

Mill Stream

Water Quality report under Authorisation No: 01/2024

Sydney WATER



Acknowledgement of Country

Sydney Water respectfully acknowledges the Traditional Custodians of the land and waters on which we work, live and learn. We pay respect to Elders past and present.

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Executive Summary

Sydney Water was granted an Authorisation, subject to conditions, under regulation 5.09 of the *Airports (Environment Protection) Regulations 1997* (Cwth) (Regulations) to operate Emergency Relief Structures (ERSs) located on Sydney Airport land, and which discharge to Mill Stream. This report addresses condition 21(a) of that Authorisation, presenting the results of the Mill Stream water quality monitoring program. This report details the results of the monitoring conducted as part of the current Authorisation period as detailed in action 5.4 of the Mill Stream Environment Management Plan (EMP). This report includes the data from previous monitoring periods which were conducted in 2020 and 2023.

The water quality monitoring for the current authorisation period was conducted quarterly, beginning in April 2024 and wrapped up in February 2025. Each quarter involved a 5 day post overflow and a single day dry weather event. Previous sampling periods were conducted in a more condensed period within each year, following the same 5 day post overflow event sampling, however dry weather events were conducted over 2 days. The post overflow sampling events corresponded to relatively high discharge volume, that was comparable to conditions observed during the 2020 monitoring program, whereas 2023 captured smaller overflow discharge conditions.

The concentration of contaminants measured from the wastewater network prior to wet weather overflow discharge were generally lower in 2024 compared to the previous monitoring periods. Median effluent concentrations decreased in 2024 from the 2020 monitoring period, with the exception of PFOS, chlorophyll-α and sulphide. Comparison to 2023 is limited as only one sample was able to be collected during the monitoring period.

Results from the 2024 monitoring program indicate that receiving waters immediately downstream of the Mill Pond Weir and ERS experienced the greatest degradation of water quality in both wet weather overflow and dry weather conditions, as observed in 2020 and 2023. Bacteriological and nutrient actors (nitrogen and phosphorus) appear to be the most heavily influenced by ERS discharges as concentrations immediately downstream of the ERS were the greatest. Spatially there was substantial reduction in pollutant concentration observed at more distal locations likely induced by greater dilution, dispersion and decay. These results suggest that works Sydney Water are undertaking to decrease the volume and duration of wet weather overflow discharged at Mill Stream would also reduce the observable impact to water quality.

Chlorophyll-α did not appear to be noticeably impacted by ERS overflow as the upstream site routinely returned the highest concentration per sampling event in both dry and wet weather. The 2024 results follow the same trend as previous periods, with chlorophyll-a concentration being the highest at the upstream site, then reducing downstream.

There was minimal spatial variation in results for metals, organics, PFAS, sulphide and other physico-chemical parameters in dry and wet weather. This suggests less influence from specific ERS overflow events and likely reflective of the baseline stormwater condition and inputs.

Results from the monitoring program has informed how the Mill Stream overflows influence the receiving waterway and allowed characterisation against relevant guideline levels. The 2024-2025 monitoring has not provided additional insights beyond what was already evidenced from previous programs. Hence, Sydney Water has not identified opportunity for any additional actions *'to improve water quality at Mill Stream'* to those already detailed in the current Mill Stream Environmental Management Plan. However, there are opportunities to refine and improve the monitoring program design, including increased monitoring to capture stormwater events without ERS discharge and a review of the sample analytes and suitability of guideline levels.

1. Introduction

1.1 Context

Emergency relief structures (ERS) are an essential component of all wastewater systems. They are critical control points which are engineered to prevent damage to networks and protect public health by preventing wastewater surcharges and flooding of private property and public spaces during wet weather. The structures and discharges are commonly referred to as overflows and most often occur at times of intense rainfall when the stormwater flows have infiltrated the wastewater system.

The Malabar wastewater system displayed in Figure 1 is the largest system that Sydney Water owns and operates. It covers approximately one third of Sydney and services more than 2 million people. The South Western Suburbs Ocean Outfall Sewer (SWSOOS) listed on the New South Wales State Heritage Register in 2020, transports wastewater from the merging chamber at Arncliffe to Malabar Wastewater Resource Recovery Facility (WRRF).

Sydney Water owns and operates eight ERS on the SWSOOS that discharge wastewater to the Mill Stream during wet weather (known collectively as the Mill Stream ERS). The Mill Stream ERS is one of the largest in Sydney Water's network and is located on federally owned land at Sydney Airport and has potential impacts on the local environment. This requires Sydney Water to apply for an Authorisation under the *Airports (Environment Protection) Regulation (AEPR) 1997* from the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts (DITRDCSA) to operate the ERS.

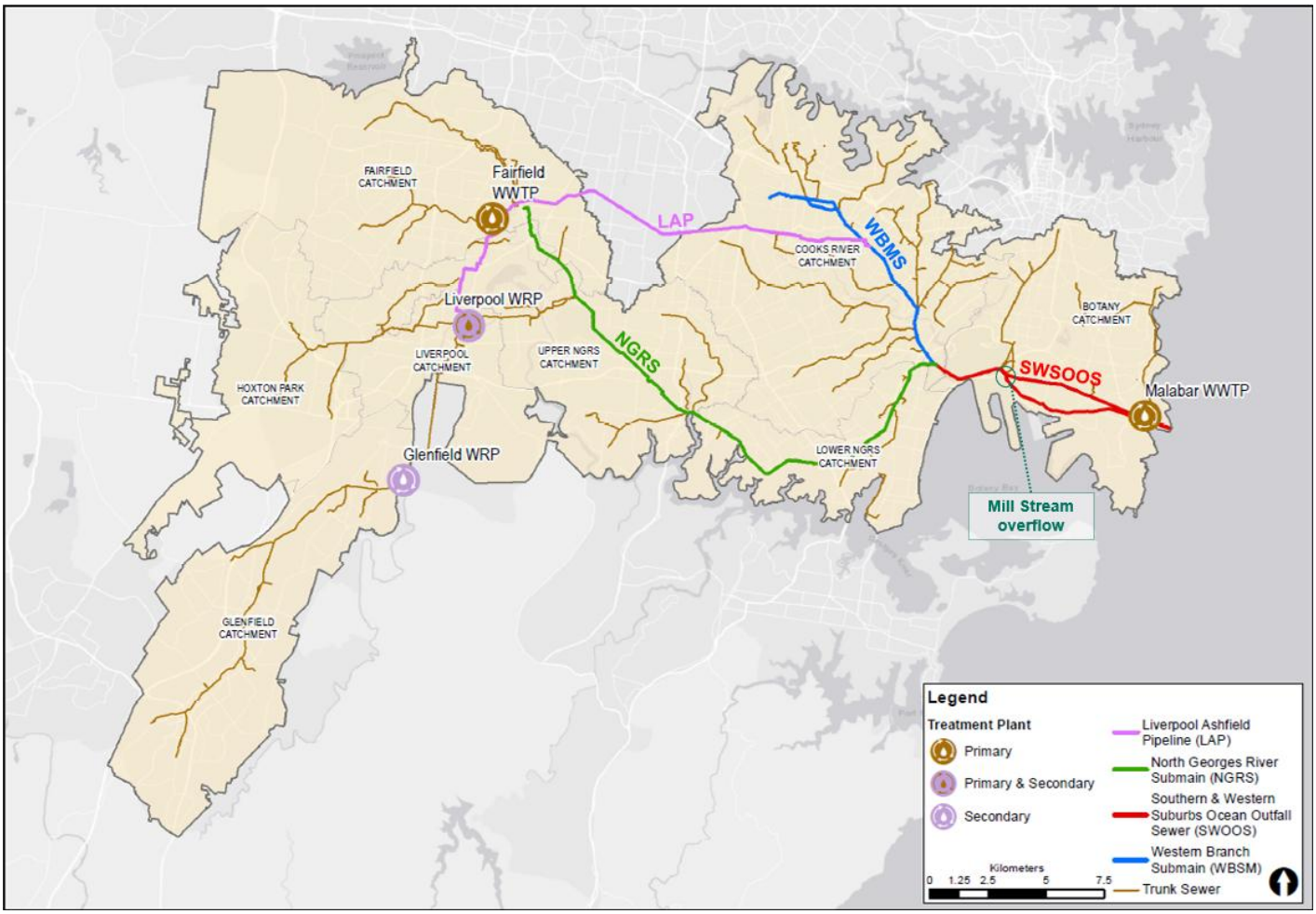


Figure 1 Malabar wastewater network and Mill Stream ERS location

1.2 Scope & objectives

The scope of this water quality monitoring report is to detail Sydney Waters monitoring of the Mill Stream and receiving waterways, satisfying condition 21(a) of the Mill Stream Authorisation No: 01/2024;

'by 31 July 2025, submit a Water Quality Monitoring Report to the AEO that reports comprehensively on Sydney Water's monitoring in Mill Stream and that sets out recommended actions for the improvement of water quality at Mill Stream and surrounding Botany Bay area'

The objectives of this report are:

- Compare monitoring results collected under authorisation No:01/2024 to previous monitoring periods
- Assess the influence of the Mill Stream ERS discharge on the receiving water quality of Mill Stream and Port Botany
- Identify pollutants of concern and assess results against the relevant guidelines and criteria
- Provide recommendations to be considered for future monitoring programs as part of the Mill Stream Authorisation.

Please note that this report builds on the analysis of previous water quality monitoring detailed in the below reports

- 2020 program - Mill Stream Emergency Relief Structures: Environmental and Ecological Assessment Report, Sydney Water. (2021).
- 2023 program - Mill Stream Water Quality Report, Sydney Water (2023)

2. Methodology

2.1 Quality Assurance

Quality control standards are satisfied by Sydney Water Laboratory Services NATA certified to ISO 9001:2015 Quality management systems; ISO 14001: 2015 Environmental Management Systems and AS/NZS 4801: 2001 Occupational Health & Safety Management System. All analytical work is performed to the requirements of AS ISO/IEC 17025: 2015 General requirements for the competence of testing and calibration laboratories. PFAS analysis in saline waters is currently not performed in-house at Sydney Waters Laboratories. Analysis was outsourced to the National Measurement Institute (NMI), a NATA accredited laboratory ensuring the use of approved methods, detection limits and reporting requirements.

2.2 Data preparation, analysis & presentation

Monitoring data was extracted from Sydney Water's databases, tidied and analysed using R statistical analysis software version: R.4.4.2. All data points were retained for analysis including descriptive summary statistics, and figures such as box and whisker plots.

Where the recorded measurement was below the laboratory limit of reporting (LOR), half the limit of reporting value was used as the recorded measurement for calculations and figures. In instances where laboratory LOR has been adjusted over time, the current LOR was used for the reporting of summary statistics.

Water quality data is presented as box and whisker plots to make comparisons across sample locations. Box and whisker plots graphed the 25th percentile value, median (50th percentile) and 75th percentile values as shown in Figure 2. The whiskers point to the maximum or minimum value within two times the interquartile range (IQR) from the median. Exceptions (outliers) are points with values between 2 and 3 times the IQR from the median.

Figures with y-axis values log10 scaled for ease of visualisation have been labelled and where applicable the water quality guidelines have been included.

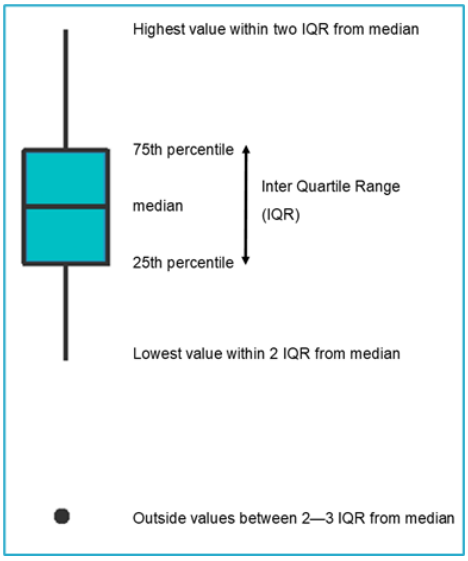


Figure 2 Example of box and whisker plot

The monitoring data obtained from 1st April 2024 to 28th February 2025 is labelled as period 2024 for simplicity. Sampling events in periods 2020 and 2023 were completed within respective calendar years.

Receiving water summary statistics are displayed as wet weather by individual monitoring periods (***2020***, ***2023*** and ***2024***) and ***overall dry*** for combined dry weather periods. Please note that wet weather monitoring is conducted when a confirmed ERS overflow event has commenced, dry weather monitoring is conducted when there has been <5mm in the preceding 72 hours, and <15mm and no overflows in the preceding 7 days.

Where appropriate Default Guideline Values (DGVs) are present, plot limit lines and summary statistic colourised comparisons are made against relevant highly disturbed system values (80% and 90%) for estuarine receiving waters, as suitable to the Mill Stream system (ANZG 2018). Colourised comparison to compliance with relevant guideline levels is included for median results only, however maximum and minimum results are included for data completeness. Site MS1 is freshwater, so while its data appears in tables and figures for a complete overview, direct comparisons to the displayed guideline levels are not appropriate; where relevant, reference to freshwater levels has been made in text.

Sydney Water has historically converted and measured all available ammonia species to the de-ionised form by pH manipulation in the lab, essentially reporting the total of both NH_3 and NH_4^+ concentrations as ammonia-nitrogen. As temperature and pH field measurements were taken at the time of sample collection, ammonium as nitrogen (NH_4^+-N) has been calculated according to the dissociation constant reported by ANZG enabling comparison to relevant limits. One limitation of this calculation is that the LOR for ammonia is 0.01 mg/L or 10 µg/L, above that of schedule 2 limit introducing error though rounding. It must also be noted that these calculations of ammonia and ammonium are not NATA accredited.

2.3 Relevant guidelines

To allow for an effective comparison to relevant guidelines, median concentrations were calculated across the monitoring periods for each site, separated by weather condition. This was done on data collected in the three monitoring periods 2020, 2023 and 2024-25. The median was then compared to the following guidelines, where guideline values were available and applicable:

- **Airports (Environment Protection) Regulations 1997 - Schedule 2**

  The Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts (DITRDCSA) is responsible for the administration of the airport environmental regulatory regime at 22 federally-leased airports around Australia. These airports are managed under an environmental regulatory framework established by the Airports Act 1996 and the *Airports (Environment Protection) Regulations 1997*. This regulatory framework applies to the management of all on-ground environmental issues, including air, soil, water (***Schedule 2***), noise and chemical pollution on-airport. As the federally-leased airports are located on Commonwealth land, state and territory laws do not apply. Relevant guideline values are presented in Table 1.

- **Australian and New Zealand guidelines for fresh and marine water quality**

  The Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018 and ANZECC 2000) are recognised as the accepted standard and best-practice guidelines for assessing receiving water quality impacts in Australia. These guidelines can be applied to the receiving waters in Mill Stream and Botany Bay. Relevant guideline values are presented in Table 1, and include specific default guideline levels, % species protection levels and lower and upper limits.

- **PFAS National Environmental Management Plan - Version 3.0**

  The per- and poly-fluoroalkyl substances (PFAS) National Environmental Management Plan (NEMP) 1.0 was released in January 2018, including the draft PFAS default guidelines values (DGVs) for species protection from the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality. The consultation of NEMP 3.0 commenced in December 2022, before the August 2023 revised draft ANZG PFOS DGVs for aquatic ecosystem protection were released and hence were not included as part of the review and release of PFAS NEMP 3.0 in 2025.

  Due to the higher reliability of the revised ANZG PFOS DGVs than the previous draft guidelines, they will be used in place of the NEMP 3.0 values for this assessment and are presented in Table 2.

Table 1 Schedule 2 and ANZG guidelines for estuarine systems

					ANZG					
Analyte	LOR	Units	Sched 2	Default Trigger	80%	90%	95%	99%	Low limit	Upper limit
Ammonia NH3 -N	<0.01	mg/L			1.7	1.2	0.91	0.5		
Ammonium (as N)		mg/L	0.005	0.015						
BOD5	<2	mg/L								
Chemical Oxygen Demand	<5	mg/L								
Chlorophyll - a	<0.2	µg/L	1	4						
Dissolved Oxygen	<0.1	mg/L	6							
Enterococci	<1	CFU/100mL							35*	230**
Faecal Coliform	<1	CFU/100mL	150						150*	1000**
Nitrate Nitrogen NO3-N	<0.01	mg/L		0.015						
Nitrite Nitrogen NO2-N	<0.001	mg/L								
Nonylphenol ethoxylate	<5	µg/L			360	220	140	50		
Oxidised Nitrogen NOx-N	<0.01	mg/L								
Percent Dissolved Oxygen	<0.1	SAT%							80	110
Soluble Reactive Phosphorus	<0.002	mg/L		0.005						
Sulphide	<30	µg/L	2	1						
Temperature Sample		°C								
Total Copper	<0.5	µg/L	5		8	3	1.3	0.3		
Total Lead	<0.1	µg/L	5		12	6.6	4.4	2.2		
Total Mercury	<0.01	µg/L	0.1		1.4	0.7	0.4	0.1		
Total Nickel	<0.2	µg/L	15		560	200	70	7		
Total Silver	<0.1	µg/L	1		2.6	1.8	1.4	0.8		
Total Zinc	<1	µg/L	50		21	12	8	3.3		
Total Nitrogen	<0.05	mg/L		0.3						
Total Phosphorus	<0.002	mg/L	0.005	0.03						
Total Suspended Solids	<2	mg/L								
Turbidity HACH White Light	<0.2	NTU							0.5	10
conductivity	<7	µS/cm								
di(2-ethylhexyl) phthalate	<10	µg/L	0.6							
pH	<0.1	pH								
PFOS	<0.02	µg/L			17	2.7	0.48	0.0091		

ANZG *primary and **secondary contact waterway guidelines

Table 2 NEMP 3.0 PFAS guidelines

PFAS Isomer	LOR	Units	80%	90%	95%	99%
PFOS	<0.02	µg/L	31	2	0.13	0.00023
PFOA	<0.01	µg/L	1824	632	220	19

2.4 Monitoring Locations

Monitoring locations have remained constant from the initial monitoring conducted in 2020 and are described in Table 3 and presented in Figure 3. Receiving water locations were selected based on feasibility to sample by boat and experimental design constituting a baseline (MS1), potential pollution source (MSERS), immediate mixing zone (MSFSR) and subsequent downstream waters influenced by dilution (MSNFB, MS4 and MSRW). It should be noted that site MS1 is located in freshwater. Due to the location of the Mill Stream ERS discharge point being directly below the weir that separates freshwater and estuary, it is not possible to have a comparable upstream estuarine site.

In dry conditions, monitoring was scheduled in advance when sampling could occur at high tide to ensure boat access to receiving waters within Mill Stream was possible. Wet weather monitoring was reactive, meaning tide cycles were not always favourable or environmental conditions prevented safe boat use (i.e. high winds and swell). Events which were unable to be sampled by boat were conducted on foot at alternate locations*.

Table 3 Receiving waterway locations

Site	Site code	Site description	Latitude	Longitude
Mill Stream upstream	MS1	Upstream of the Mill Stream ERS and weir in the Mill Stream Pond	-33.94472	151.18995
Mill Stream ERSs	MSERS*	Sample of wastewater effluent prior to discharge (within pipe)	-33.94457	151.18943
Mill Stream immediately downstream of Foreshore Rd	MSFSR*	Mill Stream from Foreshore Road	-33.94588	151.18850
Mill Stream Mid-stream	MSNFB*	Mill Stream – Northern most extent of Foreshore Beach	-33.95265	151.19190
Foreshores Beach	MS4*	Mill Stream/ Botany Bay – near Mill Stream look out	-33.95508	151.19362
Botany Bay Runway	MSRW*	Between the end of the runway and the New Botany Wharf	-33.97213	151.19894

*MSFSR alternate location by foot from Sir Joseph Bank Park, immediately upstream of Foreshore Road

*MSNFB alternate location by foot from Northern most extent of Foreshore Beach

*MS4 alternate location by foot from Eastern most extent of Mill Stream lookout break wall

*MSRW alternate location by foot from Southern most extent of Foreshore boat ramp break wall



Figure 3 Mill Stream monitoring locations

3. Water Quality

3.1 Monitored Events

A summary from the three monitoring periods is detailed in Table 4. Monitoring conducted in 2020 and 2023 was completed in a condensed timeframe within a few months. Dry weather monitoring in each campaign was two events consisting of two consecutive days, while wet weather monitoring consisted of three events each spanning five consecutive days. The 2024 monitoring campaign was completed over a year spaced quarterly consisting of four dry, single day monitoring events and four wet weather events each spanning five consecutive days. Wet weather monitoring events were conducted following a confirmation of overflow discharge from any of the Mill Stream overflows. Dry weather monitoring was conducted according to the following criteria: <5mm in the preceding 72 hours AND <15mm of rain and no overflow activity within the preceding 7 days. A summary of the daily conditions is presented in Appendix 7.1 and hydrographic gauging of daily rainfall and ERS discharge volumes have been included in Appendix 7.2.

Table 4 Summary of monitored events across three periods

Event	Event dates	Rainfall (mm)	Tidal Condition	Overflow volume (ML) & duration
2020				
Wet event #1	14/07 – 18/07	8.8	Variable tidal condition (ebb, incoming, high and low tide)	31.8 - 7 hours
Dry event #1	23/07 – 24/07	0	High tides	NA
Wet event #2	26/07 – 30/07	65.8	Variable tidal condition (high, incoming, low and medium ebb tide)	418.4 - 62 hours
Dry event #2	4/08/ - 5/08	0	Variable tidal condition (high, incoming and ebb tide)	NA
Wet event #3	8/08 – 12/08	30.4	Variable tidal condition (high, incoming, low and ebb tide)	309.3 - 49.5 hours
2023				
Wet event #1	31/08 – 4/09	8.6	Incoming or high tides	8.6 - 2 hours
Dry event #1	22/08 – 23/08	0	Incoming tides	NA
Wet event #2	5/11 – 9/11	57	Variable tidal condition (high, incoming and ebbing tides)	94.5 - 12 hours
Dry event #2	26/09 – 27/09	0	Low and ebbing tides	NA
Wet event #3	10/11 – 14/11	12.4	Variable tidal condition (high, incoming and ebbing tides)	15.3 - 4 hours
2024 - 2025				
Wet event #1	5/04 – 9/04	164.8	Variable tidal condition (high, ebb, runout and low tide)	649.2* - 64.7 hours
Dry event #1	24/05	0	High tides	NA
Wet event #2	27/09 – 1/10	31.8	Variable tidal condition (low and ebbing tides)	18.7^ – 11.5 hours
Dry event #2	6/08	0	High tides	NA
Wet event #3	30/11 – 4/12	89.4	Variable tidal condition (incoming, high and ebb)	54.2*^ – 23.8 hours
Dry event #3	31/09	0	High tides	NA
Wet event #4	16/01 – 20/01	56.3	Variable tidal condition (incoming, low, high and runout tide)	59.2*^ - 23.5 hours
Dry event #4	28/02	0	High tides	NA

* Intermittent overflows - during sampling, a second overflow occurred after a gap of >1 day from when the previous overflow ceased.

