

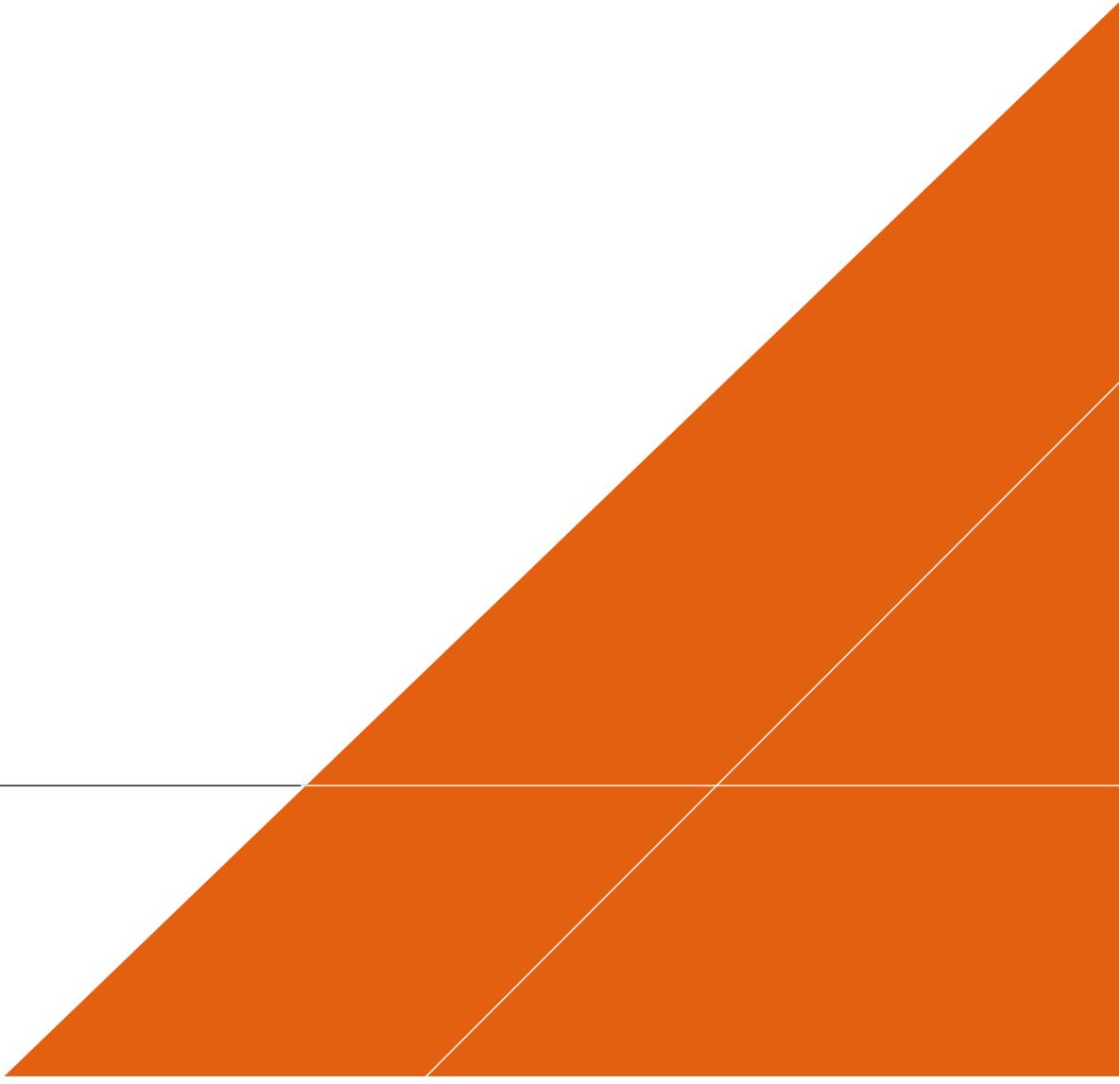


APPENDIX D – AIR QUALITY MONITORING COMPLIANCE REPORT

MOOREBANK INTERMODAL PRECINCT – EAST AND WEST PRECINCTS

Operational Air Quality Six Monthly Compliance Report #10
November 2024 – April 2025

