L) was identified at HC in September, approximately 6 times the trigger value.

Turbidity

During the quarterly monitoring period, turbidity across the South Creek catchment sites remained mostly below the turbidity WQO for South Creek (50 NTU). However, elevated turbidity was recorded on four occasions, all within July—82 NTU at SC2, 74 NTU at KC2, and 51 NTU at both BC1 and SC1.

Georges River tributaries had turbidity ranging from 0.05 to 51 NTU (Appendix 1) across the quarter, in line with the ANZECC trigger value range of 6-50 NTU. The highest turbidity was recorded at BC1 in July 2024, and most sites showed elevated turbidity during this same month.

Georges River Recreation Monitoring Sites

Turbidity

Turbidity at non-estuary recreation sites (GR1, GR1.5, and GR2) were compliant with or below the ANZECC freshwater trigger value (6-50 NTU) between July and September. At the estuary sites (GR3, GR4, and GR5) there was no compliance with the primary contact trigger value of 0.5 NTU. There was only one instance where turbidity was below the 10 NTU trigger value for secondary contact throughout this quarter. The highest record was 41.09 at GR3 in September.

Thermotolerant coliforms and Enterococci

Results of bacteria monitoring at the Georges River Recreation sites shows that breaches of the ANZECC primary and secondary contact guidelines for *Enterococci* occurred within July and September. The ANZECC primary contact guidelines *Thermotolerant coliforms* was breached in July and September, while the ANZECC secondary contact guidelines *Thermotolerant coliforms* was breached in September (Table 7).

The ANZECC primary contact guidelines for *Enterococci* was exceeded at GR1.4 and GR2 in July, and at GR1.5 and GR5 in September.

On six occasions the ANZECC secondary contact guidelines for *Enterococci* was exceeded in this quarterly monitoring period. This occurred in July at GR1, GR3, GR4 and GR5, and in September at GR1 and GR3.

There were six occurrences of the ANZECC primary contact guidelines for *Thermotolerant coliforms* being breached within the monitoring period. These breaches occurred in July at GR1, GR1.5, GR2, and GR3. As well as in September at GR1 and GR3.

The ANZECC secondary contact guidelines for *Thermotolerant coliforms* were exceeded in July at GR4 and GR5.

Cyanobacteria (blue-green algae)

Monitoring of cyanobacteria (blue-green algae) show that all recreation sites are susceptible to cyanobacteria blooms, and potentially toxic species of cyanobacteria 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.

Cyanobacteria Biovolume recorded across Georges River monitoring sites triggered the 'Green Level Surveillance Mode' in July at GR4, GR5. In August the 'Green Level Surveillance Mode' was triggered at GR4. September results show that the 'Green Level Surveillance Mode' was triggered at GR1.5, GR2, GR3, and GR5 (Table 7).

Table 7. Data summary of recreation monitoring sites. Non-compliance to ANZECC (2000) primary guidelines is indicated in orange and secondary guidelines in red. NHMRC (2008) Cyanobacteria alert levels highlighted as per the text and colour

SITE	DATE	THERMOTOLERANT COLIFORMS	ENTEROCOCCI	CYANOBACTERIA
		CFU/100mL	CFU/100mL	NHMRC Alert Level
GR1	09/07/2024	550	610	-
	09/08/2024	~8	~1	-
	05/09/2024	400	910	-
GR1.5	09/07/2024	470	140	-
	09/08/2024	~2	~6	-
	05/09/2024	68	45	Green
GR2	09/07/2024	320	220	-
	09/08/2024	25	10	-
	05/09/2024	97	16	Green
GR3	09/07/2024	760	260	-
	09/08/2024	61	~2	-
	05/09/2024	910	300	Green
GR4	09/07/2024	4700	420	Green
	09/08/2024	~4	<1	Green
	05/09/2024	33	23	-
GR5	09/07/2024	42000	3700	Green
	09/08/2024	19	~1	-
	05/09/2024	29	87	Green

PRIMARY CONTACT GUIDELINES	150	35
SECONDARY CONTACT GUIDELINES	1000	230

Due to the persistence of cyanobacteria, there is potential for future blooms to occur. NHMRC (2008) recommends weekly monitoring if 'Green' level is triggered and twice weekly monitoring if the 'Amber' and/or 'Red' Levels are triggered (Table 4).

Table 8. NHMRC Cyanobacteria 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 WQO for South Creek and/or 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 flow conditions and the decay of organic matter, and increased stormwater runoff due to high rainfall and the flooding events.

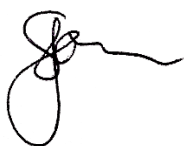
Statistical analysis of data collected by the monitoring program will be undertaken and presented in the annual report and program recommendations will be made.

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

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

If you have any questions, please get in touch.

Kind regards,



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References

ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

BOM (2024) www.bom.gov.au (accessed August 23, 2024).

NHMRC (2008) Guidelines for Managing Risks in Recreational Water