^ Overflow started the day prior to the first event date.

3.2 ERS effluent quality

Summary statistics for concentrations measured in ERS effluent within the network prior to discharge during the 2020, 2023 and 2024 monitoring periods are displayed in Table 5 and plots from Figure 5 to Figure 10. Comparison of analyte concentrations have not been made with schedule 2 or ANZG/ANZECC guidelines as these are intended for measuring impact within waterbodies and application to ERS effluent quality does not consider dilution from upstream flows or tidal flushing.

ERS discharge volumes are calculated as the cumulative volume from four gauges (IDs:802063, 802064, 802065 & 802310) (Figure 4). Rainfall is measured from Sydney Airport meteorological station ID:066037. The average discharge volume and rainfall corresponding to overflow event sampling is presented below:

- 2020: Average 35mm rainfall, average 253.2 ML discharge
- 2023: Average 26mm rainfall, average 39.8 ML discharge
- 2024: Average 59mm rainfall, average 195.3 ML discharge

ERS median effluent concentrations decreased in 2024 from the 2020 monitoring period except for PFOS, chlorophyll-α and sulphide. There are multiple factors and complexity that would determine wastewater quality (concentrations and presence) at the time that samples are collected. This would include but not be limited to the scale of rainfall event, stormwater inflow and infiltration, nature of ERS operation (syphon vs gravity), time of day, sediment/silt bed load within the network and when in an overflow event samples are collected (first pulse to tail end).

ERS median effluent concentrations of PFOS, *Enterococci*, nonylphenol ethoxylate and biochemical oxygen demand increased in 2024 from the 2023 monitoring period. However, only one ERS effluent sample could be collected during the 2023 monitoring period as sampled events were shorter and discharge had mostly ceased by the time field staff could get to the site.

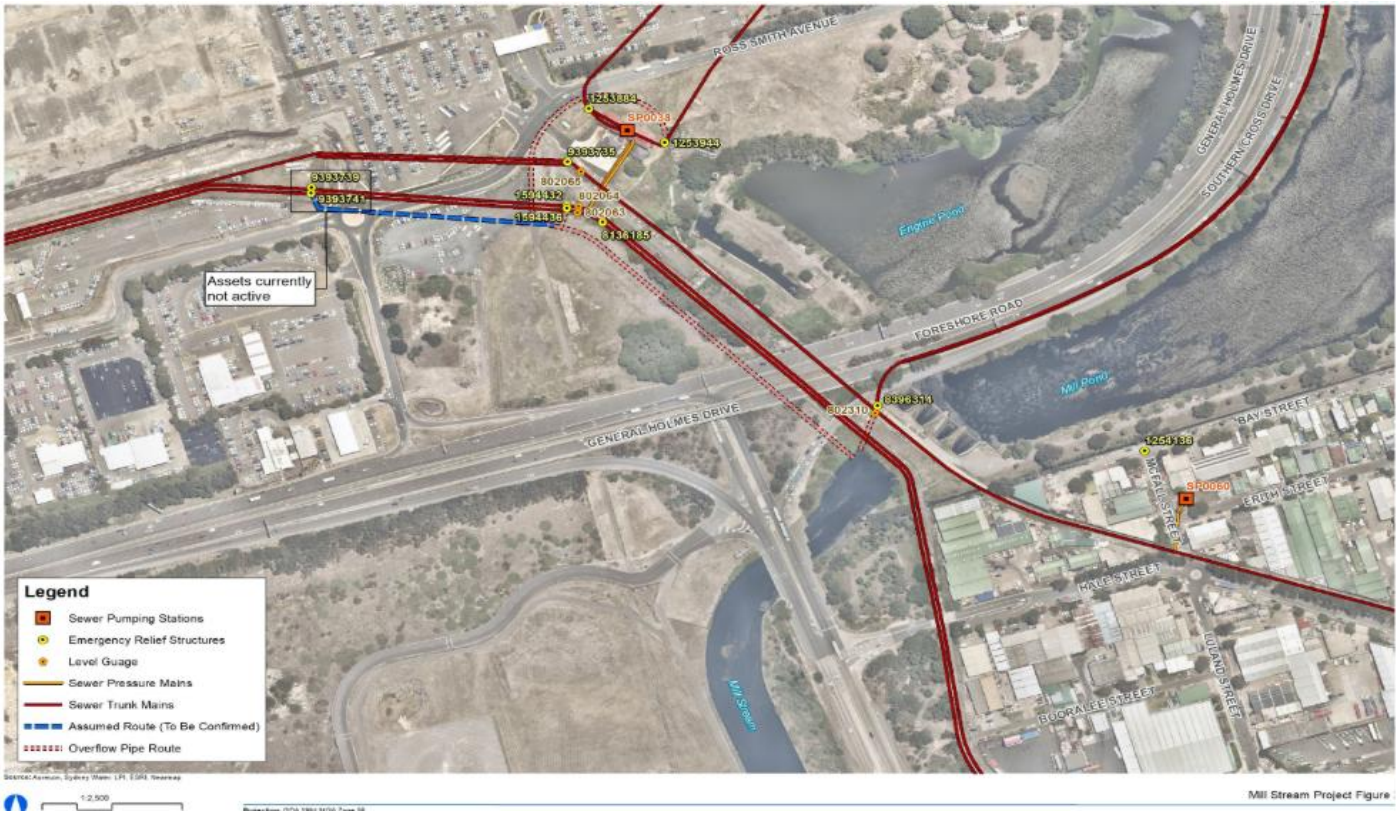


Figure 4 Location of key wastewater assets at Mill Stream, including gauged overflows

Table 5 ERS summary statistics for monitored events

	2020				2023*				2024		
Analyte	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
PFAS												
PFOA (335-67-1) [µg/L]	5	**<0.01**	<0.01	0.01	1	**0.01**	0.01	0.01	4	**<0.01**	<0.01	0.02
PFOS (1763-23-1) [µg/L]	5	**<0.05**	<0.05	<0.05	1	**<0.02**	<0.02	<0.02	4	**0.03**	<0.02	0.24
Bacteriology												
Enterococci [CFU/100mL]	5	**2100000**	1200000	3800000	1	**1000000**	1000000	1000000	5	**830000**	100000	970000
Faecal Coliform [CFU/100mL]	5	**6300000**	3700000	12000000	1	**1000000**	1000000	1000000	5	**1000000**	100000	7000000
Chlorophyll												
Chlorophyll - a [µg/L]	5	**1.1**	0.4	1.6	-	**-**	-	-	5	**3.2**	1.3	20.67
Metals												
Total Copper [µg/L]	5	**89.4**	66.8	111	1	**96.8**	96.8	96.8	5	**54.5**	24.9	89.6
Total Lead [µg/L]	5	**10.5**	7.32	11.8	1	**10.6**	10.6	10.6	5	**4.9**	4	20.9
Total Mercury [µg/L]	5	**0.03**	0.02	0.15	1	**0.14**	0.14	0.14	5	**0.03**	<0.01	0.05
Total Nickel [µg/L]	5	**3.7**	3.3	4.6	1	**4.4**	4.4	4.4	5	**2.8**	1.1	3.8
Total Silver [µg/L]	5	**<0.1**	<0.1	1.5	1	**<0.1**	<0.1	<0.1	5	**<0.1**	<0.1	0.2
Total Zinc [µg/L]	5	**146**	127	199	1	**158**	158	158	5	**103**	42	186
Nutrients												
Ammonia NH3 -N [mg/L]	4	**23.35**	18.6	24.6	1	**29.5**	29.5	29.5	5	**15.6**	6.06	35.2
Ammonium_Nitrogen [µg/L]	4	**24400**	19500	25800	1	**30500**	30500	30500	4	**25100**	6400	36300
Nitrate Nitrogen NO3-N [mg/L]	-	**-**	-	-	-	**-**	-	-	2	**0.06**	0.02	0.09
Nitrite Nitrogen NO2-N [mg/L]	-	**-**	-	-	-	**-**	-	-	2	**0.1**	0.01	0.2
Soluble Reactive Phosphorus [mg/L]	5	**2.49**	2	3.45	1	**2.72**	2.72	2.72	5	**2.16**	0.53	4.04
Total Nitrogen [mg/L]	5	**34**	33	42.9	1	**38.7**	38.7	38.7	5	**30**	9.77	41.7
Total Phosphorus [mg/L]	5	**4.45**	3.65	4.62	1	**5**	5	5	5	**2.86**	1.18	5.36
Physical Chemistry												
Conductivity [uS/cm]	5	**631**	618	709	1	**632**	632	632	4	**638**	276	1039
Dissolved Oxygen [mg/L]	5	**6.2**	2.7	7.6	1	**4**	4	4	4	**5.15**	1.2	7.8
Percent Dissolved Oxygen [%]	5	**70.6**	55.6	79.9	1	**44.6**	44.6	44.6	4	**60**	13.2	91.1
Temperature Sample [°C]	5	**17.7**	17.2	18.3	1	**21.6**	21.6	21.6	4	**23.25**	23	23.5
Total Suspended Solids [mg/L]	5	**170**	110	190	1	**190**	190	190	5	**140**	77	180
Turbidity HACH White Light [NTU]	5	**140**	94	170	1	**120**	120	120	4	**89**	39	110
pH [pH units]	5	**7.59**	7.47	7.64	1	**7.74**	7.74	7.74	4	**7.31**	7.06	7.73
Organics												
Nonylphenol ethoxylate [µg/L]	5	**658**	89	2250	1	**7**	7	7	5	**496**	114	1380
Octylphenol ethoxylate [µg/L]	5	**<5**	<5	<5	1	**<5**	<5	<5	5	**<5**	<5	14
di(2-ethylhexyl) phthalate [µg/L]	5	**<10**	<10	<10	1	**<10**	<10	<10	5	**<10**	<10	<10
Other												
BOD5 [mg/L]	5	**230**	190	310	1	**150**	150	150	5	**160**	62	190
Oil & Grease [mg/L]	5	**26**	11	53	1	**30**	30	30	5	**16**	9	31
Sulphide [µg/L]	5	**50**	<30	156	1	**265**	265	265	5	**158**	63	246

*Only one ERS sample was obtained during the 2023 monitoring period as discharges had generally ceased by field sampling arrival to site.

- no monitoring results available.

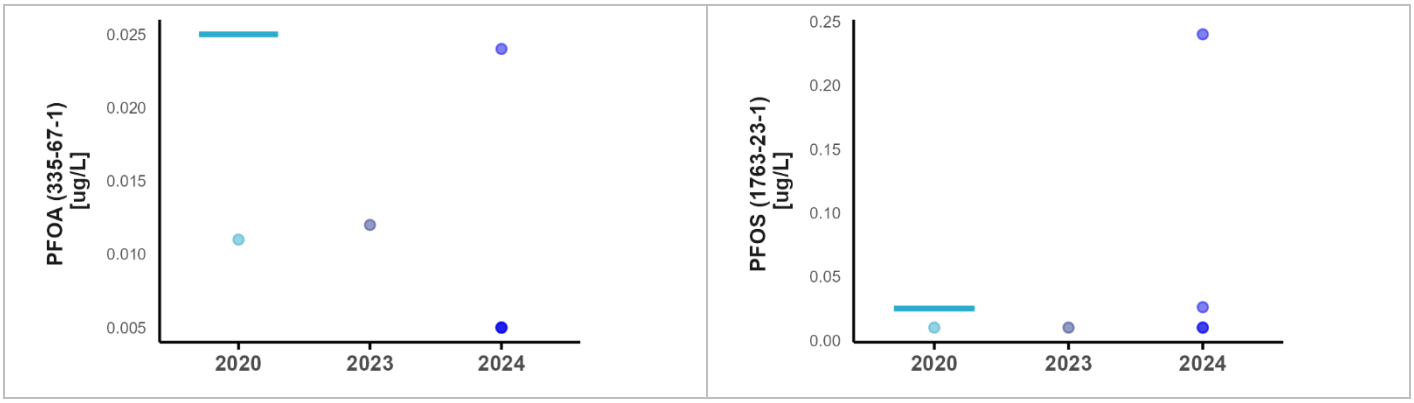


Figure 5 PFAS concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

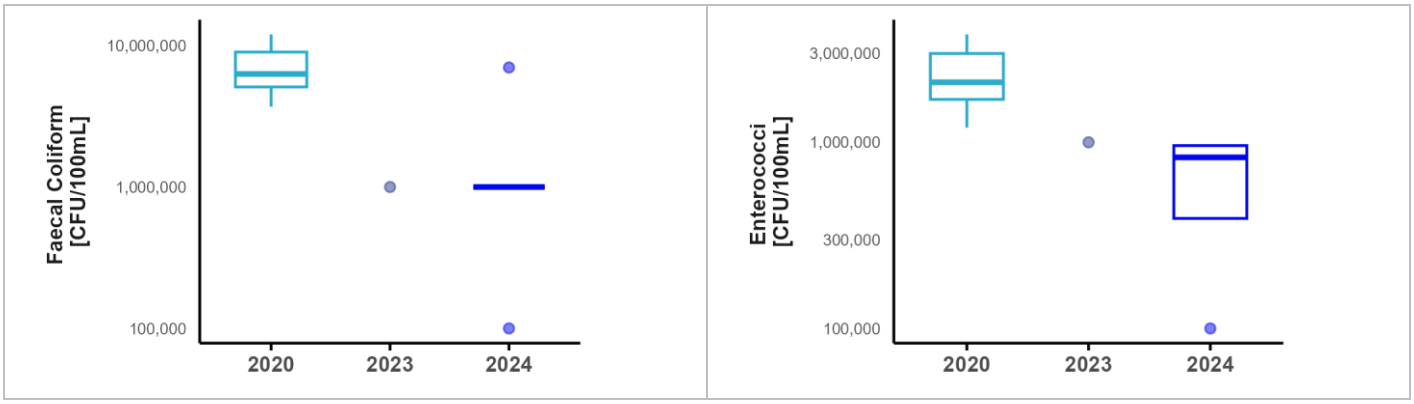


Figure 6 Bacteriological concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