23 MAY 2025



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November 2024 – April 2025

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Report No PREC-ARC-EN-RPT-0014

Date 23/05/2025

Revision Text 002

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
001	19/05/2025	Submitted draft to client for review	SB	HT
002	23/05/2025	Updated with data received after initial submission. Resubmitted to client for review	SB	HT

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1 INTRODUCTION

1.1 Background

The Moorebank Logistics Park¹ – Precinct East Operational Air Quality Monitoring Programme Framework (OAQMPF - dated 19 March 2020) provided a framework to monitor air quality during operation of the Moorebank Intermodal Precinct (MIP) East Precinct and was developed to support the implementation of the monitoring and reporting requirements identified in the Operational Air Quality Management Plan (OAQMP - Revision 18 dated 20 January 2023). MIP East Precinct (MPE) commenced operation in May 2020.

Operation of the first warehouses at MIP West Precinct (MPW) commenced in April 2024. To support the commencement of operation at MPW, under SSD 7709 CoC B47A a precinct wide OAQMP (POAQMP) that covers both MPE and MPW was prepared and approved by the Department on 20 December 2023.

The POAQMP (November 2024) now supersedes the OAQMPF (dated 19 March 2020) as per mitigation measure 2B of the Final Compilation of Mitigation Measures (MPE Stage 1). This Operational Air Quality Six Monthly Compliance Report #10 (this report and Compliance Report #9) covers the entire MIP (East and West Precincts). Compliance Reports #1 to #8 only covered MPE.

MIP (East and West Precincts) is managed in accordance with two Operational Environmental Management Plans (OEMP) and sub-plans:

- *Operational Environmental Management Plan Moorebank Logistics Park – East Precinct* (OEMP MPE) Revision 18 dated 20 January 2023 applies to MPE
- *OEMP Moorebank Intermodal Precinct - West Precinct Stage 2* (OEMP MPW) dated 6 May 2024 applies to MPW.

The POAQMP includes requirements from the following approvals:

- **EPBC Act Approval (2011/6229)** Condition of Approval (CoA) 8(f) which requires the implementation of a comprehensive air quality monitoring program (including locations, frequency, and duration)
- **Moorebank East Precinct Stage 1 (SSD 6766):**
 - Condition of Consent (CoC) F4(f)(iv) which requires measurement of air emissions generated by the Facility.
 - Final Compilation of Mitigation Measures (FCMM) 2C which requires the implementation of an air quality monitoring programme during operation for nuisance dust and air emissions [PM_{10}^2 and nitrogen dioxide (NO_2)].
- **Moorebank East Precinct Stage 2 (SSD 7628):**
 - CoC C21(c)(iii) which requires the submission of six-monthly operational compliance reports for the life of the project.
 - CoC B59(d)(i), (ii), (iii), (iv) and (vii) which require the identification of air quality monitoring methods and implementation of compliance monitoring for all emissions associated with operations of the Facility.
 - FCMM 3C which requires real-time boundary monitoring be undertaken during operation of the Facility.

¹ With LOGOS purchasing the MLP, the MLP will now be referred to as Moorebank Intermodal Precinct (MIP).

² PM_{10} - Particles with a diameter of 10 micrometres or less, which are small enough to pass through the throat and nose and enter the lungs.

- **Moorebank West Precinct Stage 2 (SSD 7709):**

- CoC B47A requires the development of an OAQMP, that covers both MPE and MPW.

In 2022, LOGOS Property took over the management of the warehouse and distribution facilities, as well as the overall management of MPE and MPW. In July 2024, ESR Group acquired the remaining interest in LOGOS, and overall management of the MIP East and West Precinct, is now the responsibility of ESR Australia & NZ (ESR). Qube Logistics will continue to maintain responsibility for the IMEX (Import Export Rail Terminal) and the Rail Link for MPE. This change in ownership does not impact the current reporting period or the current reporting requirements.