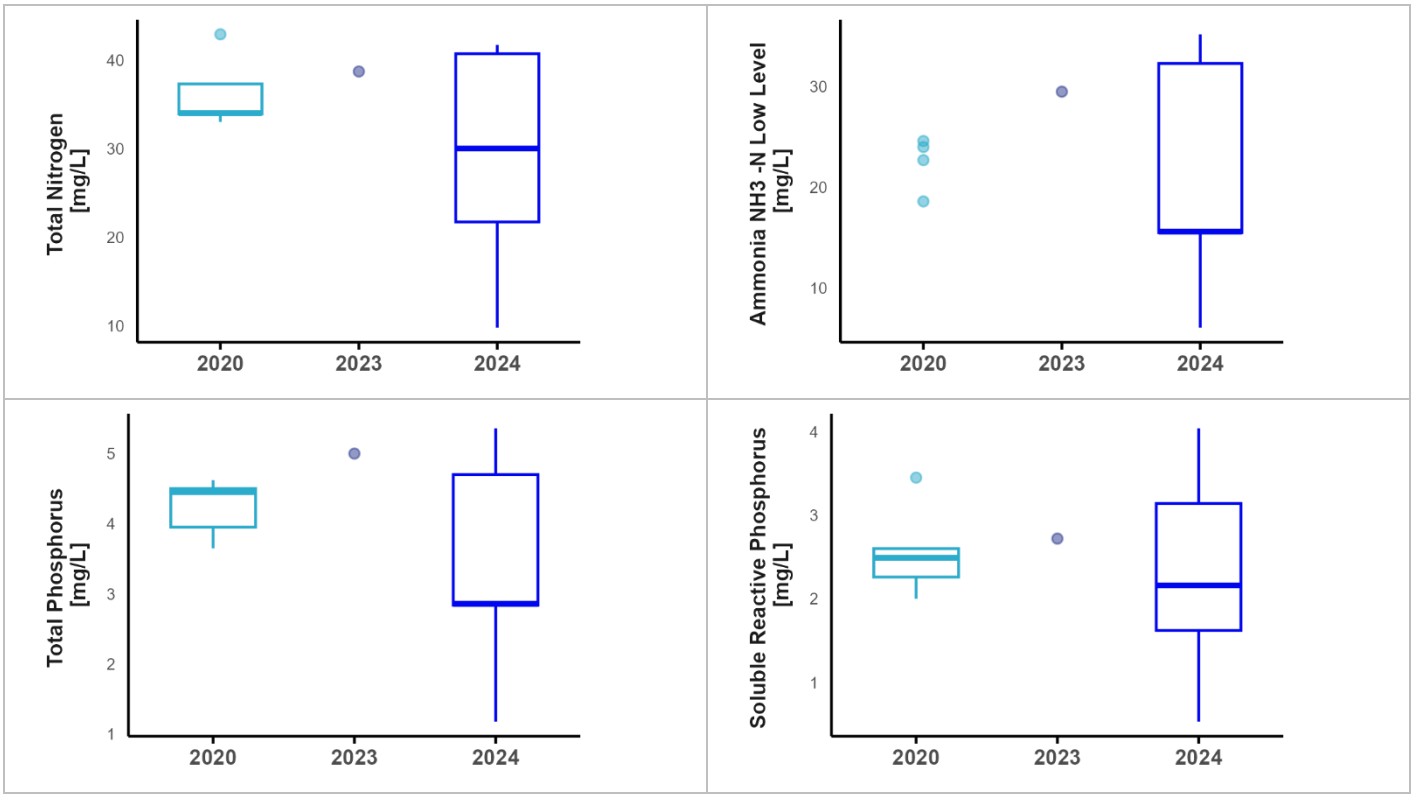


Figure 7 Nutrient concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

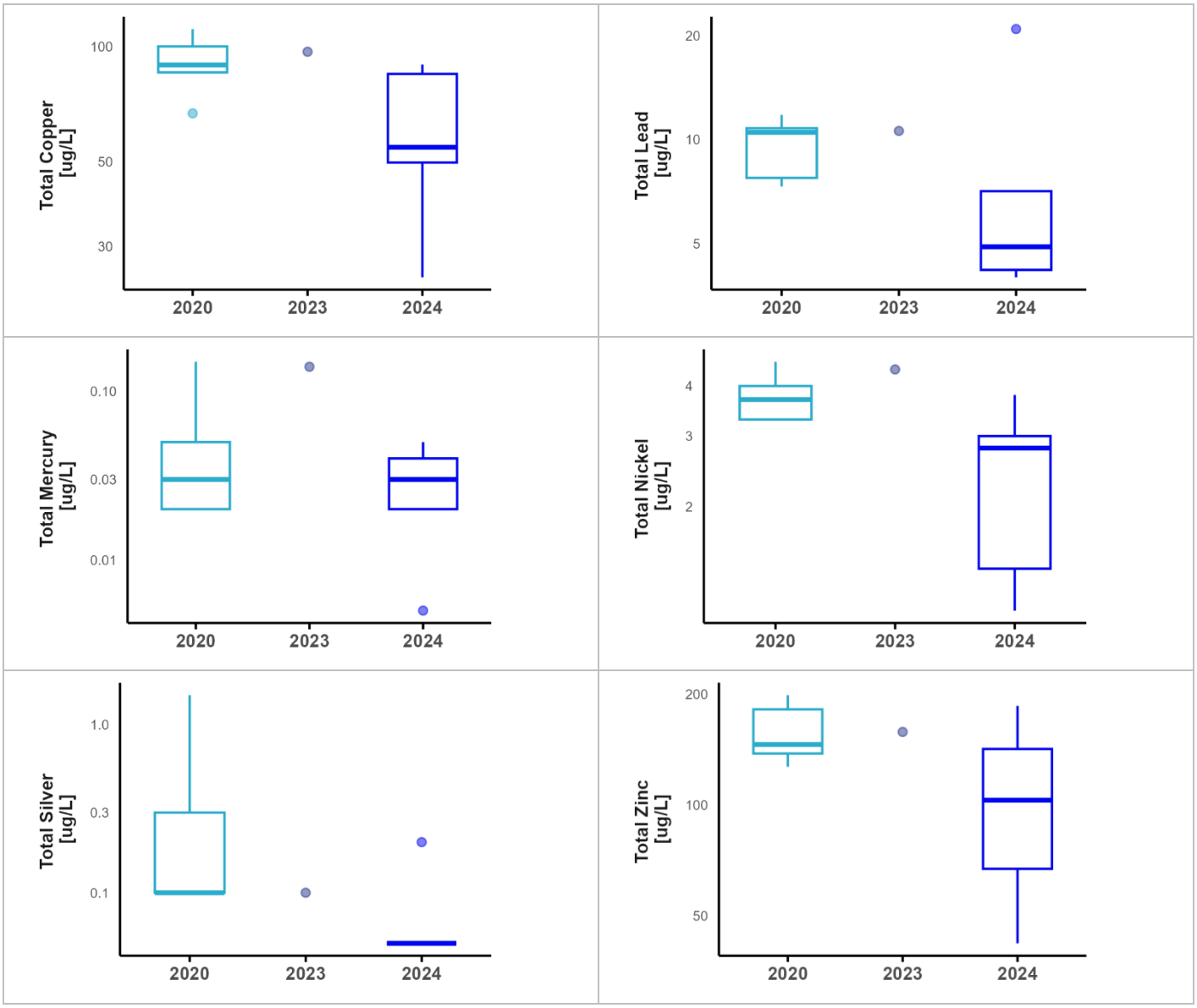


Figure 8 Metal concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

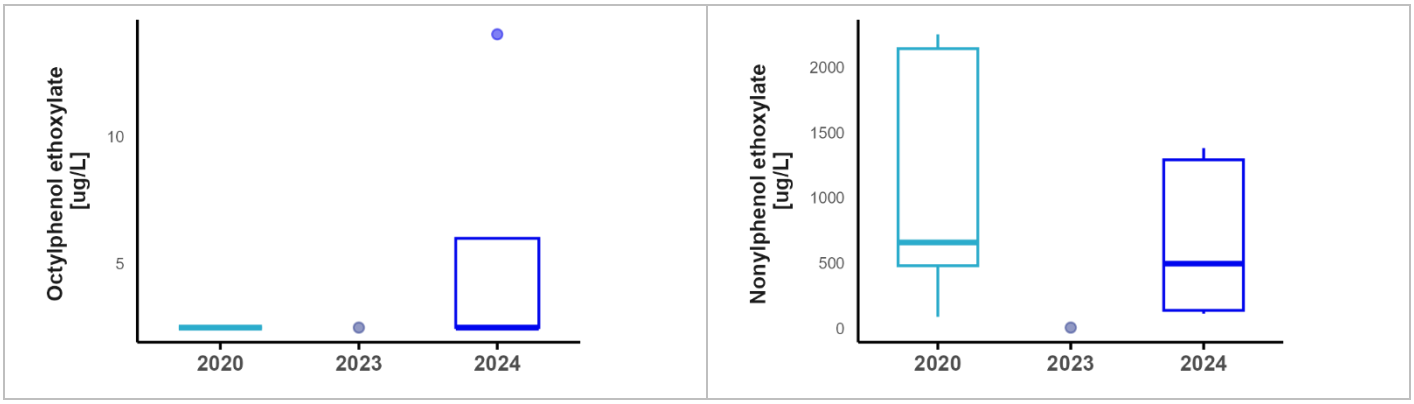


Figure 9 Surfactant concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

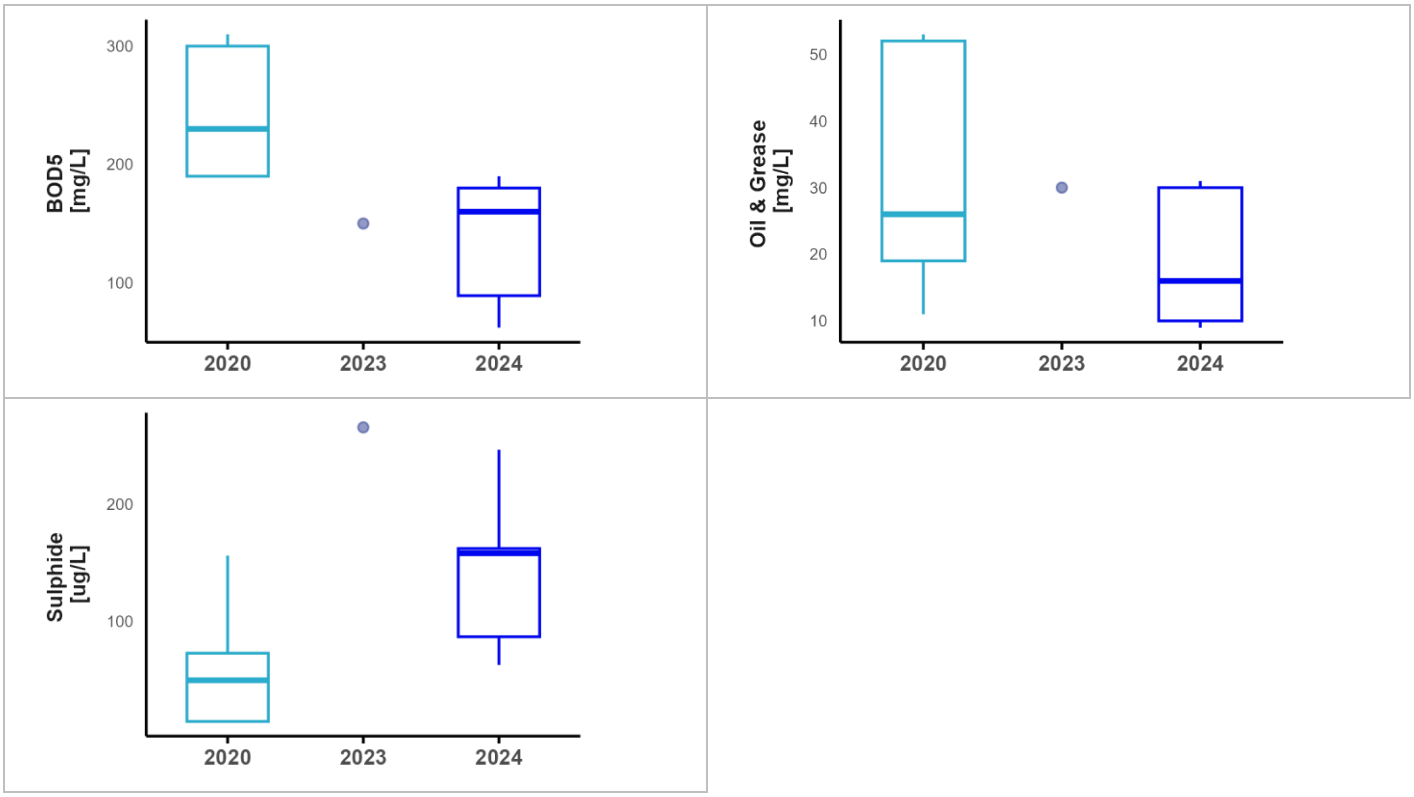


Figure 10 Additional concentrations recorded in ERS discharges from 2020, 2023 and 2024 monitoring periods

3.3 Receiving water quality

3.3.1 General observations

General observations are required when the Field Sampling Team visits each site to collect samples. These observations include odour, scum, visual pollution (with site photos), fauna and any other general comments of relevance.

Scum and visual pollution were given a rating from 0 to 3 (0 = not present, 1 = low, 2 = moderate, 3 = high). For reporting purposes, scores of 1 or above are considered as present and are summarised in Table 6 and Table 7. Visual turbidity assessment data was recorded through general comments that describe different levels of turbidity. Any mention of turbidity was captured and summarised in the tables below.

For summary Table 6 and Table 7, the sampling sites were grouped per event and if one or more sites noted a particular observation, it was counted as present for that event. Field observations can be subjective and may vary between samplers.

Table 6 Summary of Dry event general observations. "-" indicates no record.

Sampling event	Sampling dates	Odour	Scum	Visual Pollution	Turbid or clear
Dry Event 1	24/05/2024	Present (MSFR)	-	Present	Clear
Dry Event 2	6 /09/2024	-	-	-	Turbid / Clear
Dry Event 3	31/10/2024	-	-	Present	Clear
Dry Event 4	28/02/2025	-	-	-	Clear

During Dry Event 1, a 'foul ambient odour' was observed at MSFR, accompanied by organic debris and domestic rubbish, which were likely the sources of the odour. No odour was detected at any of the other sampling sites during the event.

During overflow events in the 2024–2025 period, odour was consistently present on the first day and dissipated by the fourth day. MS1 had no recorded odour and three days of visual pollution. MSFSR observed eight days with odour including a dry event and 12 instances of visual pollution. MS4 recorded 10 instances of visual pollution and five occurrences of odour. MSRW experienced only one day of odour on 5/04.

Table 7 Summary of overflow event general observations in days. "-" no data measured.

Sampling event	Sampling dates	Odour	Scum	Visual Pollution	Turbid
Overflow Event 1	5/04/2024 – 9/04/2024	4 days	-	-	5 days
Overflow Event 2	27/09/2024 – 1/10/2024	1 day	1 day	4 days	3 days
Overflow Event 3	30/11/2024 – 4/12/2024	2 days	5 days	5 days	2 days
Overflow Event 4	16/01/2025 – 20/01/2025	3 days	2 days	4 days	5 days

3.3.2 Receiving water monitoring results

Per- and poly-fluoroalkyl substances (PFAS)

The unique properties of PFAS have led to its wide usage for many decades, it is also highly resistant to physical, chemical and biological degradation. As there are no schedule 2 limits for PFAS isomers, NEMP 3.0 PFOA species protection guidelines (SPG) and ANZG PFOS default guideline values (DGVs) have been used from Table 1 and Table 2.

Summary statistics for PFAS concentrations in the receiving water is displayed in Table 8, including the 80, 90, 95 and 99% SPG's. As DGVs do not account for bioaccumulation, ANZG recommends applying the 99% DGV for PFOS in slightly-to-moderately disturbed ecosystems to consider higher trophic level organisms likely at greater risk. Comparisons of median concentrations within Table 8 have been made to higher guideline values owing to the bioaccumulation risk.

Median PFOA concentrations were below the NEMP 3.0 99% SPG of 19 µg/L at all receiving water sites in all conditions and monitoring periods.

The PFOS 99% ANZG DGV of 0.0091 µg/L is below the laboratory LOR of 0.05 (2020) and 0.02 µg/L (2023 and 2024) that has been used for sample analysis from the three monitoring periods, this has limited assessment against that DGV. However, MSFSR and MSNFB median concentrations were above the 99% ANZG DGV for most sampling periods and conditions. Median PFOS concentrations were below the ANZG 95% DGV of 0.48 µg/L at all receiving water sites in dry weather and the three wet weather periods. The maximum PFOS concentration recorded was 0.46 µg/L in dry weather at MSFSR, below the ANZG 95% DGV.

Table 8 Summary PFAS concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
PFOA (335-67-1) [µg/L] NEMP 3.0: 80%:1824, 90%:632, 95%:220, 99%:19																
MS1	15	**<0.05**	<0.01	<0.05	15	**<0.01**	<0.01	0.01	20	**<0.01**	<0.01	0.01	12	**<0.01**	<0.01	0.01
MSFSR	15	**<0.05**	<0.05	<0.05	15	**0.01**	<0.01	0.03	20	**<0.01**	<0.01	0.01	12	**0.01**	<0.01	0.02
MSNFB	15	**<0.05**	<0.05	<0.05	15	**<0.01**	<0.01	0.01	20	**<0.01**	<0.01	0.03	12	**<0.01**	<0.01	0.01
MS4	15	**<0.05**	<0.05	<0.05	15	**<0.01**	<0.01	<0.01	20	**<0.01**	<0.01	<0.01	12	**<0.01**	<0.01	<0.05
MSRW	15	**<0.05**	<0.05	<0.05	15	**<0.01**	<0.01	<0.01	20	**<0.01**	<0.01	<0.01	12	**<0.01**	<0.01	0.02
PFOS (1763-23-1) [µg/L] ANZG: 80%:17, 90%:2.7, 95%:0.48, 99%:0.0091																
MS1	15	**<0.05**	<0.05	0.04	15	**0.03**	<0.02	0.08	20	**0.02**	<0.02	0.05	12	**0.05**	<0.05	0.08
MSFSR	15	**<0.05**	<0.05	0.21	15	**0.24**	0.03	0.34	20	**0.07**	<0.02	0.17	12	**0.13**	0.09	0.46
MSNFB	15	**0.08**	<0.05	0.15	15	**0.09**	<0.02	0.24	20	**0.05**	<0.02	0.20	12	**0.08**	<0.05	0.28
MS4	15	**<0.05**	<0.02	0.16	15	**<0.02**	<0.02	0.12	20	**0.04**	<0.02	0.13	12	**<0.02**	<0.02	0.12
MSRW	15	**<0.05**	<0.02	0.05	15	**<0.02**	<0.02	0.07	20	**<0.02**	<0.02	0.07	12	**<0.02**	<0.02	0.37

Note: ANZG DGV or NEMP SPG 99% exceeded

Bacteriological

Faecal coliforms (FC) and *Enterococci* (Ent) bacteria are the most common biological indicators used to assess water quality to inform human health risk. The presence of faecal coliforms and Enterococci in water may indicate the presence of more harmful pathogens, like enteric viruses or protozoa such as Cryptosporidium or Giardia. Stormwater and wastewater overflows are common sources of FC and Ent in urban waters (Marsalek & Rochfort, 2004; Soller et al, 2015). Schedule 2 defines an adverse effect because entry of a substance into waters when:

a. *median faecal coliform count is above 150 CFU, or*
b. *more than 20% of 5 samples taken at regular intervals in a month exceed 600 CFU*

ANZG guidelines for recreational water quality recommend applying 150 CFU/100 mL FC count and 35 CFU/100 mL Ent as threshold to primary contact waterways (PCW) suitable for activities such as swimming. Secondary contact waterways (SCW) such as boating and kayaking bacteriological thresholds are 1,000 FC and 230 Ent CFU/100 mL. Recreational water quality guidelines have been developed with the intent of providing an indication of risk swimmers or other water users may have in developing an illness from contact with the water, applying site specific guidelines related to waterway use. Applying this risk-based approach to the monitoring locations based on public use or restriction; MS4 would likely be defined as primary contact owing to its proximity to Foreshore Beach while MSRW likely a secondary contact zone, due to extensive recreational boating use.

Summary statistics for bacteriological results and comparisons to ANZG guidelines are presented in Table 9. Accompanying FC and Ent analyte boxplots are displayed in Figure 11 and Figure 12.

In dry weather median faecal and Ent counts at MS1, MS4 and MSRW were below primary waterway guidelines, while MSFSR and MSNFB were between PCW and SCW guidelines.

In wet weather, median concentrations for FC and Ents were above schedule 2 and ANZG PCW guidelines at all sites in 2024. SCW guidelines were exceeded at all sites downstream of the Mill Stream ERS, except Ents counts at MSRW.

Table 9 Summary bacteriological concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry		
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Enterococci [CFU/100mL] ANZECC primary: 35, secondary: 230																
MS1	15	**84**	2	5000	15	**14**	<1	4300	20	**45.5**	4	11000	12	**8**	<1	8900
MSFSR	15	**3000**	430	650000	15	**3000**	110	500000	20	**3050**	320	250000	12	**210**	15	5200
MSNFB	15	**2800**	380	160000	15	**1100**	11	260000	20	**735**	43	570000	12	**70**	10	670
MS4	15	**3400**	60	170000	15	**19**	<1	55000	20	**1400**	20	240000	12	**5**	<1	520
MSRW	15	**2700**	24	310000	15	**<1**	<1	590	20	**98.5**	<1	33000	12	**<1**	<1	3
Faecal Coliform [CFU/100mL] ANZECC primary: 150, secondary: 1000																
MS1	15	**110**	15	4100	15	**65**	15	5900	19	**470**	43	18000	12	**37.5**	5	300
MSFSR	15	**28000**	4400	5400000	15	**3500**	110	1000000	20	**12000**	2300	1000000	12	**600**	20	5200
MSNFB	15	**50000**	1900	630000	15	**3500**	17	1000000	20	**85500**	1400	1100000	12	**220**	20	3900
MS4	15	**80000**	860	640000	15	**68**	<1	100000	20	**74000**	460	1100000	12	**5.5**	<1	3100
MSRW	15	**35000**	10	1000000	15	**12**	<1	22000	20	**11150**	48	1000000	12	**<1**	<1	14

Note: ANZG PCW exceeded, ANZG SCW exceeded

Comparing results spatially, both FC and Ent results are consistent with there being a source of bacteriological contamination between sites MS1 and MSFSR. Untreated effluent has FC and Ent concentration of ~10,000,000 CFU, indicating that the Mill Stream ERS is the predominant source of the observed bacteriological counts. While counts are significantly lower in dry weather

when the ERS isn't active, a similar trend is observed. It is possible that other sources of contamination occur and reduced tidal flushing in upper Mill Stream results in elevated counts.

Bacteriological results for downstream waters in 2024 resemble data obtained from 2020. There was a notable decrease in bacteriological counts in 2023. Comparison of average rainfall and ERS discharge volumes across the three monitoring periods suggest that the lower counts in 2023 were reflective of lower overflow volumes and rainfall during monitoring.

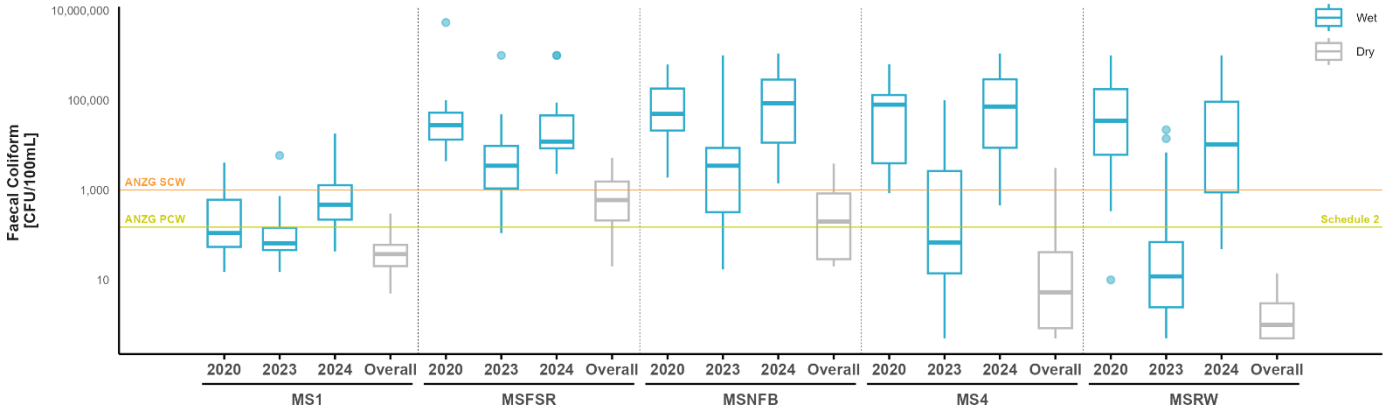


Figure 11 Faecal coliform counts at Mill Stream waterway sites

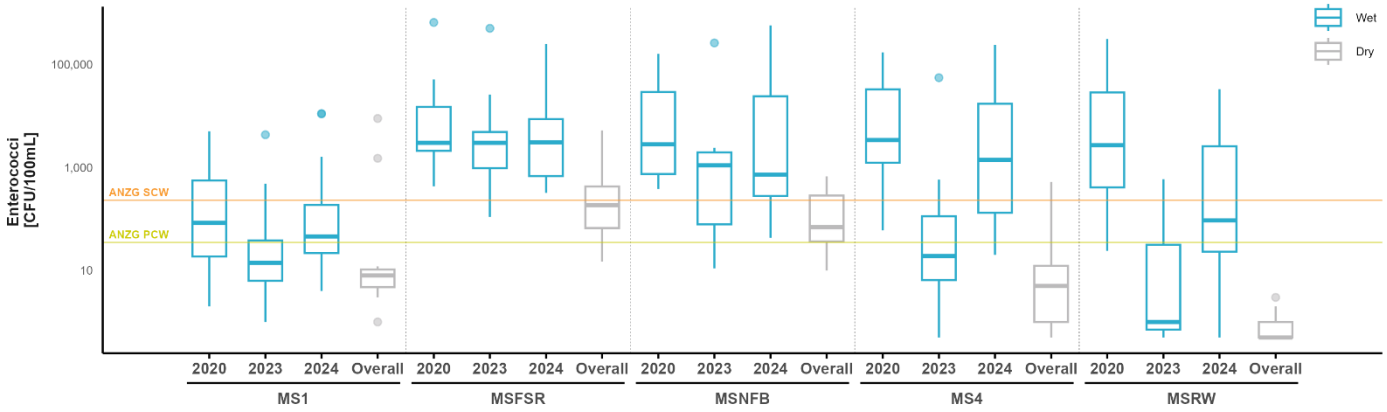


Figure 12 *Enterococci* counts at Mill Stream waterway sites

Nutrients

Nitrogen and phosphorus are the key essential nutrients required for the growth of photosynthetic organisms such as weed or algae and can enter waterways from geological sources, controlled or uncontrolled discharges, urban runoff, agricultural run-off and submarine groundwater discharge (Weinstein et al 2011). As nitrogen availability often limits the primary productivity of many ecosystems, large changes in the availability of nitrogen can lead to severe alterations of the nitrogen cycle in ecosystems. Likely activities relevant to significantly impacting the nitrogen cycle in the Mill Stream are ammonification from wastewater discharges and runoff of nitrogen-based fertilizers both increasing the amount of biologically available nitrogen. While ammonia is attributed to toxicity, nitrification as described in the nitrogen cycle is the process of converting ammonia to nitrite then to nitrate and can lead to an increase in biotic growth potentially causing eutrophication (Bernhard 2010).

The drainage basin contributing to Mill Stream covers Botany, Mascot, Randwick and Kensington with Centennial Parklands at the furthest edge. It is expected fertilisers, animal waste, sediments, organic material, roadways and vehicular biproducts originating from stormwater would routinely attribute to nutrient loads in addition to periodic wet weather discharges from the Mill Stream ERS. Nitrogen and phosphorus actors give an indication as to availability of nutrients in the water column, potentially leading to eutrophic conditions.

Summary statistics for nitrogen based nutrient analytes and comparisons to respective guidelines are presented in Table 10. Accompanying total nitrogen, ammonia, ammonium, nitrite and nitrate boxplots are displayed from Figure 13 to Figure 17.

Table 10 Summary nitrogen based nutrient concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry		
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Total Nitrogen [mg/L] - ANZG default trigger: 0.3																
MS1	15	**0.92**	0.72	1.08	15	**0.64**	0.43	0.86	20	**0.92**	0.61	1.16	12	**0.84**	0.44	1.84
MSFSR	15	**1.82**	0.57	18.7	15	**0.81**	0.47	13.7	20	**1**	0.62	3.96	12	**0.79**	0.49	1.32
MSNFB	15	**1.34**	0.63	5.54	15	**0.55**	0.25	11.3	20	**1.04**	0.28	10.8	12	**0.52**	0.32	1.14
MS4	15	**1.14**	0.27	5.93	15	**0.24**	0.2	4.92	20	**0.9**	0.29	6.42	12	**0.23**	0.15	0.42
MSRW	15	**1.01**	0.18	6.53	15	**0.21**	0.17	0.62	20	**0.5**	0.21	2.11	12	**0.19**	0.13	0.3
Ammonia NH3-N [mg/L] - ANZG trigger values for marine water species protection: 80%:1.7, 90%:1.2, 95%:0.91, 99%:0.5																
MS1	11	**0.08**	0.04	0.12	15	**<0.01**	<0.01	0.24	20	**0.07**	<0.01	0.19	12	**<0.01**	<0.01	0.06
MSFSR	11	**0.16**	0.1	1.58	15	**0.16**	0.06	9.89	20	**0.14**	0.03	2.47	12	**0.14**	<0.01	0.53
MSNFB	11	**0.54**	0.11	3.82	15	**0.11**	<0.01	8.09	20	**0.31**	<0.01	7.54	12	**0.12**	0.02	0.37
MS4	11	**0.73**	0.03	3.22	15	**0.02**	<0.01	3.59	20	**0.25**	<0.01	4.57	12	**<0.01**	<0.01	0.17
MSRW	11	**0.58**	0.02	4.24	15	**0.02**	<0.01	0.2	20	**0.12**	<0.01	1.16	12	**<0.01**	<0.01	0.02
Ammonium-Nitrogen [µg/L] –Schedule 2: 5 / ANZG default trigger: 15																
MS1	11	**84**	42	126	15	**11**	5	253	19	**73**	5	201	12	**16**	5	61
MSFSR	11	**170**	105	1662	15	**170**	63	10387	19	**150**	31	2593	12	**150**	11	557
MSNFB	11	**570**	115	4022	15	**120**	5	8506	19	**380**	5	7924	12	**120**	20	389
MS4	11	**770**	31	3376	15	**20**	10	3779	19	**320**	5	4739	12	**15**	5	173
MSRW	11	**600**	20	4447	15	**20**	10.	206	19	**130**	5	1216	12	**10**	5	20

	2020				2023				2024				Overall Dry			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Nitrite Nitrogen NO_2-N [mg/L]																
MS1	-	-	-	-	-	-	-	-	15	**0.008**	0.002	0.020	4	**0.009**	0.003	0.016
MSFSR	-	-	-	-	-	-	-	-	15	**0.011**	0.005	0.024	4	**0.006**	0.002	0.020
MSNFB	-	-	-	-	-	-	-	-	15	**0.013**	<0.001	0.121	4	**0.004**	0.003	0.032
MS4	-	-	-	-	-	-	-	-	15	**0.008**	<0.001	0.066	4	**0.002**	<0.001	0.014
MSRW	-	-	-	-	-	-	-	-	15	**0.003**	<0.001	0.014	4	**<0.001**	<0.001	0.002
Nitrate Nitrogen NO_3-N [mg/L] –Schedule 2: 0.01																
MS1	-	-	-	-	-	-	-	-	15	**0.14**	0.02	0.53	4	**0.26**	<0.01	0.8
MSFSR	-	-	-	-	-	-	-	-	15	**0.22**	0.05	1.07	4	**0.12**	0.02	0.39
MSNFB	-	-	-	-	-	-	-	-	15	**0.10**	0.01	0.48	4	**0.07**	0.02	0.27
MS4	-	-	-	-	-	-	-	-	15	**0.08**	<0.01	0.36	4	**0.02**	<0.01	0.16
MSRW	-	-	-	-	-	-	-	-	15	**0.06**	<0.01	0.12	4	**<0.01**	<0.01	<0.01

Note: Schedule 2 exceeded, ANZG default trigger or 90% SPG exceeded

Total nitrogen

Total nitrogen is the sum of all nitrogen-based actors primarily ammonia (NH3), nitrates (NO3), nitrite (NO2) and nitrous oxides (NxO). The schedule 2 total nitrogen freshwater limit is 0.1 mg/L and there is no specified marine limit. The ANZG default trigger value for south-east Australian estuarine waters is 0.3 mg/L and 0.35 mg/L for lowland rivers in NSW.

Median concentration values for total nitrogen have exceeded the respective ANZG default trigger values at MS1, MSFSR and MSNFB in each of the three wet weather monitoring campaigns and in encompassing dry weather. MS4 and MSRW was below the ANZG default trigger value in dry weather and during 2023 in wet weather. The highest total nitrogen median and maximum concentrations were observed at site MSFSR in 2020 and 2023, however in 2024 this occurred at MSNFB.

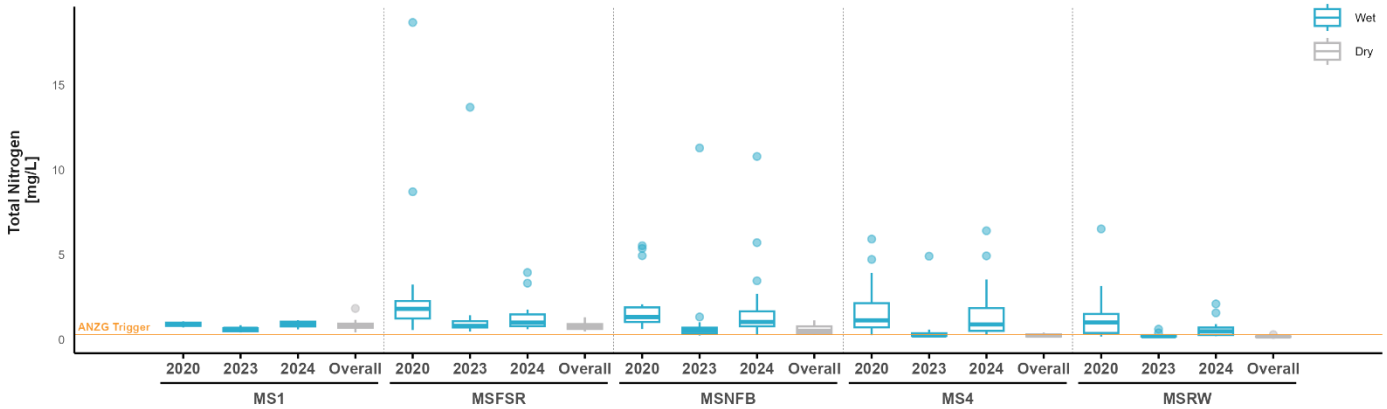


Figure 13 Total nitrogen concentration at Mill Stream waterway sites

Ammonia and ammonium

The term ‘ammonia’ refers to two chemical species of ammonia that are in equilibrium in water: the un-ionised ammonia, NH_3, and the ionised ammonium ion, NH_4^+. The proportion of the two chemical forms in water varies with the physico-chemical properties of the water, particularly pH and temperature.

The schedule 2 ammonium limit is 5 µg/L for estuarine and coastal waters while ANZG has set a default trigger limit of 15 µg/L. ANZG additionally lists a 95% species protection marine trigger value for total ammonia-nitrogen of 0.91 mg/L (0.910 µg/L) based on toxicity of ammonium at a calculated pH of 8.0. These comparatively low limits of ammonium to ammonia is representative of the greater toxicity unionised ammonia possesses and the ionisation pH equilibrium in relevant aquatic environments displayed in Table 11.

Table 11 ANZG 95% marine species protection for total ammonia-N at varying pH

pH	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5
NH_3-N (µg/L)	3910	3560	3200	2840	2490	2150	1850	1560	1320	1100	910	750	620	510	420	350

Total ammonia

Median total ammonia concentrations at all sites in dry weather were below the ANZG 95% species protection level of 0.91 mg/L based on a pH of 8.0. In wet weather median total ammonia concentrations were below the ANZG 95% species protection level at all sites. Median ammonia concentrations at MS1 exceeded the schedule 2 freshwater limit of 0.02 mg/L in wet weather during 2020 and 2024.

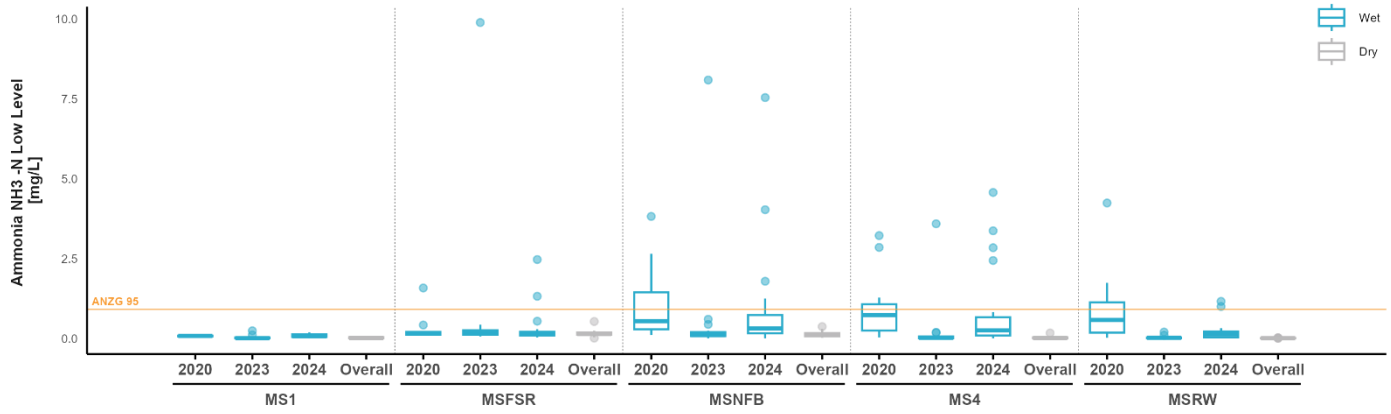


Figure 14 Total ammonia-nitrogen concentrations at Mill Stream waterway sites

Calculated ammonium

The schedule 2 marine limit for ammonium is 5 µg/L, respective ANZG default trigger values for estuarine and lowland rivers are 15 and 20 µg/L.

Median ammonium concentrations calculated from total ammonia, pH and temperature were above the schedule 2 marine limit of 5 µg/L at all sites in dry weather and wet weather. Median ammonium concentrations also exceeded estuarine ANZG default trigger MS4 and MSRW in dry weather. Median ammonium concentrations at MS1 exceeded the lowland river ANZG default trigger in wet weather during 2020 and 2024.

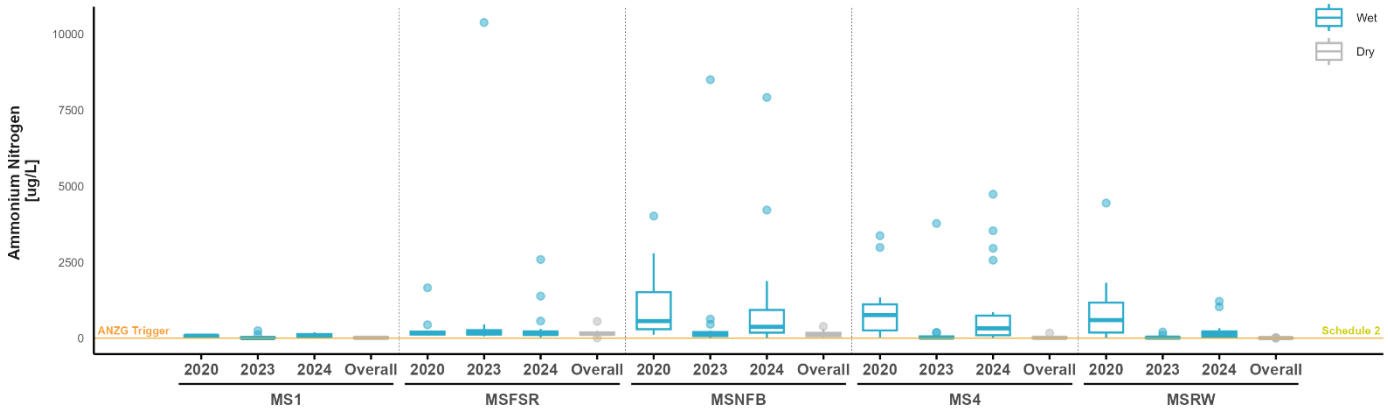


Figure 15 Calculated ammonium-nitrogen concentrations at Mill Stream waterway sites

Nitrites / Nitrates

Nitrites are the first intermediate compound in the nitrification process converting ammonia to nitrate, carried out by microorganisms known as ammonia-oxidisers. Nitrite monitoring as an analyte commenced during the 2024 monitoring period and there is no schedule 2 or ANZG limits listed for nitrite concentration in estuarine waterways. Median nitrite concentrations in dry weather were highest in the upstream, decreasing down Mill Stream. In dry weather median nitrite concentrations were found to be highest in the first two receiving water sites.

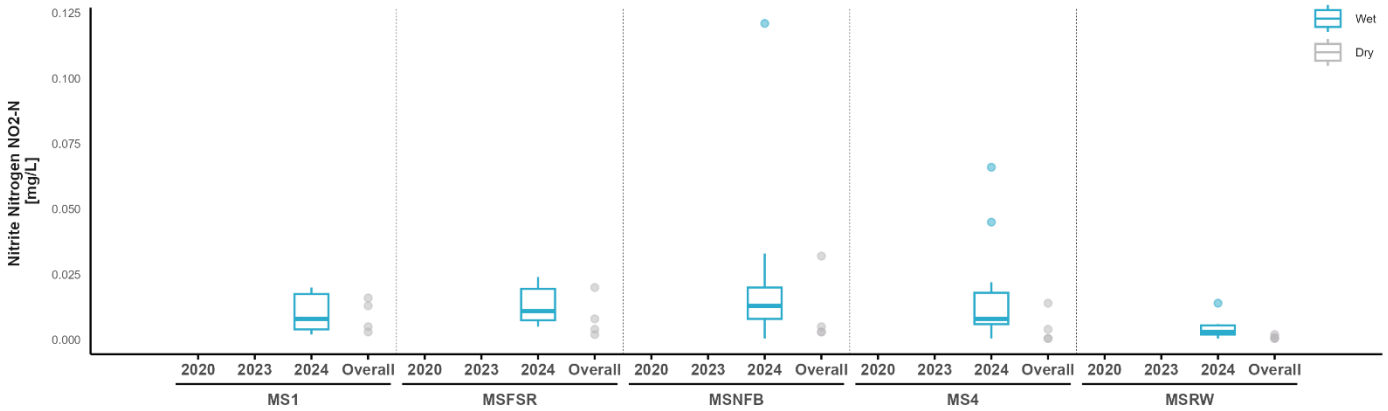


Figure 16 Nitrite concentrations at Mill Stream waterway sites

The second step in nitrification is the oxidation of nitrite to nitrate carried out by a separate group of microorganisms known as nitrite-oxidising bacteria. Nitrate monitoring as an analyte commenced during the 2024 monitoring period and the LOR is 0.01 mg/L. The estuarine schedule 2 limit for nitrate is 10 µg/L where the previous ANZECC 2000 default trigger value for nitrate (15 µg/L) was found to be erroneous and has subsequently been retracted. A recent technical brief (ANZG 2025) found nitrate toxicity in freshwater largely influenced by water hardness. For reference comparing the relative 80% and 99% DGVs, ‘soft’ (low ion concentration) freshwater is 2.3 and 0.64 mg/L, while ‘hard’ seawater (high ion concentration) is 56 and 18 mg/L respectively.

Median nitrate concentrations exceeded the schedule 2 limit at all sites in 2024 except for MSRW in dry weather. In dry weather nitrate concentrations decrease from the upstream to downstream-bay locations. This decreasing trend was also observed in median nitrate wet weather concentrations although the MSFSR had an increase from MS1.

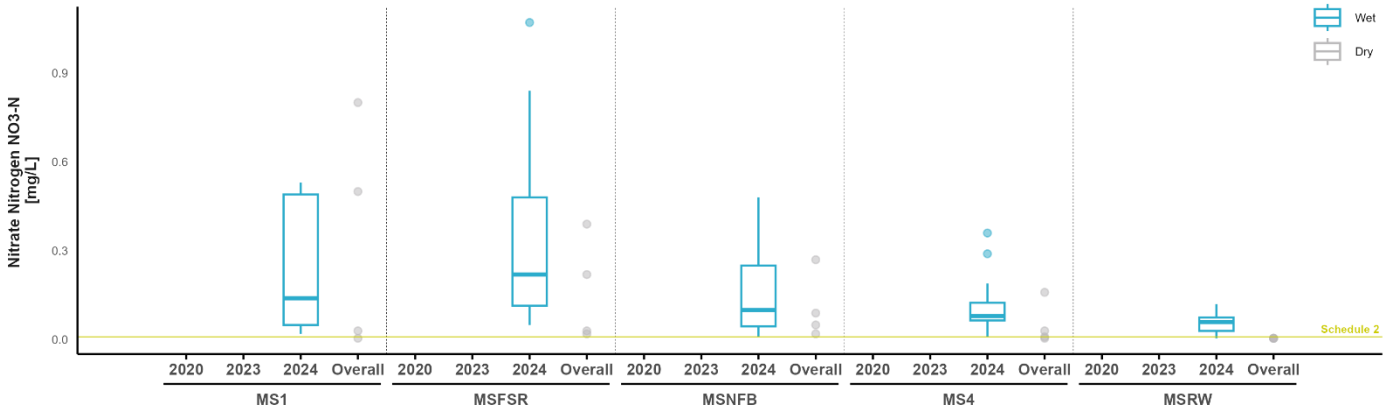


Figure 17 Nitrate concentrations at Mill Stream waterway sites

Phosphorus

The two laboratory methods of phosphorus analysis performed on samples obtained from the three monitoring periods are total phosphorus and soluble reactive phosphorus. Total phosphorus is the total content of phosphorus in an unfiltered, digested aliquot to measure the entire phosphorus element concentration as P. Soluble reactive phosphorus (SRP) is a measure of orthophosphate, the labile form of phosphorus directly used by plant cells and often attributed to eutrophication and water quality degradation (Minesota Stormwater Manual).

Summary statistics for phosphorus based nutrient analytes and comparisons to respective guidelines are presented in Table 12. Accompanying total phosphorus and SRP analyte boxplots are displayed in Figure 18 and Figure 19.

Table 12 Summary phosphorus based nutrient concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry		
Site	n	Median	Min	Max	n	Median	Min	Max	n	Median	Min	Max	n	Median	Min	Max
Total Phosphorus [mg/L] - Schedule 2: 0.005 / ANZG estuarine default trigger: 0.03																
MS1	15	**0.03**	0.02	0.04	15	**0.03**	0.01	0.04	20	**0.05**	0.02	0.11	12	**0.02**	0.01	0.09
MSFSR	15	**0.12**	0.04	2.12	15	**0.07**	0.02	1.58	20	**0.07**	0.05	0.75	12	**0.07**	0.03	0.1
MSNFB	15	**0.1**	0.03	0.52	15	**0.06**	0.02	1.17	20	**0.08**	0.04	1.22	12	**0.05**	0.03	0.09
MS4	15	**0.13**	0.02	0.53	15	**0.03**	0.02	0.48	20	**0.09**	0.02	0.6	12	**0.02**	0.01	0.04
MSRW	15	**0.07**	0.02	0.54	15	**0.02**	0.01	0.09	20	**0.04**	0.02	0.27	12	**0.02**	0.01	0.02
Soluble Reactive Phosphorus [mg/L] – ANZG estuarine default trigger: 0.005																
MS1	15	**<0.002**	<0.002	<0.002	15	**<0.002**	<0.002	<0.002	20	**<0.002**	<0.002	0.01	12	**<0.002**	<0.002	0.01
MSFSR	15	**0.02**	0.01	1.71	15	**0.02**	0.01	0.94	20	**0.02**	<0.002	0.16	12	**0.03**	0.02	0.05
MSNFB	15	**0.05**	0.01	0.33	15	**0.02**	<0.002	0.66	20	**0.03**	<0.002	0.65	12	**0.02**	0.01	0.04
MS4	15	**0.03**	<0.002	0.26	15	**0.01**	<0.002	0.23	20	**0.02**	<0.002	0.32	12	**0.01**	<0.002	0.02
MSRW	15	**0.03**	0.01	0.32	15	**0.01**	<0.002	0.04	20	**0.02**	<0.002	0.1	12	**0.01**	<0.002	0.01

Note: Schedule 2 exceeded, ANZG default trigger or 90% SPG exceeded

The schedule 2 limit for phosphates (as P) of 0.005 mg/L in estuarine waters is assumed to encompass all phosphorus containing actors (ie total phosphorus), similar to the freshwater phosphorus limit of 0.01 mg/L. The ANZG estuarine and lowland river default trigger guidelines for total phosphorus are 0.03 and 0.05 mg/L respectively.

Total phosphorus median concentrations exceed interpreted schedule 2 limits at all sites in both weather conditions. In dry weather median total phosphorus concentrations at MSFSR and MSNFB exceeded the ANZG default trigger limit. In wet weather, median total phosphorus concentrations in receiving waters exceeded estuarine ANZG default trigger limits at all sites except MS4 and MSRW during 2023.

The ANZG default trigger for SRP is 0.005 mg/L for estuarine waters and 0.02 mg/L for lowland rivers. The LOR for SRP is 0.002 mg/L. SRP median concentrations at MS1 were below the LOR and subsequent ANZG trigger value in wet and dry conditions. SRP median concentrations at all receiving water sites exceeded the ANZG estuarine default trigger value in wet and dry weather conditions.

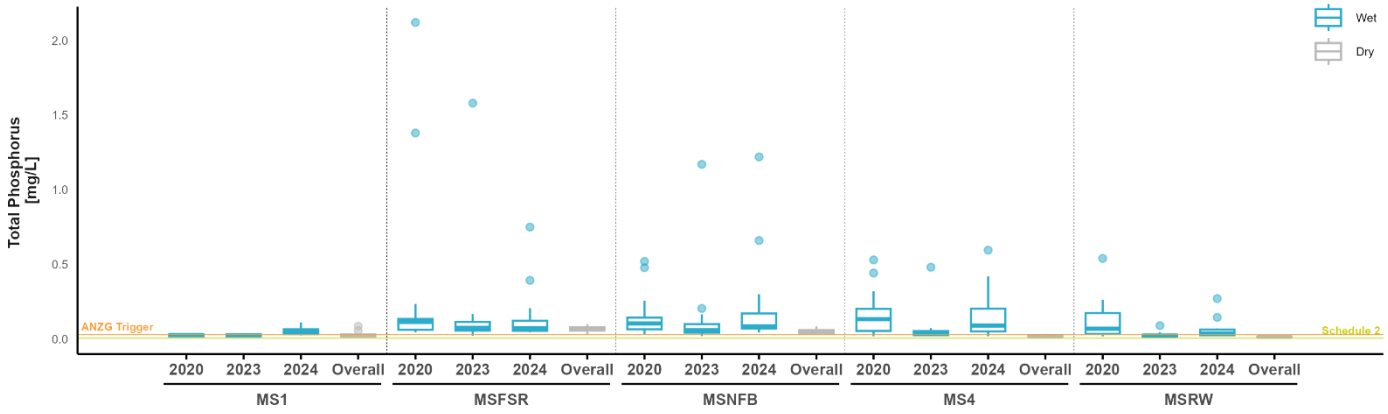


Figure 18 Total phosphorus concentrations at Mill Stream waterway sites.