1.2 MIP (East and West Precincts) Site operation

1.2.1 MPE

MPE operates 24 hours, 7 days a week (24/7). This currently includes operation of the IMEX terminal, Rail Link, Warehouse 1, Warehouse 3, Warehouse 4, Warehouse 5, Warehouse 6 and Warehouse 7a and 7b. No major construction related activities are expected to occur during 2025. Warehouse 2 (Area 5) and the freight village (Area 6) are the last of the areas to be constructed. These are scheduled to be operational by Q4 2026. Construction activities would be undertaken during standard working hours, unless stated otherwise.

1.2.2 MPW

The MPW Stage 2 development is located west of Moorebank Avenue and involves the construction and operation of a multi-purpose Intermodal (freight) Terminal (IMT) facility, which includes:

- A rail link connection
- Warehousing
- Freight village
- Upgrades to the Moorebank Avenue and Anzac Road intersection and the subdivision of site including ancillary works.

Operation of the IMT facility includes:

- Operation of the rail link to the Southern Sydney Freight Line (SSFL) and container freight movement by truck to and from the MPE Site (included as part of MPE Stage 1 (SSD 6766)).
- A warehousing estate on the northern part of the site servicing the IMT facility, including:
 - six warehouses and associated infrastructure and amenities and
 - a freight village (operating from 7am to 6pm, 7 days/ week) including staff/ visitor amenities.

Currently Warehouses N1, N2, NDC and JN are operational, with the rest of the development still under construction.

MPW Stage 2 has been granted approval to receive imported material outside of standard construction hours, along with specific types of work.

1.2.3 MIP Wide

There are also works and activities that occur outside of standard construction hours under specific approvals processes from time-to-time. These can include construction works and activities associated with both MPE and MPW.

Table 1-1 summarises the works, activities and material importation undertaken outside of standard construction hours during the six-monthly reporting period.

Table 1-1: Summary of works outside of standard construction hours

Dates	Activities undertaken
17 December 2024	Moorebank Avenue upgrade (Including Anzac Road)
6 January 2025 to 31 March 2025	Moorebank Avenue upgrade and Moorebank Avenue and Anzac Road intersection upgrade
1 April 2025 to 30 June 2025	Moorebank Avenue upgrade and Moorebank Avenue and Anzac Road intersection upgrade

1.1 Purpose of the report

This six-monthly air quality report has been prepared to meet reporting requirements of SSD 7709 CoC B47A and as detailed in Section 5 of the OAQMPF (March 2020) and Section 4.3 of the POAQMP (November 2024).

This six-monthly air quality report includes:

- A background to the air quality monitors and their locations (Section 2)
- Weather data and regional air quality (Section 3)
- Analysis of the raw data and comparison against identified criteria / trigger level, identification of exceedances, complaints or ad hoc monitoring undertaken (Section 4)
- An overview of any investigations undertaken to determine the cause of the exceedance or complaint (Sections 4.2, 4.3, 4.4 and 4.5).
- A high-level overview of the dust deposition data (Section 4.2).
- Conclusions and recommendations based on the 6-month's data (Section 5)
- Summarised data in graphs and tables (Appendix A).

1.2 Reporting period

MPE commenced operations on 13 May 2020 and MPW commenced operations in April 2024.

This six-monthly air quality report has been prepared to provide an overview of operational air quality results for the six-month operational period from 1 November 2024 to 30 April 2025 (inclusive) to inform the six-monthly operational compliance reports required for the life of the project.

This report will be the tenth report since MPE operations began in May 2020. Reports 1-8 were for MPE only, with Reports 9 and 10 (this report) combining the operations of MPE and MPW.

1.3 Limitations

All findings contained in this report are based on downloaded monitoring data at the time of writing the monthly reports and information relating to air quality provided by Tactical Group, Envirosuite (Omnis), NEON system (weather monitor), Bureau of Meteorology (BOM) and Site Environmental and Remediation Services (SERS) who manage the dust deposition gauges (DDG). Arcadis do not take responsibility for the accuracy or limitations of the downloaded and provided DDG data.

2 OVERVIEW OF AIR QUALITY MONITORING

2.1 Air quality monitors

The dust and air quality monitoring system installed across the MIP Precincts comprises four Kunak AIR Lite units integrated with Omnis™ software, which is hosted in the cloud.

The Kunak AIR Lite units measure the following dust and air quality parameters:

- NO₂ (range: 0-25 ppb)
- PM₁₀ (particles with have a diameter less than 10 microns)
- PM_{2.5} (range: 0-1000 µg/m³)
- CO (installed since March 2020).