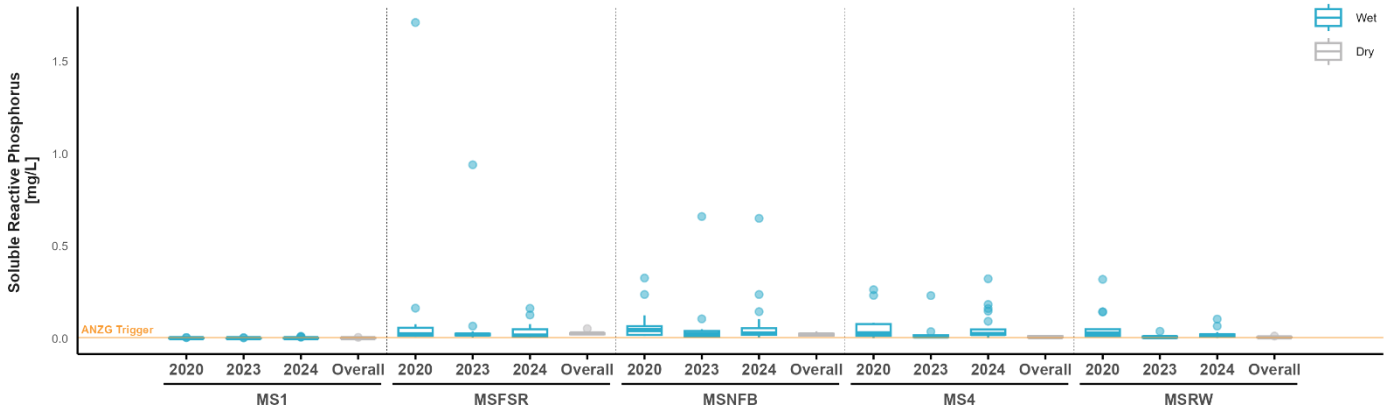


Figure 19 Soluble reactive phosphorus concentrations at Mill Stream waterway sites.

Chlorophyll–α

Nutrient monitoring is conducted as a measure of pressure input into the system. Nitrogen and phosphorus actors give an indication as to availability of nutrients in the water column, allowing biota to grow potentially causing eutrophication. Chlorophyll-a (Chl-α) is the primary photosynthetic pigment in algae and cyano-bacteria giving its green colour (Sudradjat et al, 2024). Whilst not directly a pollutant, Chl-α is used as a surrogate to measure biota concentration an indication of stress on the ecosystem leading to eutrophication. One assumption of using Chl-α as an indicator to ecosystem stress is that biota growth is a result of nutrient availability.

Summary statistics for Chl-α and comparison to relevant guidelines are presented in Table 13, with accompanying boxplot displayed in Figure 20.

The schedule 2 limit for Chl-α is 1 µg/L in estuarine waters compared to the ANZG default trigger guideline of 4 µg/L in estuaries and 3 µg/L for lowland rivers. Median Chl-α concentrations exceed the schedule 2 limit at all sites, over each monitoring period and in both weather conditions.

In dry weather the Chl-α ANZG limits are exceeded at MS1 (freshwater) and MSFSR before median concentrations at the remaining three receiving water sites drop below the 4 µg/L limit. In wet weather, 2024 median Chl-α results follow the same trend as previous periods where Chl-α concentration is highest upstream then subsequently reducing downstream, with MSRW the only site below the ANZG limit.

Table 13 Summary Chlorophyll-a concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Chlorophyll – a [µg/L] –Schedule 2: 1 / ANZG default trigger for estuaries: 4																
MS1	15	**8**	2.4	19.6	15	**8.6**	2.2	20	20	**21.59**	8.2	37.17	12	**9.15**	5	53.2
MSFSR	15	**6**	1.6	70	15	**3.3**	1.1	8.9	20	**15.86**	2.3	31.5	12	**7.58**	1.3	16.4
MSNFB	15	**3.8**	1.2	18.8	15	**2**	0.7	4.7	20	**7.06**	1.6	23.13	12	**1.75**	1.2	18.5
MS4	15	**3.2**	1.5	17.7	15	**2.2**	1.1	4.6	20	**5.59**	0.9	44.4	12	**1.9**	1.2	5.7
MSRW	15	**1.5**	0.7	3.6	15	**1.9**	1.2	4.7	20	**2.65**	0.9	76.72	12	**1.48**	0.5	6.3

Note: Schedule 2 exceeded, ANZG default trigger exceeded

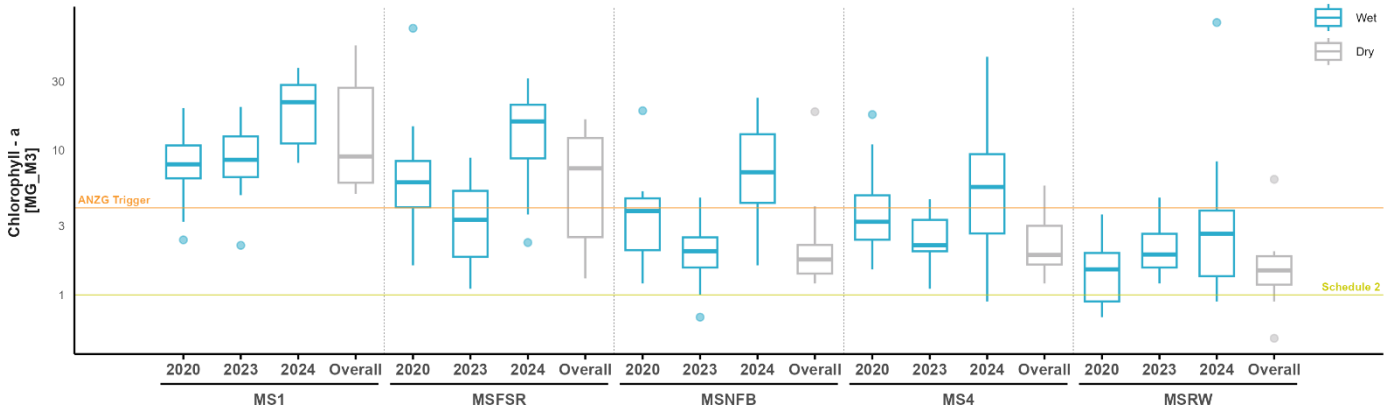


Figure 20 Chlorophyll-a concentrations at Mill Stream waterway sites

Metals

Heavy metals have the capacity to have a toxic effect on marine biota, especially in high concentration and waterways receiving anthropogenic pollution (ANZG, 2000). Domestic chemicals and biproducts, natural sediments, motor vehicles, and road dust entering the bay via stormwater and wastewater overflows are all likely sources of trace metal pollution. Studies on the sources of heavy metal pollutants in and around Sydney Harbour have shown that copper, lead and zinc are the greatest concern due their elevated concentrations and potential toxicity to marine organisms (Hatje et al, 2001, Hatje et al, 2003). Hatje et al, (2001) suggests that metals like zinc and nickel are uniform in their distribution throughout the harbour whereas copper and lead are significantly influenced by anthropogenic inputs.

Summary statistics for metal analytes and comparisons to respective guidelines are presented in Table 14. Accompanying copper, lead, mercury, nickel, silver and zinc boxplots are displayed from Figure 21 to Figure 26.

Table 14 Summary Metal concentrations at Mill Stream waterway sites

	2020				2023				2024				Overall Dry			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Total Copper [µg/L] –Schedule 2: 5 / ANZG trigger values for marine water: 80%:8, 90%:3, 95%:1.3, 99%:0.3																
MS1	15	**2.4**	1.5	3.8	15	**1.9**	1.5	4	20	**2.2**	1.7	8.4	12	**1.5**	0.7	2.4
MSFSR	15	**7.0**	2.6	95.7	15	**1.5**	0.6	27.5	20	**2.5**	1.2	23.3	12	**1.05**	<0.5	10.9
MSNFB	15	**3.7**	1.7	18.2	15	**1.3**	<0.5	17.6	20	**2.9**	<0.5	19.2	12	**0.95**	<0.5	4.2
MS4	15	**2.8**	0.7	20.1	15	**1.0**	0.6	9.2	20	**2.2**	<0.5	27.5	12	**<0.5**	<0.5	1.6
MSRW	15	**2.2**	<0.5	10.3	15	**0.7**	<0.5	1.3	20	**1.1**	0.6	2.7	12	**<0.5**	<0.5	0.9
Total Lead [µg/L] –Schedule 2: 5 / ANZG trigger values for marine water: 80%:12, 90%:6.6, 95%:4.4, 99%:2.2																
MS1	15	**2.2**	1.49	3.09	15	**1.2**	0.7	2.4	20	**2.7**	1.7	12.4	12	**1.5**	0.9	2.6
MSFSR	15	**2.6**	1.61	58.4	15	**0.9**	0.6	4.2	20	**2.5**	0.9	18.6	12	**1.0**	0.5	7.2
MSNFB	15	**1.6**	0.95	4.83	15	**0.8**	0.3	3.6	20	**2.1**	0.2	7.2	12	**0.7**	0.29	3.8
MS4	15	**1.5**	0.18	5.66	15	**0.5**	0.2	3	20	**1.9**	0.3	34.1	12	**0.5**	0.13	1.1
MSRW	15	**0.9**	0.11	3.57	15	**0.4**	<0.1	0.7	20	**0.5**	0.2	2	12	**0.3**	<0.1	1.2
Total Mercury [µg/L] –Schedule 2: 0.1 / ANZG trigger values for marine water: 80%:1.4, 90%:0.7, 95%:0.4, 99%:0.1																
MS1	15	**<0.01**	<0.01	0.02	15	**<0.01**	<0.01	0.06	20	**<0.01**	<0.01	<0.01	12	**<0.01**	<0.01	<0.01
MSFSR	15	**<0.01**	<0.01	0.23	15	**<0.01**	<0.01	0.08	20	**<0.01**	<0.01	<0.01	12	**<0.01**	<0.01	0.02
MSNFB	15	**<0.01**	<0.01	0.03	15	**<0.01**	<0.01	0.06	20	**<0.01**	<0.01	0.02	12	**<0.01**	<0.01	<0.01
MS4	15	**<0.01**	<0.01	0.02	15	**<0.01**	<0.01	0.06	20	**<0.01**	<0.01	0.02	12	**<0.01**	<0.01	<0.01
MSRW	15	**<0.01**	<0.01	0.02	15	**<0.01**	<0.01	0.06	20	**<0.01**	<0.01	<0.01	12	**<0.01**	<0.01	<0.01

	2020				2023				2024				Overall Dry		
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Total Nickel [µg/L] –Schedule 2: 15 / ANZG trigger values for marine water: 80%:560, 90%:200, 95%:70, 99%:7																
MS1	15	**0.3**	0.3	0.5	15	**0.4**	<0.2	1.2	20	**0.4**	<0.2	0.9	12	**0.4**	<0.2	0.4
MSFSR	15	**0.9**	0.5	6.8	15	**0.5**	0.3	2.0	20	**0.6**	0.3	4.2	12	**0.4**	<0.2	1.0
MSNFB	15	**0.5**	0.4	1.6	15	**0.3**	<0.2	1.4	20	**0.5**	<0.2	1.4	12	**0.3**	<0.2	0.5
MS4	15	**0.5**	<0.2	1.4	15	**<0.2**	<0.2	1.0	20	**0.5**	<0.2	2.4	12	**<0.2**	<0.2	0.3
MSRW	15	**0.4**	<0.2	0.9	15	**<0.2**	<0.2	0.4	20	**0.3**	<0.2	0.5	12	**<0.2**	<0.2	1.8
Total Silver [µg/L] –Schedule 2: 1 / ANZG trigger values for marine water: 80%:2.6, 90%:1.8, 95%:1.4, 99%:0.8																
MS1	15	**<0.1**	<0.1	<0.1	15	**<0.1**	<0.1	0.7	20	**<0.1**	<0.1	0.9	12	**<0.1**	<0.1	0.2
MSFSR	15	**<0.1**	<0.1	<0.1	15	**<0.1**	<0.1	1.1	20	**<0.1**	<0.1	0.3	12	**<0.1**	<0.1	0.4
MSNFB	15	**<0.1**	<0.1	<0.1	15	**0.2**	<0.1	0.6	20	**<0.1**	<0.1	0.6	12	**<0.1**	<0.1	0.9
MS4	15	**<0.1**	<0.1	<0.1	15	**0.3**	<0.1	0.9	20	**<0.1**	<0.1	0.9	12	**<0.1**	<0.1	0.5
MSRW	15	**<0.1**	<0.1	<0.1	15	**0.2**	<0.1	3.4	20	**<0.1**	<0.1	2.2	12	**<0.1**	<0.1	0.7
Total Zinc [µg/L] –Schedule 2: 50 / ANZG trigger values for marine water: 80%:21, 90%:12, 95%:8, 99%:3.3																
MS1	15	**12**	9	26	15	**7**	3	13	20	**9**	5	30	12	**7**	2	15
MSFSR	15	**33**	10	474	15	**8**	3	79	20	**13**	4	152	12	**6**	3	34
MSNFB	15	**15**	7	58	15	**5**	2	36	20	**11**	2	39	12	**4**	2	13
MS4	15	**12**	3	52	15	**3**	<1	23	20	**9**	2	116	12	**2**	<1	8
MSRW	15	**8**	2	25	15	**3**	<1	7	20	**4**	<1	12	12	**<1**	<1	2

Note: Schedule 2 exceeded, ANZG default trigger 90% exceeded, ANZG default trigger 80% exceeded

Copper

The schedule 2 marine and freshwater limits for copper are 5 µg/L and 2 µg/L respectively. ANZG 80% and 90% species protection guidelines (SPG) in marine waters are 8 and 3 µg/L, corresponding freshwater guidelines are 2.5 and 1.8 µg/L. The copper LOR is 0.5 µg/L.

In dry weather median copper concentration was below schedule 2 and 90% SPG at all sites. Median copper concentrations for 2024 in wet weather was below schedule 2 and 90% SPG at all sites except MS1 which exceeded the freshwater schedule 2 and 90% SPG. Median copper concentrations in 2024 were higher than 2023 however a notable improvement from 2020 results where MSFSR and MSNFB exceeded the 90% SPG including respective schedule 2 limit exceedances at MS1 and MSFSR.

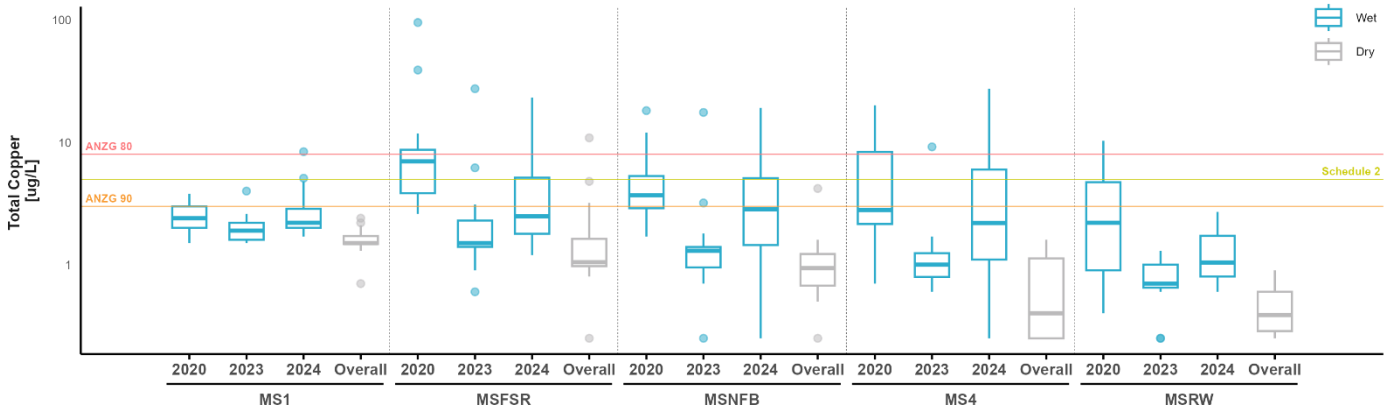


Figure 21 Total copper concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Lead

The schedule 2 marine and freshwater limits for lead are 5 and 1 µg/L respectively. ANZG 80%, and 90% SPG are 12 and 6.6 µg/L, corresponding freshwater guidelines are 9.4 and 5.6 µg/L. The lead LOR is 0.1µg/L.

In dry weather median lead concentrations were below schedule 2 marine limits and respective 90% SPGs at all sites, the freshwater schedule 2 limit was exceeded at MS1.

In wet weather, median lead concentrations were below 90% SPG limits at all sites. Median lead concentrations at receiving waters were below schedule 2 marine limits, however MS1 exceeded the freshwater limit across all periods.

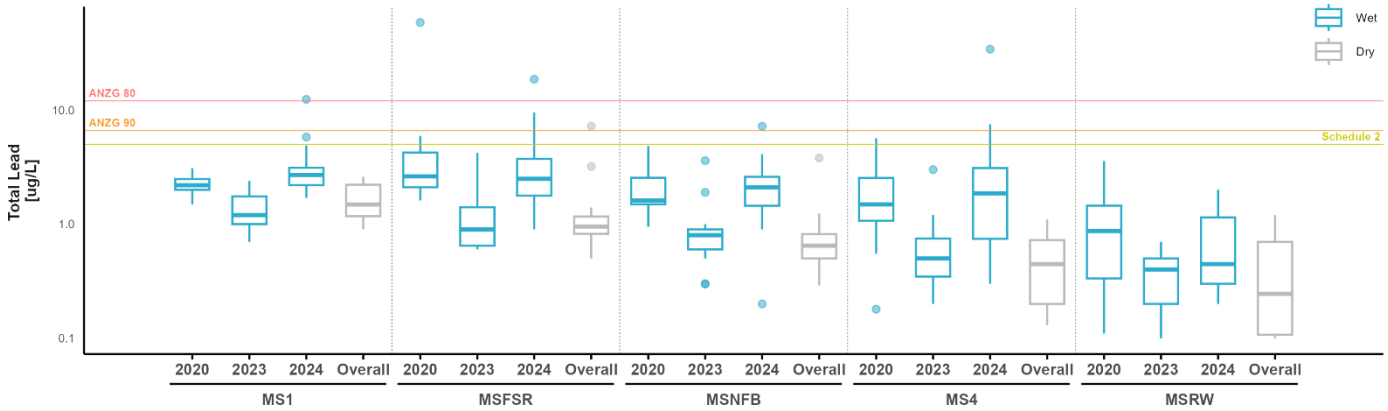


Figure 22 Total lead concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Mercury

The schedule 2 marine and freshwater limit for mercury is 0.1 µg/L. ANZG 80% and 90% SPGs are 1.4 and 0.7 µg/L, corresponding freshwater guidelines are 5.4 and 1.9 µg/L. The mercury LOR is 0.01 µg/L.

Median mercury concentrations were below the 0.01 µg/L LOR at all sites in dry weather and across the three wet weather periods.

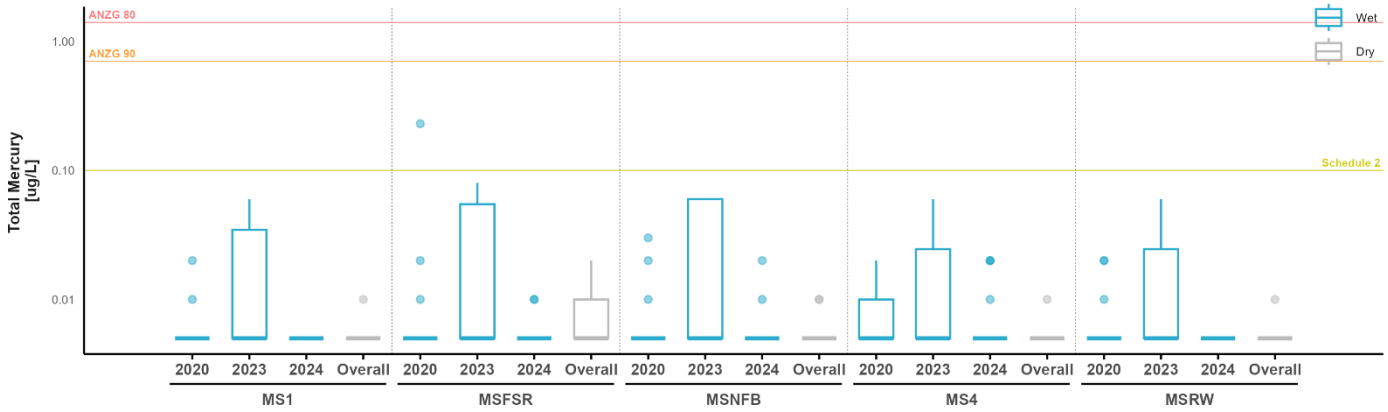


Figure 23 Total mercury concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Nickel

The schedule 2 marine and freshwater limit for nickel is 15 µg/L. ANZG 80% and 90% SPGs are 560 and 200 µg/L, corresponding freshwater guidelines are 17 and 13 µg/L. The nickel LOR is 0.2 µg/L.

Median nickel concentrations were below the 90% SPGs and schedule 2 limits at all sites in dry weather and across the three wet weather periods.

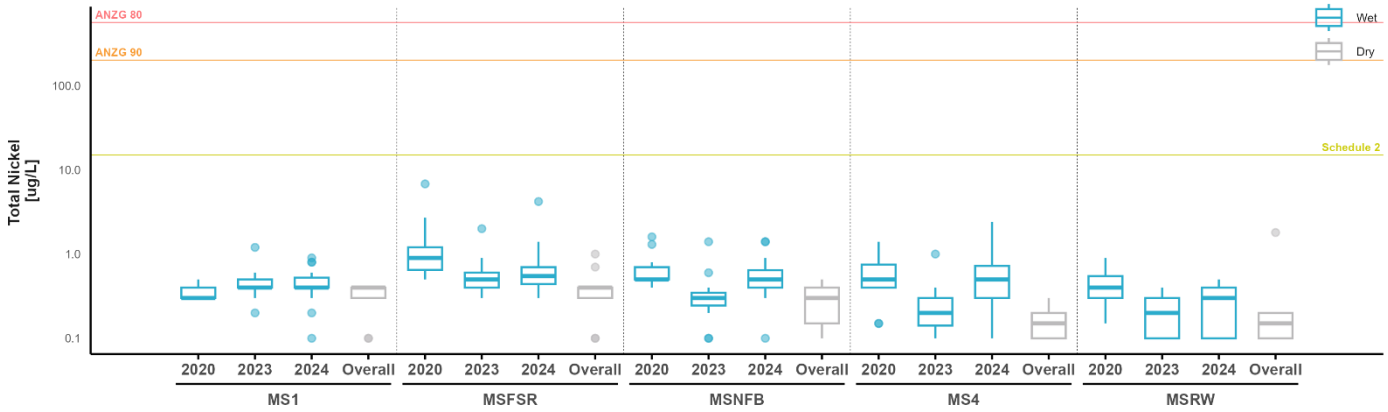


Figure 24 Total nickel concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Silver

The schedule 2 marine and freshwater limits for silver are 1 and 0.1 µg/L respectively. ANZG 80% and 90% SPGs are 2.6 and 1.8 µg/L, corresponding freshwater guidelines are 0.2 and 0.1 µg/L. The silver LOR is 0.1 µg/L.

Median silver concentrations were below the 90% SPGs and schedule 2 limits at all sites in dry weather and across the three wet weather periods.

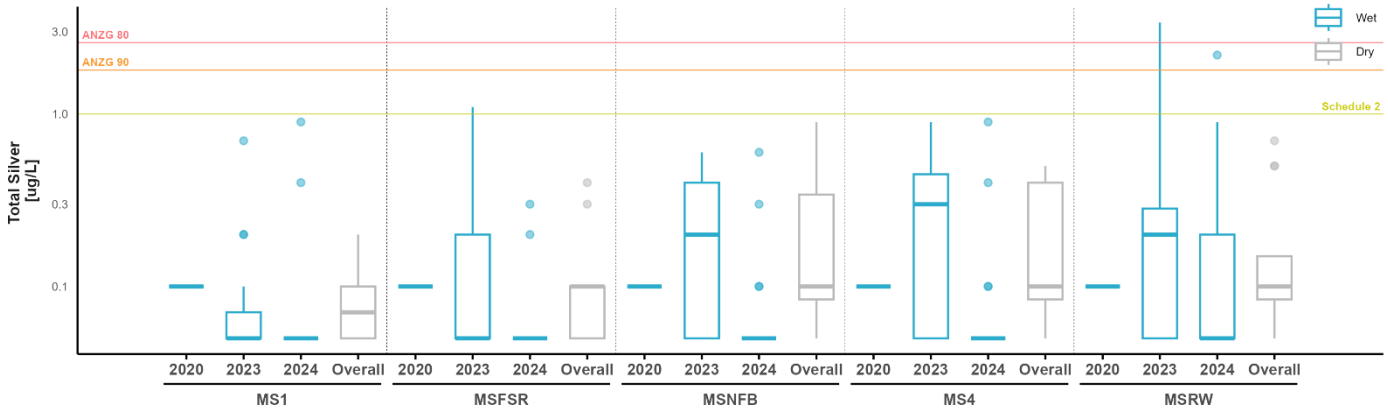


Figure 25 Total silver concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Zinc

The schedule 2 marine and freshwater limits for zinc are 50 and 5 µg/L respectively. ANZG 80% and 90% SPGs are 21 and 12 µg/L, corresponding freshwater guidelines are 31 and 15 µg/L. The zinc LOR is 1 µg/L.

In dry weather median zinc concentrations were below schedule 2 marine limits and respective 90% SPGs at all sites, the freshwater schedule 2 limit was exceeded at MS1.

In wet weather, zinc median concentrations in 2024 exceeded the 90% SPG at MSFSR at 12.5 µg/L. Median zinc concentrations were higher in 2024 than 2023 yet improved from 2020, where MSFSR exceeded the 80% SPG and MSNFB exceeded the 80% SPG. The freshwater schedule 2 limit was exceeded at MS1 in all wet periods.

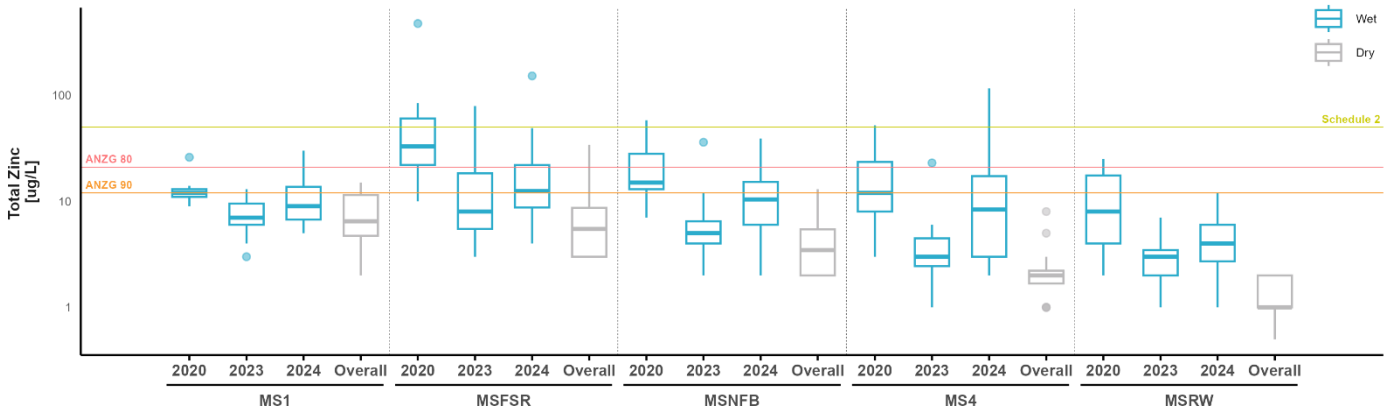


Figure 26 Total zinc concentrations at Mill Stream waterway sites. Axis log_{10} transformed

Physicochemical

There are two types of physical stressors that are broadly categorised as *directly* or *indirectly* effecting an ecosystem. Stressors directly effecting biota are distinguished by their directly toxic affect while others can indirectly result in ecosystem changes such as pH (metal release), temperature (physiological rates) etc.

Summary statistics for physicochemical parameters and comparisons to respective guidelines are presented in Table 15 Accompanying conductivity, dissolved oxygen, pH, temperature, total suspended solids, and turbidity are displayed from Figure 27 to Figure 33.

Table 15 Summary Physicochemical parameters at Mill Stream waterway sites

	2020				2023				2024				Overall		
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Conductivity [uS/cm]																
MS1	15	**167**	128	240	15	**214**	101	353	20	**187.5**	83	271	12	**241**	201	300
MSFSR	15	**753**	191	11100	15	**23100**	325	42300	20	**1827.5**	103	38200	12	**30950**	17400	46000
MSNFB	15	**6150**	490	45400	15	**43300**	492	53400	20	**17100**	279	51300	12	**43050**	18800	53300
MS4	15	**32600**	3130	51300	15	**51900**	3320	53600	20	**31000**	1337	51500	12	**52850**	41800	54000
MSRW	15	**43200**	23200	52900	15	**53000**	45300	53500	20	**47050**	25500	52900	12	**53550**	49900	53900
Dissolved Oxygen [mg/L] –Schedule 2: 6 mg/L																
MS1	15	**9.6**	9.0	10.3	15	**7.8**	6.2	9.8	20	**8.0**	5.6	11.2	12	**9.9**	7.9	10.8
MSFSR	15	**9.4**	5.9	10.1	15	**6.0**	2.8	9.7	20	**8.0**	4.0	10.8	12	**5.9**	0.2	8.1
MSNFB	15	**8.5**	5.8	10.2	15	**6.7**	3.1	9.2	20	**7.1**	1.6	9.0	12	**6.4**	3.4	8.6
MS4	15	**9.2**	6.2	10.3	15	**8.0**	4.6	10	20	**7.6**	5.7	8.7	12	**7.9**	5.6	10
MSRW	15	**8.1**	4.7	10.1	15	**7.7**	4.4	9.8	20	**7.2**	6.3	8.1	12	**8.1**	6.7	10.1
Percent Dissolved Oxygen [%] – ANZG default trigger for estuarine: 80 – 110 %																
MS1	15	**94.1**	85.8	98.3	15	**89.2**	72.2	122	20	**89.8**	70	122	12	**100.5**	94.7	116
MSFSR	15	**95.0**	59.1	99.9	15	**70.1**	37.3	108	20	**91.1**	53.3	118	12	**69.9**	2.4	92.3
MSNFB	15	**87.8**	55	100	15	**80.1**	40.2	101	20	**83.2**	18.6	101	12	**78.5**	38.1	92.1
MS4	15	**97.2**	59.3	102	15	**99.6**	56.8	118	20	**96.1**	65.3	109	12	**98.6**	79.1	106
MSRW	15	**93.9**	44.2	98.5	15	**99.1**	88.8	106	20	**95.6**	77.4	102	12	**100.5**	95.7	105
Temperature Sample [°C]																
MS1	15	**13.9**	11.8	16.1	15	**21.2**	16.8	26.5	20	**21.15**	15.8	26.4	12	**17.15**	13.3	28.4
MSFSR	15	**14.8**	12.5	16.3	15	**21**	15.3	26.4	20	**21.3**	17.1	27	12	**17.8**	13.9	25.1
MSNFB	15	**13.8**	12.4	16.4	15	**20**	14	23.8	20	**21.05**	16.7	25.5	12	**17**	13.1	24
MS4	15	**14.5**	13.2	16.4	15	**20.6**	16.1	25.1	20	**21.2**	16.4	25.1	12	**17.3**	14.7	23.5
MSRW	15	**14.1**	12.8	15.8	15	**20**	16.1	21.9	20	**20.95**	16.5	23.7	12	**17.1**	15.1	24.2

	2020				2023				2024				Overall		
Site	n	Median	Min	Max	n	Median	Min	Max	n	Median	Min	Max	n	Median	Min	Max
Total Suspended Solids [mg/L]																
MS1	15	**3**	<2	6	15	**3**	<2	7	20	**7**	3	110	12	**3.5**	<2	9
MSFSR	15	**8**	<2	260	15	**7**	<2	42	20	**10.5**	3	96	12	**6**	3	25
MSNFB	15	**7**	<2	37	15	**9**	5	27	20	**9.5**	3	29	12	**6**	3	31
MS4	15	**16**	<2	96	15	**9**	<2	19	20	**11**	<2	160	12	**7**	<2	33
MSRW	15	**7**	<2	28	15	**9**	4	19	20	**6.5**	<2	19	12	**5**	<2	15
Turbidity HACH White Light [NTU] – ANZG default trigger for estuarine: 0.5 – 10 NTU																
MS1	15	**3.6**	1.7	6.7	15	**2.1**	1.3	7.9	20	**6.85**	2.9	33	12	**2.3**	0.9	4.8
MSFSR	15	**7**	3.9	66	15	**4.2**	2.8	49	20	**7.85**	3.6	32	12	**5.75**	2.9	34
MSNFB	15	**8.7**	4.7	37	15	**3.7**	1.5	30	20	**6.55**	2.9	25	12	**2.55**	1.5	36
MS4	15	**11**	1.5	41	15	**2.2**	1.1	22	20	**5.6**	1.1	60	12	**1.35**	0.7	8.8
MSRW	15	**4.9**	0.6	20	15	**1.0**	0.6	2.2	20	**1.6**	0.6	13	12	**0.8**	0.5	1.7
pH [pH units] – ANZG default trigger for estuarine: 7.0 – 8.5																
MS1	15	**7.32**	7.13	7.63	15	**7.27**	7.00	8.69	19	**7.32**	6.65	8.13	12	**7.53**	7.24	9.18
MSFSR	15	**7.33**	7.07	7.53	15	**7.35**	7.09	7.58	19	**7.25**	6.77	7.72	12	**7.59**	7.08	7.9
MSNFB	15	**7.45**	7.28	8.09	15	**7.73**	7.11	8.1	19	**7.35**	7.00	8.11	12	**7.82**	7.13	8.04
MS4	15	**7.83**	7.50	8.16	15	**8.08**	7.19	8.2	19	**7.78**	7.19	8.1	12	**8.12**	7.92	8.18
MSRW	15	**8.02**	7.59	8.14	15	**8.07**	7.87	8.15	19	**8.03**	7.38	8.12	12	**8.14**	8.05	8.2

Note: Schedule 2 exceeded, ANZG default trigger exceeded

Dissolved Oxygen

Rapidly moving water tends to contain higher concentrations of dissolved oxygen, while stagnant water contains very little. If surface waters are moving sufficiently fast, they will generally have 100% dissolved oxygen saturation due to free exchange within the atmosphere. Bacteria and/or organic matter consume dissolved oxygen in water, therefore when in excess, they can cause oxygen depletion and aquatic life experiences competition for available oxygen. This is more likely to occur in the summer when there is a seasonal low in dissolved oxygen, as increasing temperatures decrease the ability of water to hold dissolved oxygen (Baird 1997).

Dissolved oxygen is measured in two ways: concentration (mg/L) as an *absolute* expression of the weight of oxygen dissolved in water, or as percent saturation (% DO) *relative* to the maximum dissolved oxygen content at a given temperature and pressure. Schedule 2 uses the *absolute* measurement defining an adverse effect when dissolved oxygen content of water to falls:

a. *below 6 mg/L, or*
b. *to 80% average saturation level for a 24-hour period*

ANZG default trigger values are set based on *relative* DO content listing south-east Australian estuaries lower and upper saturation limits at 80% and 110% respectively. Due to the monitoring design an average saturation level for each site is too variable to define and as such comparison will be made to the 6 mg/L absolute and 80-110 % relative guideline levels.

Median dissolved oxygen concentration was above the schedule 2 limit at all sites, periods and weather conditions, except MSFSR in 2024 dry conditions where it fell just below the limit (5.9mg/L). The lowest median dissolved oxygen concentration in wet weather was observed at MSFSR in 2023 (6.0 mg/L).

Similar results were observed with dissolved oxygen saturation (%) results. In dry weather median dissolved oxygen saturation at MSFSR and MSNFB were both below the lower ANZG default trigger value. In wet weather conditions the median dissolved oxygen saturation at MSFSR in 2023 was the only site below the lower ANZG default trigger value.

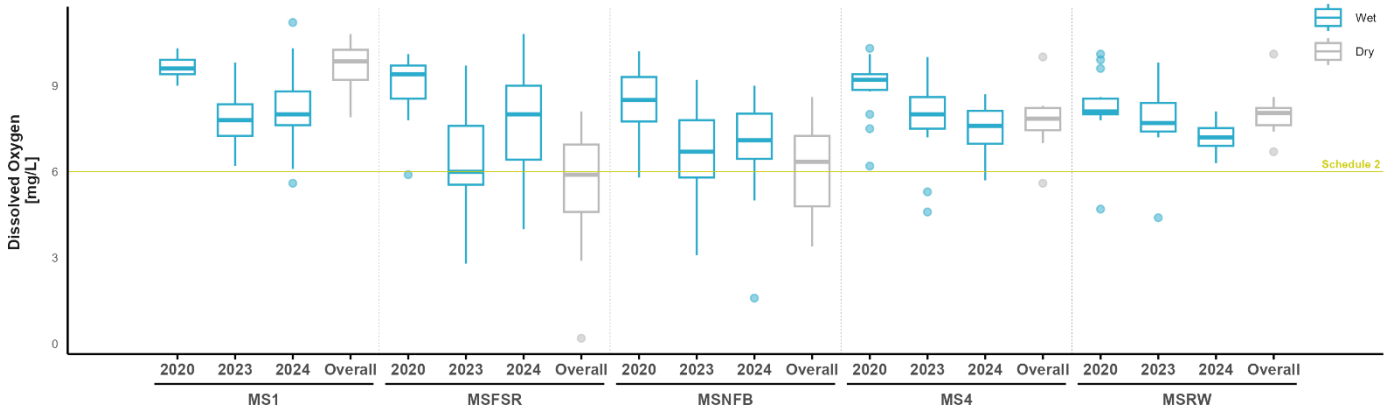


Figure 27 Dissolved oxygen at Mill Stream waterway sites

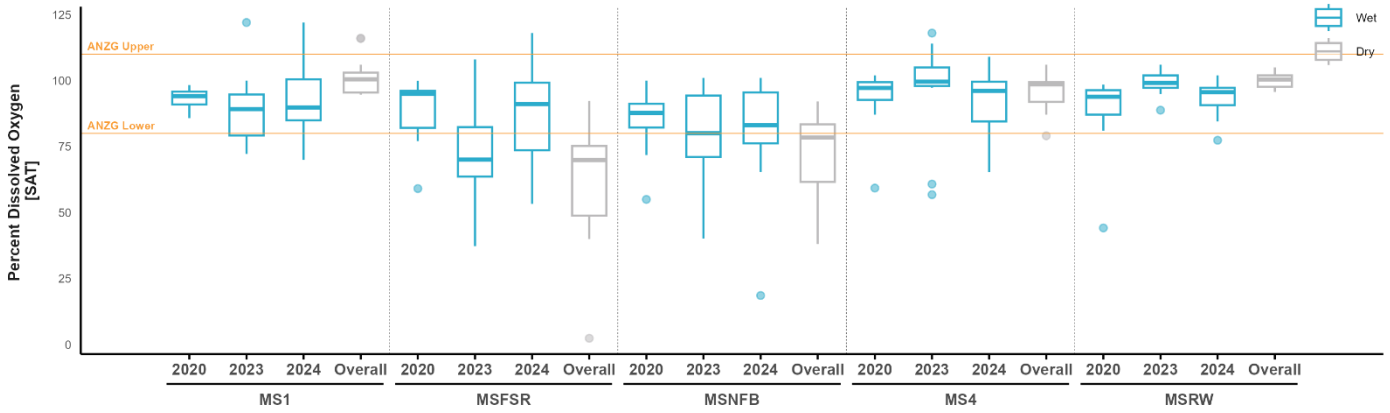


Figure 28 Dissolved oxygen saturation at Mill Stream waterway sites

pH

Schedule 2 defines an adverse effect when the pH of marine waters rises by more than 0.2 whereas the ANZG guideline for NSW estuarine systems is pH is 7.0 – 8.5. Owing to the design of the monitoring program and complexity of the Mill Stream estuarine system, comparison to schedule 2 limits is not suitable so ANZG guidelines have been applied.

Median pH values in dry and wet weather are all within ANZG guidelines for each monitoring period. In both dry and wet weather monitoring, an increasing trend in pH from the freshwater upstream site through to MS4 and MSRW is observed. This is likely due to dilution of the upstream freshwater flow through the tidally influenced estuarine system and into the bay where sea water buffering occurs stabilising the pH at 8.1.

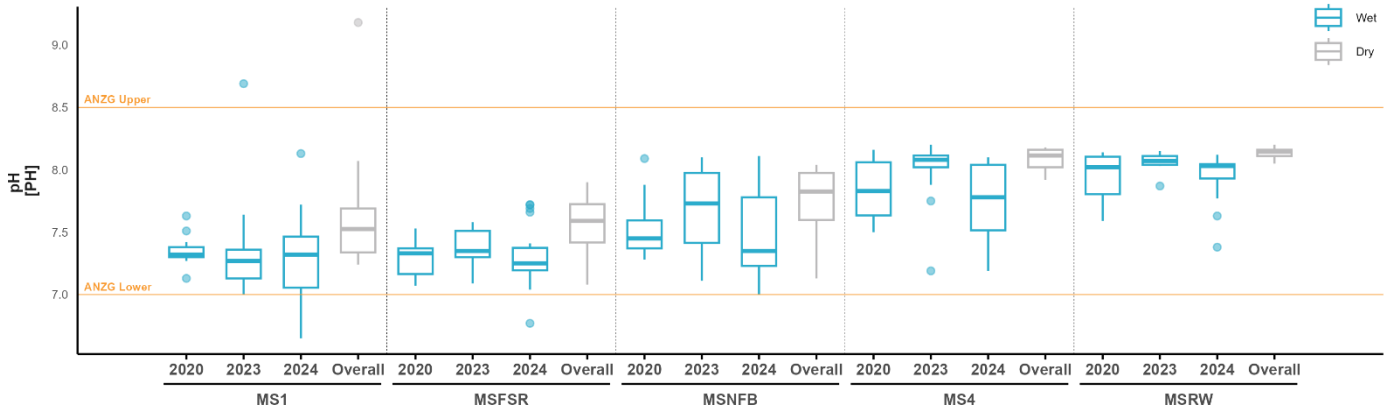


Figure 29 pH concentrations at Mill Stream waterway sites

Conductivity

Millstream is a tidally influenced estuarine system as observed in the dry weather monitoring data. We see an increasing conductivity trend as distance from the upstream freshwater site MS1 increases, terminating at MSRW where conductivity is comparable with standard ocean water (~53 mS/cm) in dry weather. Lower conductivity is observed at monitored locations during wet weather as additional non-saline (stormwater) inputs enter the estuarine system.

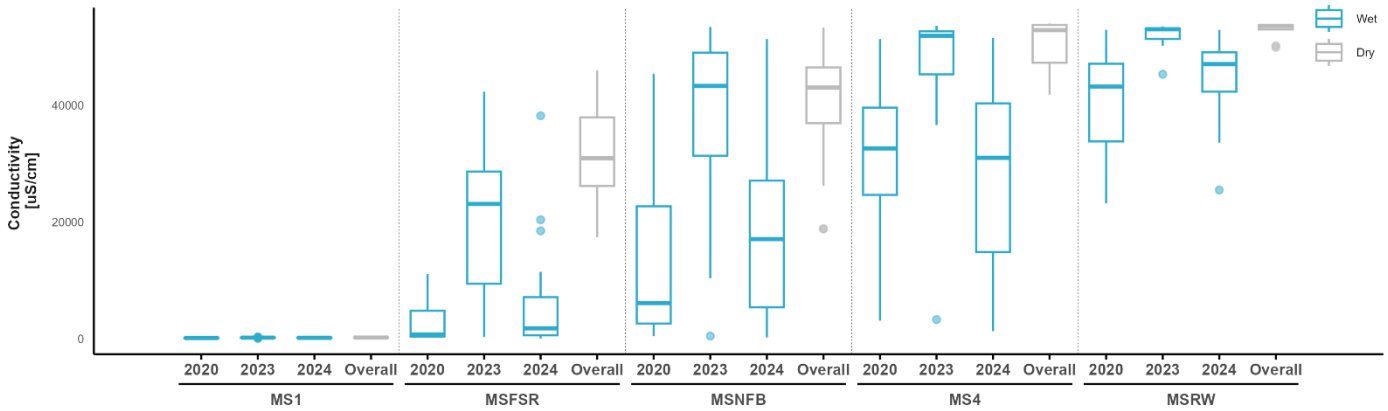


Figure 30 Conductivity at Mill Stream waterway sites

Temperature

Owing to the design of the monitoring program, no assessment against schedule 2 criteria has been made. Schedule 2 defines a *two-degree change in temperature is an influence*, however the temperature within the Mill Stream receiving waters are likely the result of stormwater inputs and the tidal cycle at the time of monitoring.