The original air quality monitors installed at the start of the MPE operations were replaced in mid-April 2024 with the Kunak AIR Lite sensors. The Kunak system also measures PM₁ i.e. particulates of less than one micron in size.

2.2 Dust deposition gauges

Seven DDGs were installed in May 2021. Another three DDG's were added to the Precinct in November 2024, bringing the total to ten across the Precinct. However, Stage 1 DDG 1 was removed in the first quarter of 2025, for a total of nine DDGs across the Precinct as of April 2025. The DDG's are currently managed and monitored by Site Environmental and Remediation Services (SERS). SERS provide monthly to quarterly DDG reports which are used to inform the monthly Air Quality Reports.

The gauges consist of 5-litre glass bottles with 150 mm diameter glass funnels and silicone bungs. The purpose of this sampling is to determine which particles settle from the ambient air over an approximate 31-day sampling period. This equipment is compliant with the Australian Standard AS/NZS 3580.10.1:2016.

2.3 Monitoring locations

The locations of the continuous air quality monitoring stations are identified on Figure 2-1 and the DDG locations are shown on Figure 2-2.

The site boundary is considered representative of the closest receptors (including the adjacent commercial premises). The locations of the continuous air quality monitors means that the construction and operation activities for both MPE and MPW Stage 2 have been captured.

DDG locations were also chosen so that a true representation of dust generated from operational activities at MPE could be established. The additional three DDGs capture construction activities occurring at MPW Stage 2 (see Figure 2-2).