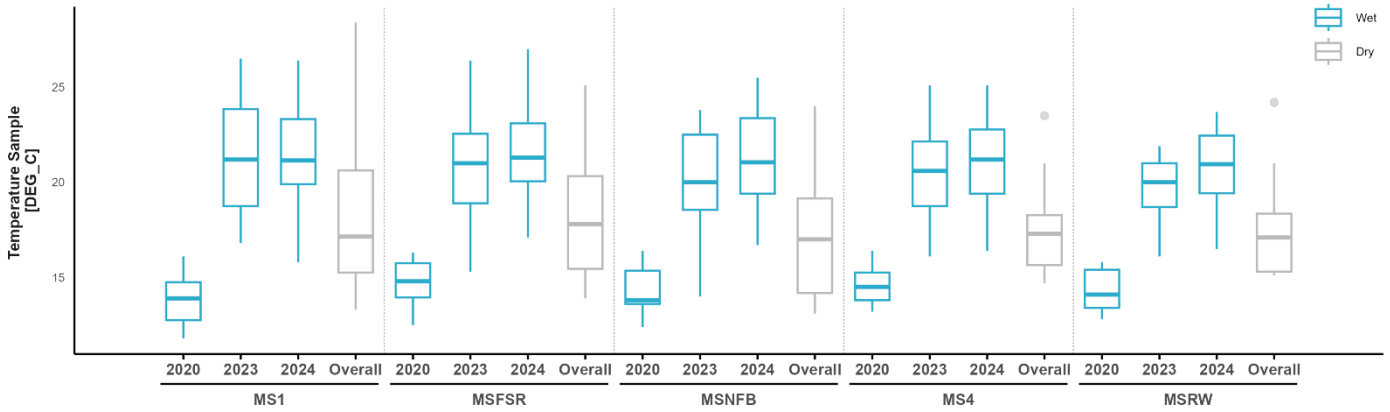


Figure 31 Temperature at Mill Stream waterway sites

Total Suspended Solids & Turbidity

Total suspended solids (TSS) is the concentration of suspended solid particles such as silt, organic matter, algae and microscopic organisms measured in the laboratory by filtering a known volume of sample and recording its dried mass. Turbidity allows field measurement of water clarity by its optical properties and does not necessarily correlate to water quality. Although different methods, TSS and turbidity give insight into similar water quality characteristics and affect temperature, photosynthesis, nutrient concentration and microbiology (EPA 2021).

Schedule 2 defines an adverse effect because entry of a substance into waters:

c. *Total suspended solids concentration changes by >10% from the seasonal mean, or*
d. *Visual clarity (inverse of turbidity) is reduced by >10% from the seasonal mean*

Owing to the configuration of the monitoring program, no assessment against schedule 2 criteria for TSS or turbidity against a seasonal mean can be made. The ANZG default trigger values for south-east estuarine and marine turbidity is 0.5-10 NTU, there is no guideline levels for TSS.

Median turbidity values in dry weather were all within the lower and upper ANZG trigger values. MS4 in 2020 was the only median turbidity to exceed the trigger values, at 11 NTU, in wet weather.

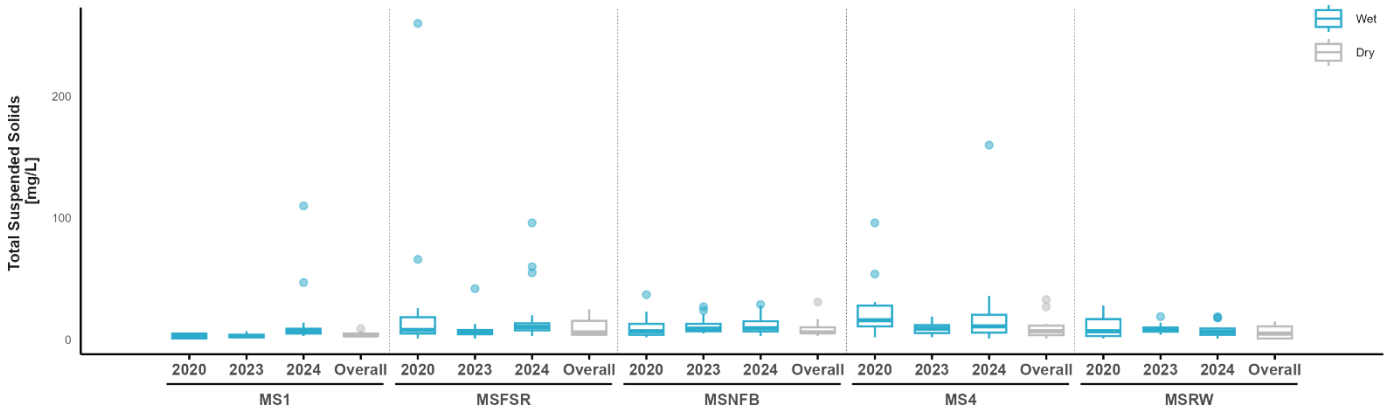


Figure 32 Total suspended solids at Mill Stream waterway sites

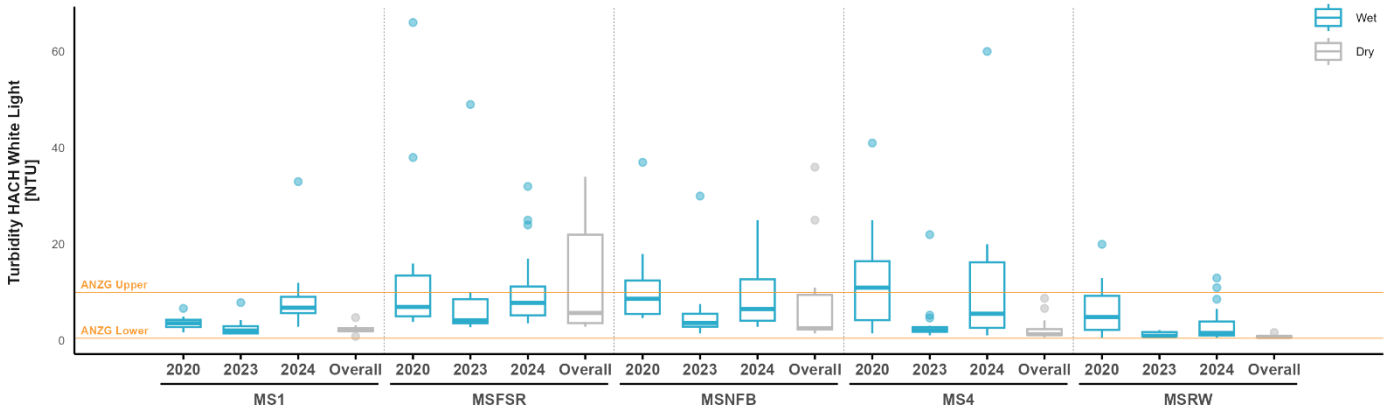


Figure 33 Turbidity at Mill Stream waterway sites

Additional Analytes

Summary statistics for additional analytes and comparisons to respective guidelines are presented in Table 16. Accompanying biochemical oxygen demand, oil & grease and sulphide boxplots are displayed from Figure 34 to Figure 36.

Table 16 Summary additional parameters at Mill Stream waterway sites

	2020				2023				2024				Overall			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
BOD_5 [mg/L]																
MS1	15	**<2**	<2	6	15	**<2**	<2	94	20	**<2**	<2	9	12	**<2**	<2	7
MSFSR	15	**4**	<2	69	15	**<2**	<2	49	20	**3**	<2	50	12	**5**	<2	15
MSNFB	15	**3**	<2	22	15	**<2**	<2	22	20	**<2**	<2	24	12	**<2**	<2	3
MS4	15	**4**	<2	27	15	**<2**	<2	12	20	**<2**	<2	14	12	**<2**	<2	10
MSRW	15	**<2**	<2	19	15	**<2**	<2	8	20	**<2**	<2	10	12	**<2**	<2	15
Oil & Grease [mg/L]																
MS1	15	**<5**	<5	<5	15	**<5**	<5	<5	20	**<5**	<5	<5	12	**<5**	<5	<5
MSFSR	15	**<5**	<5	9	15	**<5**	<5	<5	20	**<5**	<5	24	12	**<5**	<5	<5
MSNFB	15	**<5**	<5	9	15	**<5**	<5	<5	20	**<5**	<5	<5	12	**<5**	<5	<5
MS4	15	**<5**	<5	10	15	**<5**	<5	<5	20	**<5**	<5	<5	12	**<5**	<5	<5
MSRW	15	**<5**	<5	6	15	**<5**	<5	<5	20	**<5**	<5	<5	12	**<5**	<5	<5
Sulphide [µg/L] –Schedule 2: 2.0																
MS1	15	**<30**	<30	<30	15	**<30**	<30	<30	20	**<30**	<30	50	12	**<30**	<30	50
MSFSR	15	**<30**	<30	339	15	**<30**	<30	183	20	**<30**	<30	50	12	**<30**	<30	1160
MSNFB	15	**<30**	<30	38	15	**<30**	<30	<30	20	**<30**	<30	50	12	**<30**	<30	174
MS4	15	**<30**	<30	40	15	**<30**	<30	<30	20	**<30**	<30	88	12	**<30**	<30	50
MSRW	15	**<30**	<30	<30	15	**<30**	<30	<30	20	**<30**	<30	50	12	**<30**	<30	50

Note: Schedule 2 exceeded

Biochemical Oxygen Demand

Microorganisms in aerobic waters consume dissolved oxygen in digesting organic material from the surrounding water body as part of their cellular cycle. This microbial metabolism creates an oxygen demand which is measured in the laboratory over five days known as biochemical oxygen demand (BOD_5). In some circumstances biochemical oxygen demand can be greater than the contribution from autotrophic actors (algae, macrophytes) and natural atmospheric diffusion potentially leading to anoxic conditions.

No schedule 2 or ANZG aquatic ecosystem protection guideline values exist for BOD_5.

In dry weather the median BOD_5 concentration at MSFSR was above the 2 mg/L LOR. In wet weather median BOD_5 concentrations at MSFSR, MSNFB and MS4 during 2020 and MSFSR during 2024 were above the LOR. All other median BOD_5 concentrations were below the LOD.

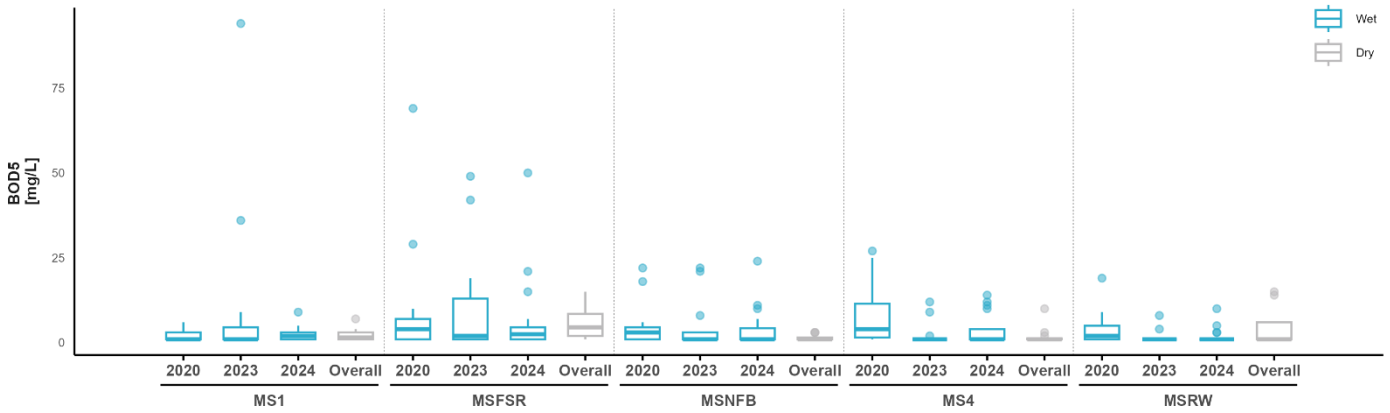


Figure 34 Biochemical oxygen demand concentration at Mill Stream waterway sites

Oil & Grease

Oil and grease (O&G) is the group of organic substances defined by their low affinity to water such as hydrocarbons, fatty acids, soaps, lipids and waxes. Organic substances are hydrophobic in nature and generally less dense than water, leading to formation of thin films on the water's surface potentially limiting light penetration or atmospheric oxygen (Pintor et al 2016).

No schedule 2 or ANZG aquatic ecosystem protection guideline values exist for O&G. In dry weather all measured concentrations were below the 5 mg/L LOR. In wet weather median O&G concentrations were below 5 mg/L. In the 2024 monitoring period, MSFSR was the only receiving water site to observe an O&G concentration above the LOR at 24 mg/L.

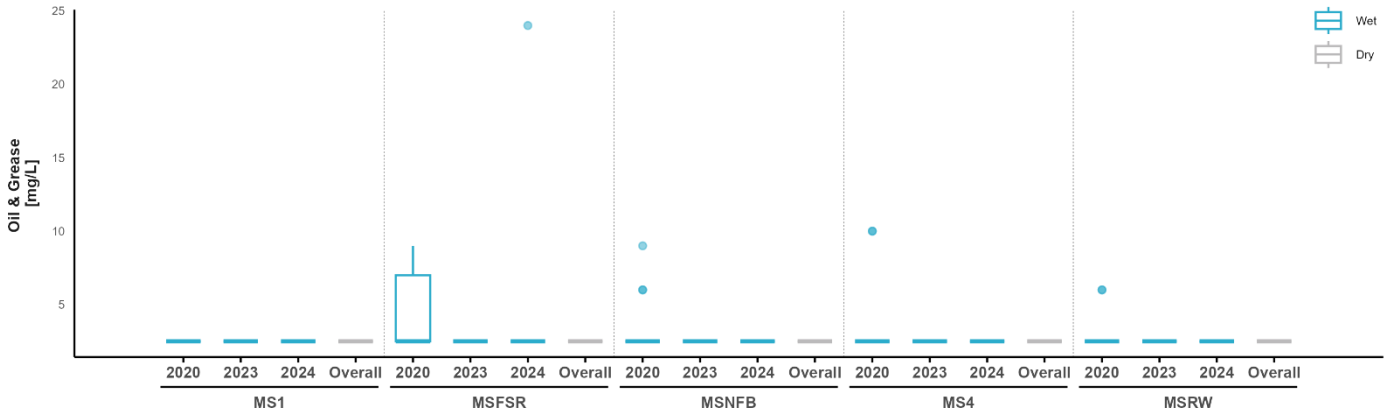


Figure 35 Oil and grease concentrations at Mill Stream waterway sites

Sulphide

Reduced oxygen availability in natural aquatic and sedimentary environments is often correlated to increased sulphide production. Anthropogenic eutrophication leading to organic enrichment and subsequent anoxia from decomposition of algal matter are generally from the discharge of organic-rich effluents (e.g. sewage) and enrichment of nutrients (fertiliser, detergent run-off).

The schedule 2 limit for sulphide is 2 µg/L, slightly above the ANZG low reliability marine trigger value of 1 µg/L specific to unionised hydrogen sulphide (H_2S). Median concentrations for sulphide were below the LOR (<30 µg/L) for all upstream and downstream sites in dry and wet weather. The analysis method used measures total sulphide, while not specifically applicable to the given limits if total sulphide concentration is below guideline values then so is the unionised sulphide concentration.

In dry weather, sulphide concentrations above detection limit have been observed at all sites, with MSFSR observing the maximum receiving water concentration of 1160 µg/L. In wet weather maximum sulphide concentrations observed were at MS4 in 2024 at 88 µg/L whilst in 2020 and 2023 the maximum receiving water concentrations were observed at MSFSR with 339 and 183 µg/L respectively.

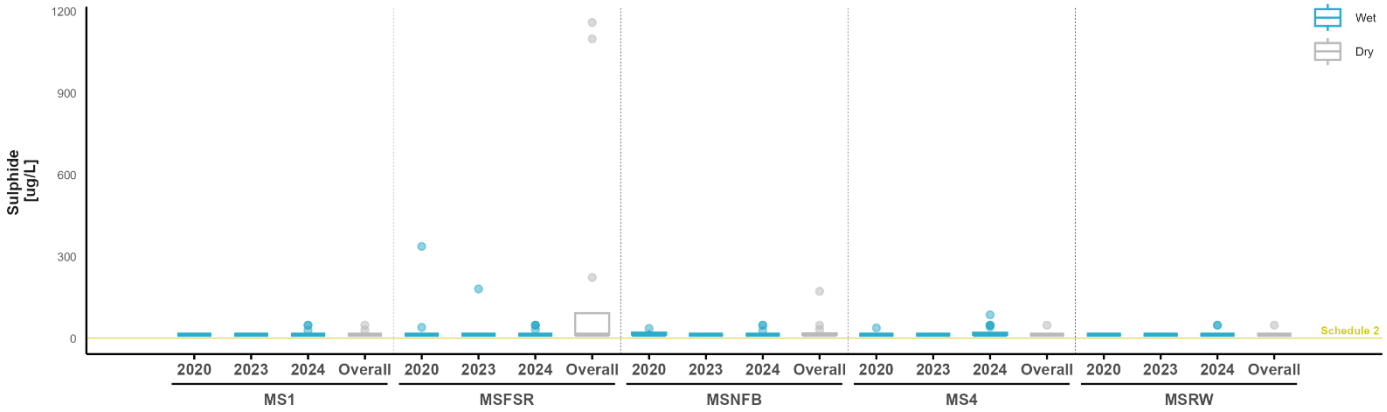


Figure 36 Sulphide concentrations at Mill Stream waterway sites

Organics

Summary statistics for organic analytes and comparisons to respective guidelines are presented in Table 17, with accompanying nonylphenol ethoxylate boxplots displayed in Figure 37.

Table 17 Summary organics concentrations at Mill Stream waterway sites

	2020				2023				2024				Dry Overall			
Site	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**	**n**	**Median**	**Min**	**Max**
Nonylphenol ethoxylate [µg/L] - ANZG default trigger for freshwater: 80%:360, 90%:220, 95%:140, 99%:50																
MS1	15	<5	<5	9	15	<5	<5	<5	20	<5	<5	15	12	<5	<5	19
MSFSR	15	<5	<5	888	15	<5	<5	<5	20	<5	<5	85	12	<5	<5	19
MSNFB	15	9	<5	58	15	<5	<5	9	20	<5	<5	250	12	<5	<5	9
MS4	15	11	<5	58	15	<5	<5	<5	20	<5	<5	89	12	<5	<5	18
MSRW	15	6	<5	185	15	<5	<5	<5	20	<5	<5	20	12	<5	<5	9
Octylphenol ethoxylate [µg/L]																
MS1	15	<5	<5	<5	15	<5	<5	<5	20	<5	<5	<5	12	<5	<5	<5
MSFSR	15	<5	<5	<5	15	<5	<5	<5	20	<5	<5	<5	12	<5	<5	<5
MSNFB	15	<5	<5	<5	15	<5	<5	<5	20	<5	<5	<5	12	<5	<5	<5
MS4	15	<5	<5	<5	15	<5	<5	<5	20	<5	<5	<5	12	<5	<5	<5
MSRW	15	<5	<5	<5	15	<5	<5	<5	20	<5	<5	<5	12	<5	<5	<5
di(2-ethylhexyl) phthalate [µg/L]																
MS1	15	<10	<10	<10	15	<10	<10	<10	20	<10	<10	<10	12	<10	<10	<10
MSFSR	15	<10	<10	<10	15	<10	<10	<10	20	<10	<10	<10	12	<10	<10	<10
MSNFB	15	<10	<10	<10	15	<10	<10	<10	20	<10	<10	<10	12	<10	<10	<10
MS4	15	<10	<10	<10	15	<10	<10	<10	20	<10	<10	<10	12	<10	<10	<10
MSRW	15	<10	<10	<10	15	<10	<10	<10	20	<10	<10	<10	12	<10	<10	<10

Surfactants

Nonylphenol ethoxylate (NPE) and octylphenol ethoxylate (OPE) are non-ionic surfactants used for reducing surface tension facilitating the wetting process, are used in detergents, paints and pesticides. Both NPE and OPE are classified as endocrine disrupters and can interfere with the hormonal system of organisms (Soares et al, 2008). Due to its low solubility and high hydrophobicity, surfactants tend to accumulate within sewage sludge and sediments.

There is no specific limits for NPE or OPE under schedule 2 or ANZG, however alcohol ethoxylated surfactant ANZG freshwater trigger values for 80% and 90% SPG of 360 and 220 µg/L was used in previous Mill Stream reporting, and so is included in this report.

Median NPE concentrations were below the 90% SPG at all sites in dry weather and across the three wet weather periods. Since 2023, wet weather median NPE concentrations were less than the 5 µg/L LOR.

Median, min and max concentrations of OPE were less than the 5 µg/L LOR at all sites, hence no figure has been included for reporting. There were two samples detected to contain OPE both from the ERS on the 5th and 6th of April 2025 at 14 and 6 µg/L respective.

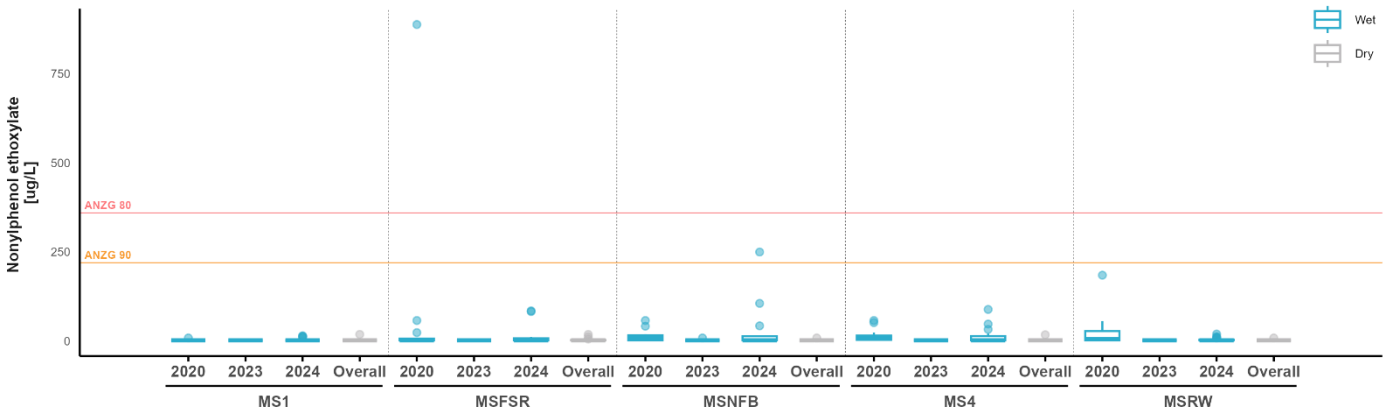


Figure 37 Nonylphenol ethoxylate concentrations at Mill Stream waterway sites

Phthalate esters

Di-(2-Ethylhexyl) phthalate (DEHP) primary use is as a plasticiser making plastics more flexible. Like most organic compounds, it is colourless and insoluble in pure water although can be transported into aquatic environments via acid solubilisers. DEPH in particle phase is subject to breakdown by small organisms in surface water or soils, causing a level of bioaccumulation higher to that of surrounding waters (DCCEEW). Higher level food chain animals are able to breakdown DEHP so tissue levels are generally low.

The schedule 2 accepted limit for DEHP is 0.6 µg/L compared to ANZG 80% and 90% trigger values for freshwater species protection of 1300 and 1100 µg/L respectively. As limited data for marine species these figures are recommended as an indicative interim working level only.

DEHP was not found present at concentrations above the 10 µg/L LOR in any samples analysed across the three Millstream monitoring periods and hence no figure has been included for reporting.

4. Conclusions

Waters immediately downstream of the Mill Stream ERS generally experienced the greatest degradation of water quality with respect to monitored pollutants. Spatial interpretation of the three monitoring periods indicated analytes impacting the estuarine Mill Stream receiving waters originating from both measured upstream wetland flow (MS1) and the ERS discharge (ERS). Temporally, 2023 monitoring results were generally lower in pollutant concentrations compared to 2020 and 2024 monitoring periods, reflecting the lower rainfall and overflow volume monitored.

Median concentrations of PFOA were below NEMP 99% SPG at all receiving water sites across the three monitoring periods. The median PFOA concentration at MSFSR in 2023 was the only site that returned a median above the LOR, although there was occasional samples from other sites that were above the LOR. Median PFOS concentrations fell between ANZG 95% and 99% DGVs at all sites during wet weather monitoring in all periods, however, please note that median concentrations at some sites were below the LOR. PFOS concentrations were generally higher in 2023 and during dry weather monitoring when compared to the wet weather monitoring in 2020 and 2024.

Spatially, both FC and Ent results indicate the input of a considerable microbial source between sites MS1 and MSFSR. Median concentrations of FC and Ent generally exceeded ANZG secondary contact guidelines in wet weather. Exceptions to this trend were observed at the more distal sites MS4 and MSRW during 2023, and specifically for Ent at MSRW in 2024 where only primary contact guidelines were exceeded.

Spatially, nitrogen and phosphorus results indicate the input of a considerable nutrient source between sites MS1 and MSFSR. All receiving water sites experience episodic high-concentration events exceeding the least stringent ANZG trigger values, indicating potential short-term risks to aquatic ecosystems. Median total nitrogen consistently exceeded ANZG default trigger values at MS1, MSFSR, and MSNFB across all monitoring periods, including dry weather. Additionally in 2020 and 2024, median values at the more distal sites MS4 and MSRW, also exceeded the ANZG default trigger value. Median total phosphorus concentrations exceed schedule 2 limits at all sites while ANZG trigger values were exceeded at all receiving water sites except for MS4 and MSRW during 2023 and dry weather. Median SRP concentrations exceed ANZG trigger values at all receiving water sites while MS1 was below LOR across all periods. The absence of SRP at MS1 suggests phosphorus originating from upstream is inert or deposited as non-soluble debris such as sediment or cell tissue. Temporally, median total phosphorus and SRP concentrations appear to have decreased since 2020, indicating a reduction of additional phosphorus input despite consistent concentration from MS1.

Median ammonia concentrations are below ANZG 95% marine water species protection at all sites across all monitoring periods. During the wetter 2020 and 2024 periods, higher median concentrations were observed beyond the immediate input zone at MSNFB and MS4 compared to MSFSR. Calculated median ammonium concentrations exceeded the schedule 2 and ANZG default trigger values at all receiving water sites in wet weather. As concentration data was calculated from ammonia with minor temperature and pH considerations, spatial trends are repeated.

The bacteriological and nutrient results evidence the impact that the Mill Stream overflows had on water quality during and following wet weather overflow discharge. As previously discussed, the data from 2023 was collected from overflows with shorter duration and volume and the results indicate reduced influence on water quality than the 2020 and 2024 periods which captured larger overflow events. These results suggest that works Sydney Water are undertaking to decrease the volume and duration of wet weather overflow discharged at Mill Stream would also reduce the potential impact to water quality at Mill Stream posed by the overflows.

Median Chl-α concentrations exceed schedule 2 limits at all sites. Spatially, the highest median Chl-α concentrations are consistently recorded at MS1, upstream of the ERS discharge suggesting Mill Pond is the significant source of Chl-α to the Mill Stream. Temporally, 2024 showed a significant increase in Chl-α concentrations at all sites from the previous 2020 and 2023 monitoring periods.

In 2024 median concentrations of copper, lead, mercury, nickel, silver and zinc did not exceed the marine schedule 2 limit criteria at any sample site. Median copper concentrations were below ANZG 90% marine trigger value for all weather periods except MSFSR and MSNFB during wet weather in 2020. Median lead, mercury, nickel and silver concentrations were below schedule 2 and ANZG 90% marine trigger values at all sites. Median zinc concentrations were below ANZG 90% marine trigger value for all weather periods except MSFSR in 2024 and MSFSR and MSNFB in 2020. Median zinc concentration at MSFSR in 2020 was the only occurrence of exceeding an ANZG 80% marine trigger value for metals.

Median dissolved oxygen concentration was above the schedule 2 limit at all sites in wet weather. Median dissolved oxygen concentration at MSFSR in dry weather was the only schedule 2 limit exceedance. Median dissolved oxygen saturation was within

the ANZG default range for estuarine waters at all sites in wet weather except MSFSR in 2023. Median dissolved oxygen saturation at MSFSR and MSNFB in dry weather was below the lower ANZG default limit. Median turbidity was within the ANZG default range for estuarine waters at all sites in wet weather except MS4 in 2020. Median pH was within the ANZG default range for estuarine waters at all sites in wet weather.

Median BOD_5 concentrations are typically low or below LOR at all sites for all monitoring periods with no guideline values available for comparison. Episodic high-concentration events were observed at MS1 and MSFSR, indicating potential short-term risks to aquatic ecosystems. Median oil and grease concentration was below the LOR at all sites for all monitoring periods with no guideline values available for comparison. Median sulphide concentrations exceeded the schedule 2 limit at all sites despite being below the LOR. Median sulphide concentrations are consistently below detection. The high LOR relative to schedule 2 limits suggests that concentrations likely exceed while not explicitly detected. Episodic high-concentration events were observed at all sites exceeding the Schedule 2 limit.

Median NPE concentrations are consistently below LOR and the ANZG 90% freshwater trigger value for alcohol ethoxylated surfactants. Recorded OPE concentrations within receiving waters are all below LOR with no guideline values available for comparison. Recorded DEHP concentrations are all below LOR with no guideline values available for comparison. It is a recommendation to remove this analyte from future monitoring.

5. Recommendations

As reported, the Mill Stream overflows impact water quality when in operation, in particular this is noticeable in the bacteriological and nutrient results. Condition 21 (a) of the current Authorisation requires that this report, in part, sets out recommended actions for the improvement of water quality at Mill Stream and surrounding Botany Bay area. Sydney Water has undertaken extensive planning studies to assess the feasibility and deliverability of actions that can improve the frequency, volume and quality of overflow discharge at Mill Stream. These actions are detailed in the Mill Stream Environmental Management Plan (EMP) 2024-27 and present the most suitable options for Sydney Water to contribute to the improvement of water quality at Mill Stream and Botany Bay. Results from the monitoring program has informed how the Mill Stream overflows influence the receiving waterway and allowed characterisation against relevant guideline levels, however this monitoring period has not provided insights beyond what was already evidenced and hence no additional actions have been recommended to *'improve water quality at Mill Stream'*. However, there are recommendations for future water quality monitoring, and these are included below.

Future Monitoring

The following recommendations should be considered for future Mill Stream water quality monitoring programs:

- The addition of wet weather (rainfall) monitoring events, without Mill Stream ERS discharge, should be added to the monitoring program. This will allow further understanding of the baseline stormwater conditions during rainfall without influence from Mill Stream overflows.
- Water quality results should continue to be assessed against the current reference guideline levels from schedule 2 and ANZG 2018 as presented in this report and incorporate any future amendments made to the relevant water quality guidelines.
- Review of the current water quality parameters and collection methods - additional analytes and data sources may provide greater understanding of the influence of the Mill Stream overflows and other catchment sources.
- Investigate the possibility of standardised monitoring approaches for the routine (Environmental) and reactive (Emergency Response) monitoring programs to enhance the available data for analysis and reporting. This would need to consider regulatory and resourcing requirements during incident/event sampling.
- There should be a targeted approach to overflow event sampling to ensure overflows of different scales are monitored, when possible:
    - Larger events are required to collect ERS discharge samples (in-pipe wastewater quality), smaller events cease before sampling teams can attend the site (see 2023 monitoring period)
    - Capture variation in receiving environment water quality as a result of short and long overflow durations, and multiple events over the 5 monitoring days (see appendix 7.2)

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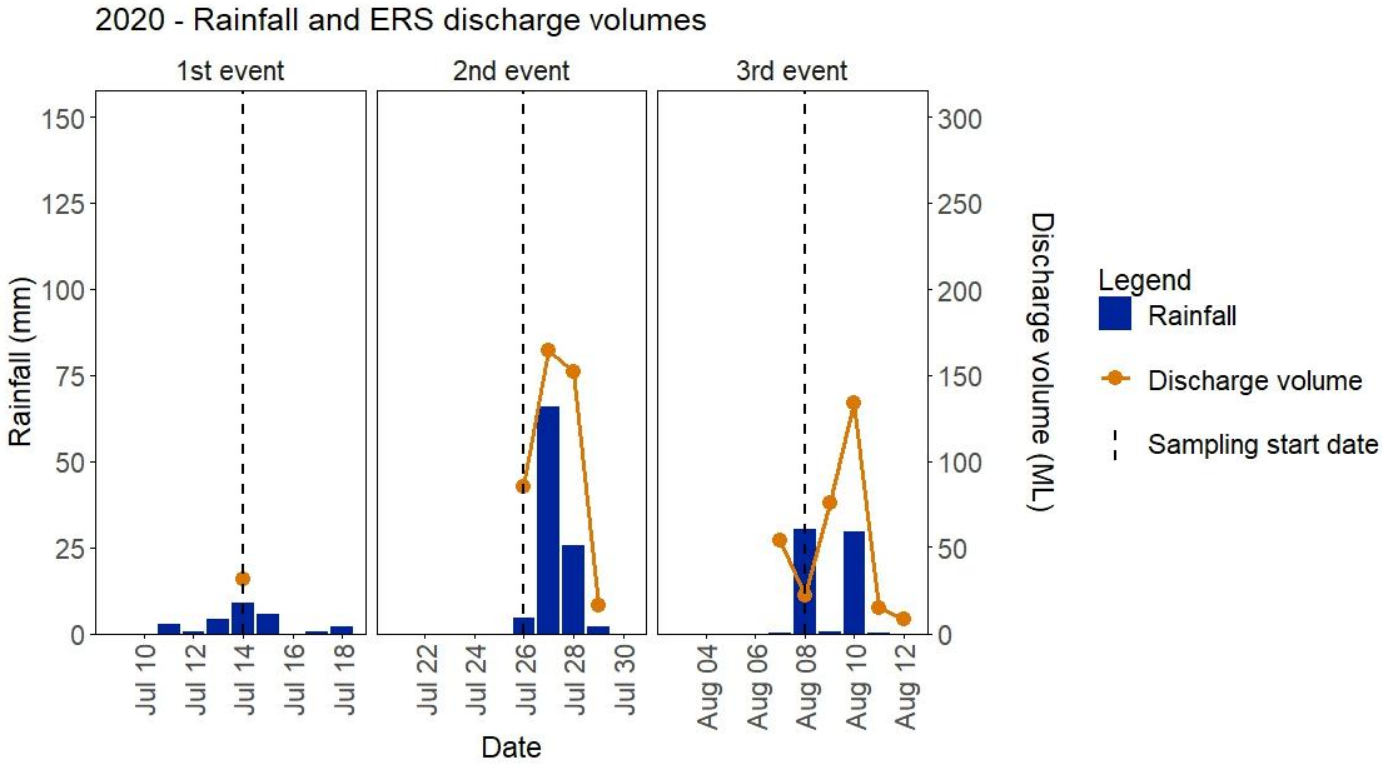
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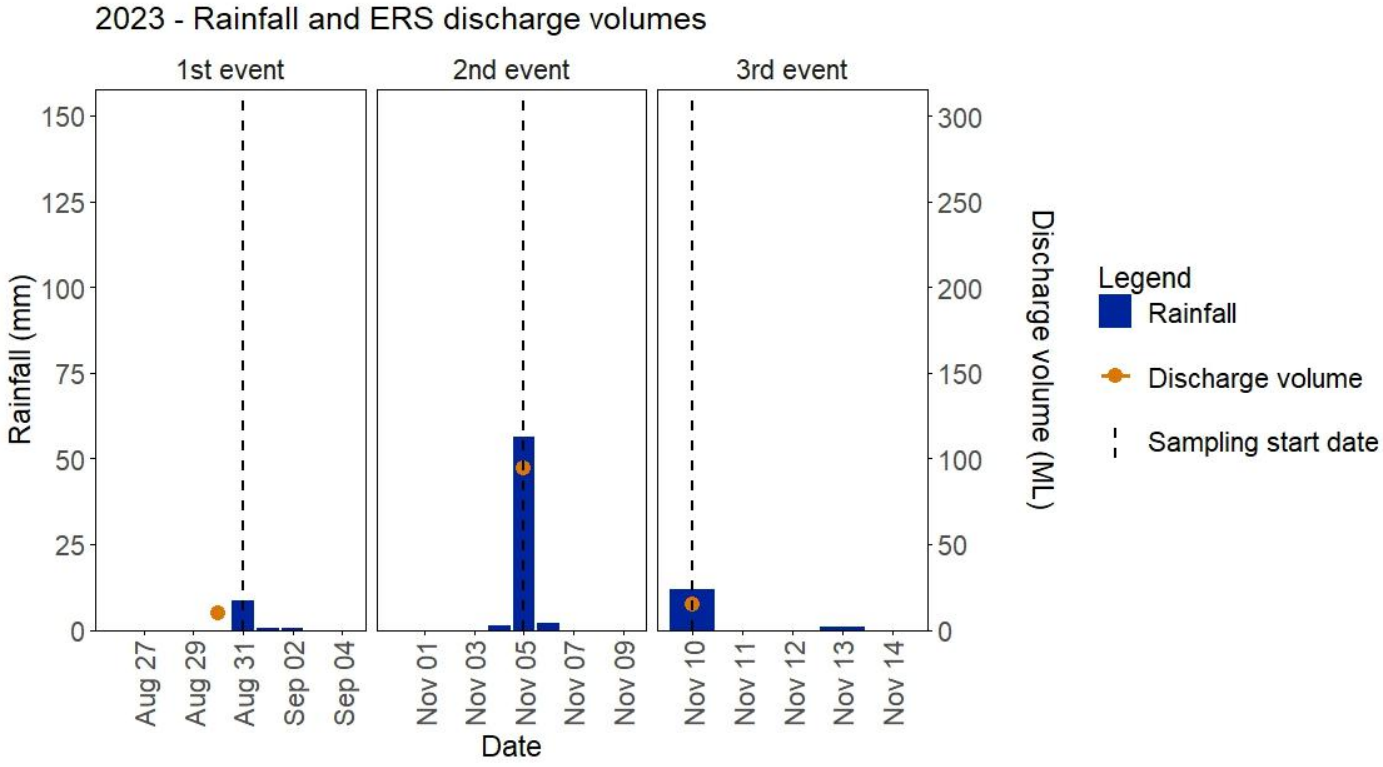
7. Appendices

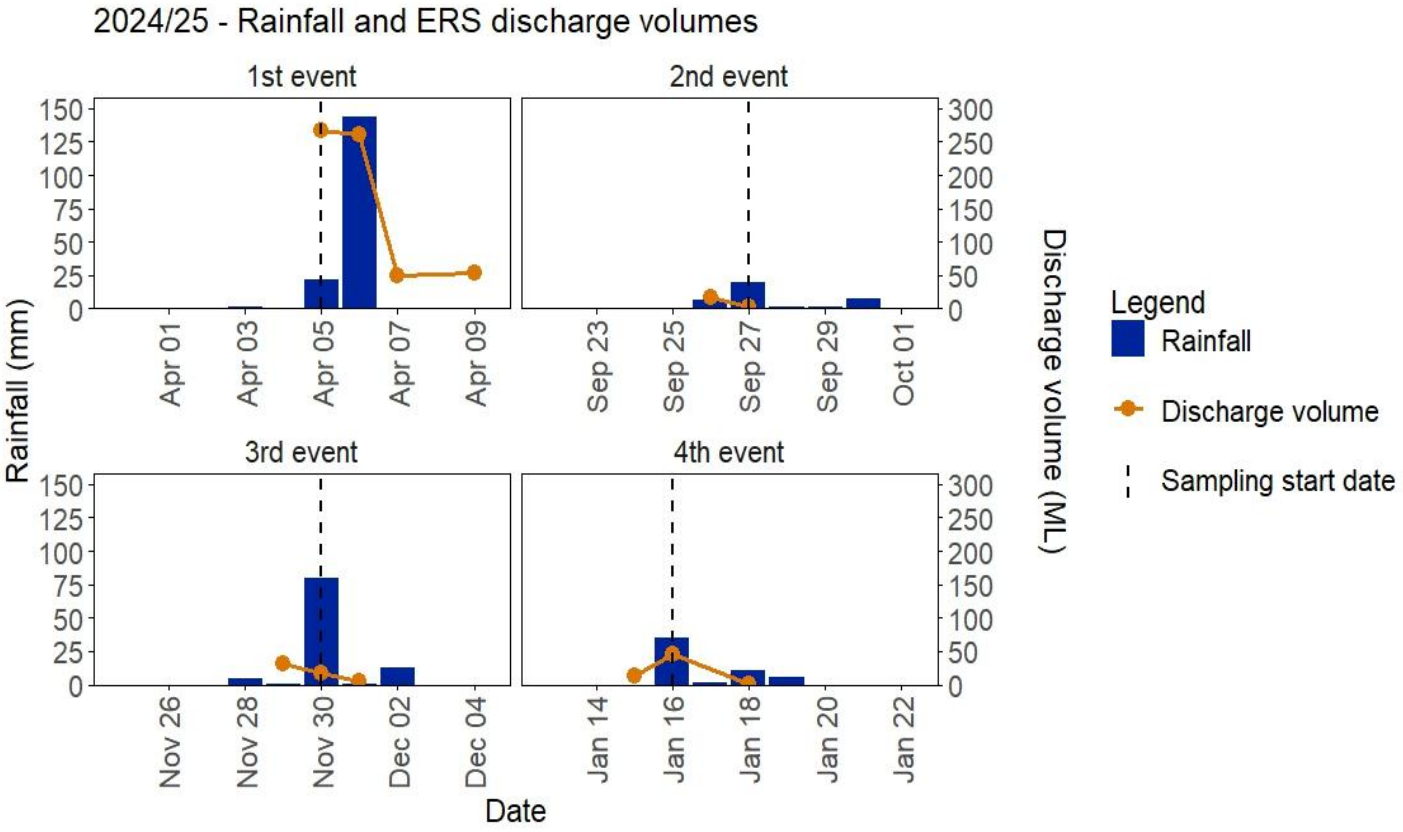
7.1 Monitored event daily condition summary

Sampling event	Sampling dates	24 hr Rain(mm)	Sampling method	Tide	Wind
Overflow Event 1	Friday, 5 April 2024	21.4	Road	Mid to low	SE @ 26 km/h
	Saturday, 6 April 2024	143.4	Boat	Mid to low	NNW @ 15 km/h
	Sunday, 7 April 2024	0	Boat	Mid to low	NM @ 9 km/h
	Monday, 8 April 2024	0	Road	Mid to low	S @ 17 km/h
	Tuesday, 9 April 2024	0	Boat	High to mid	SW @ 11 km/h
Dry Event 1	Friday, 24 May 2024	0*	Boat	High to mid	NW @ 13 km/h
Dry Event 2	Friday, 6 September 2024	0*	Boat	High	NW @ 4 km/h
Overflow Event 2	Friday, 27 September 2024	20.2	Road	Low	SSE @ 35 km/h
	Saturday, 28 September 2024	1.2	Road	Low	SSE @ 15 km/h
	Sunday, 29 September 2024	1.8	Road	Mid to low	WNW @ 9 km/h
	Monday, 30 September 2024	8	Road	Mid to low	SSW @ 24 km/h
	Tuesday, 1 October 2024	0.6	Road	Mid to low	WNW @ 7 km/h
Dry Event 3	Thursday, 31 October 2024	0*	Boat	High	SSW @ 11 km/h
Overflow Event 3	Saturday, 30 November 2024	74.4	Boat	High to mid	NE @ 24 km/h
	Sunday, 1 December 2024	0.4	Boat	High	WNW @ 17 km/h
	Monday, 2 December 2024	14.6	Road	High to mid	NW @ 17 km/h
	Tuesday, 3 December 2024	0	Road	High	NNE @ 13 km/h
	Wednesday, 4 December 2024	0	Road	High	S @ 26 km/h
Overflow Event 4	Thursday, 16 January 2025	35.6	Road	Low	S @ 50 km/h
	Friday, 17 January 2025	1.6	Road	Mid to high	SSW @ 44 km/h
	Saturday, 18 January 2025	11	Road	Mid to high	SSE @ 44 km/h
	Sunday, 19 January 2025	5.4	Road	Mid to high	S @ 30 km/h
	Monday, 20 January 2025	0	Road	Mid to high	SSW @ 17 km/h
Dry Event 4	Friday, 28 February 2025	0	Boat	High to mid	NW @ 13 km/h

7.2 Daily rainfall and ERS discharge volumes






2024/25 - Rainfall and ERS discharge volumes
1st event
2nd event
3rd event
4th event
Rainfall (mm)
Discharge volume (ML)
Date
Apr 01
Apr 03
Apr 05
Apr 07
Apr 09
Sep 23
Sep 25
Sep 27
Sep 29
Oct 01
Nov 26
Nov 28
Nov 30
Dec 02
Dec 04
Jan 14
Jan 16
Jan 18
Jan 20
Jan 22
Legend
Rainfall
Discharge volume
Sampling start date

7.3 Monitoring Data

Data to be included as excel attachment