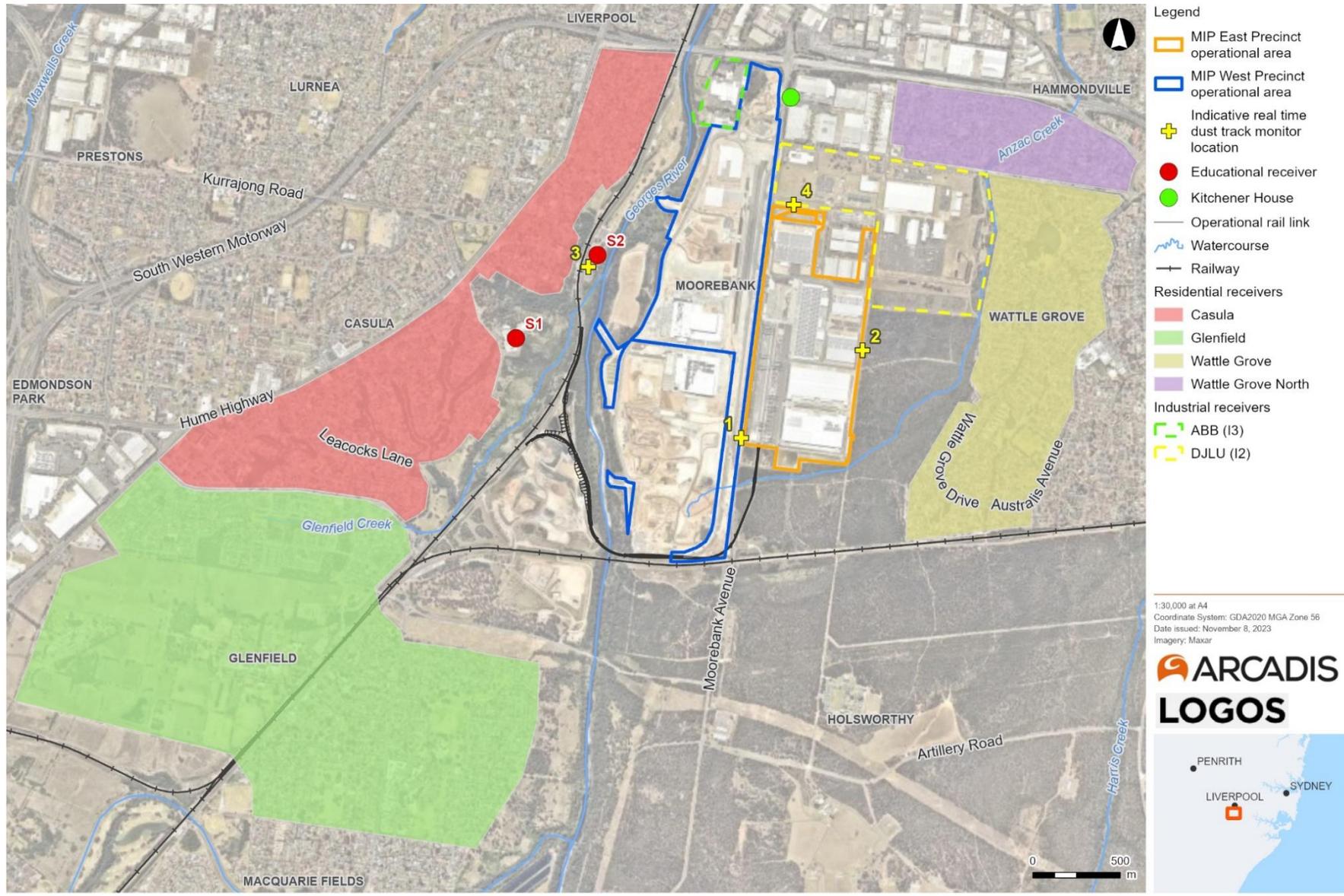


Figure 2-1: Continuous real-time air quality monitors (Source: Arcadis, 2023)



FIGURE 1 Dust Deposition Gauge- Sampling Location

<p>SERS Soil Environmental Remediation Services</p> <p>Tel: +61 (08) 9220 2000 http://www.sers.net.au</p>	CLIENT: Rottneest Island Authority PROJECT: Moorebank Avenue- Dust Deposition monitoring PROJECT No: 162536 BASEMAP: Nearmaps	LEGENDS: DDG Sampling locations	<p>© SERS Pty Ltd</p>
	SCALE: NTS ISSUE: FINAL DESIGN/DRAWN: RK DATE: March 2025		

Figure 2-2: Location of Dust Deposition Gauges (Source: SERS, May 2025). Stage 1 DDG1 was removed in the first quarter of 2025.

Stage 1 (STG 1) refers to MPE Stage 1 and Stage 2 (STG 2) refers to MPE Stage 2

2.4 Air quality monitoring station availability

A summary of availability (time of operation) of the continuous air quality monitoring stations for this reporting period is summarised in Table 2-1, with the most recent calibration date also stated.

Table 2-1: Monitoring station availability (%)

Monitoring station	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	Average %	Latest calibration date
	% availability each month							
AQM01	99	100	100	100	97	100	99	March 2024
AQM02	99	100	100	100	97	100	99	March 2024
AQM03	99	100	100	100	97	100	99	March 2024
AQM04	99	100	100	100	97	100	99	March 2024

All monitors were replaced around mid-April 2024. The older existing monitoring system (Sentinel) was also replaced with Omnis to support operations of the new monitors.

All monitors had an average of 99% availability throughout the reporting period.

3 WEATHER

3.1 Meteorological Conditions

3.1.1 Prevailing wind conditions

Prevailing winds influence the dispersion of dust, and other air emissions potentially generated by the Facility. A weather station is located adjacent to Moorebank Avenue at MPW to capture representative conditions at the site. The prevailing wind speed and direction is discussed in more detail below.

3.1.2 Observed wind data

3.1.2.1 Site weather station

The average wind speed and direction data from the site weather monitor from November 2024 to April 2025 is summarised below in Table 3-1.

Table 3-1: Site weather station average wind speed and direction for November 2024 to April 2025

Month	Wind speed (m/s)	Beaufort Wind scale category ³	Wind direction
November 2024	1.81	Light breeze	South (175°)
December 2024	2.02	Light breeze	South (184°)
January 2025	2.42	Light breeze	South (192°)
February 2025	1.85	Light breeze	South (184°)
March 2025	1.77	Light breeze	South-southwest (201°)
April 2025	1.39	Light air	Southwest (223°)

3.1.3 Ambient temperature and rainfall

Ambient temperature and rainfall are recorded at the Bankstown Airport AWS due to the availability of long-term averages for ambient temperature and rainfall which can be compared to the reporting period data. Based on the AWS, the monthly mean temperatures (minimum and maximum) and rainfall (long-term monthly average and total) for the reporting period are summarised in Table 3-2.

Table 3-2: Temperature and rainfall recorded at the Bankstown Airport AWS for the reporting period

Month	Mean minimum temperature (°C)	Mean maximum temperature (°C)	Total rainfall (mm)	Long-term monthly average rainfall (mm)
Nov 2024	17.2	27.8	52.8	76.0
Dec 2024	18.5	30.3	56.0	66.9
Jan 2025	18.8	28.7	163.0	92.5
Feb 2025	18.7	28.8	68.8	109.2

³ Based on the Beaufort wind force scale which is an empirical measure that relates wind speed to observed conditions at sea or on land (https://en.wikipedia.org/wiki/Beaufort_scale)

Month	Mean minimum temperature (°C)	Mean maximum temperature (°C)	Total rainfall (mm)	Long-term monthly average rainfall (mm)
Mar 2025	18.8	27.8	105.6	111.6
Apr 2025	14.3	25.6	78.6	85.5

Source: [Bankstown, NSW - April 2025 - Daily Weather Observations](#)

Rainfall for the reporting period was mixed throughout the 6-month period. However, January 2025 was well above the long-term monthly average rainfall and February was well below the long-term monthly average.

3.2 Ambient Air Quality

The NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) uses air quality categories (AQC) for NSW. These categories are based on air quality data readings which are taken continuously from the various monitoring sites throughout NSW and are averaged to give hourly and daily air quality information. NSW DCCEEW use minute data, and report concentrations as hourly and daily averages. All averages are arithmetic means. Air quality data is updated hourly, and a daily air quality forecast is made for the Greater Sydney Metropolitan Region at 4 pm each day.

The AQC is generally used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. The AQC ranges from 'Good' to 'Extremely Poor' and is summarised in Figure 3-1⁴.

		Air quality categories (AQC)					
Air pollutant	Averaging period	Units	GOOD	FAIR	POOR	VERY POOR	EXTREMELY POOR
Ozone	1-hour	pphm	<6.7	6.7–10.0	10.0–15.0	15.0–20.0	20.0 and above
O ₃	4-hour rolling	pphm	<5.4	5.4–8.0	8.0–12.0	12.0–16.0	16.0 and above
Nitrogen dioxide	1-hour	pphm	<8	8–12	12–18	18–24	24 and above
NO ₂							
Visibility	1-hour	bsp	<1.5	1.5–3.0	3.0–6.0	6.0–18.0	18.0 and above
Neph							
Carbon monoxide	8-hour rolling	ppm	<6.0	6.0–9.0	9.0–13.5	13.5–18.0	18.0 and above
CO							
Sulfur dioxide	1-hour	pphm	<13.3	13.3–20.0	20.0–30.0	30.0–40.0	40.0 and above
SO ₂							
Particulate matter	1-hour	µg/m ³	<50	50–100	100–200	200–600	600 and above
< 10 µm PM ₁₀							
Particulate matter	1-hour	µg/m ³	<25	25–50	50–100	100–300	300 and above
< 2.5 µm PM _{2.5}							

Figure 3-1: Air quality categories

⁴ <https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/air-quality-categories>

The PM₁₀, PM_{2.5}, NO₂, Visibility and CO air quality data from the Liverpool⁵ monitoring station is reviewed monthly and is summarised for the six-month reporting period in Table 3-3.

Table 3-3: Summary of AQC from the Liverpool monitoring station for the reporting period

Month	Average for Reporting Period	Comment for reporting period
NO ₂ (ppm) maximum 1 hourly average	Good	Good every day
CO (ppm) maximum rolling 8 hourly averages	Good	Good every day
PM ₁₀ 24-hour average	Mostly good, with 1 day fair.	'Good' every day except for: <ul style="list-style-type: none"> • Saturday 1 March 2025 which had 'fair' PM₁₀ (36.2µg/m³).
PM _{2.5} 24-hour average	Mostly good, with 1 day fair.	'Good' every day except for: <ul style="list-style-type: none"> • Saturday 12 April 2025 which had 'fair' PM_{2.5} (20.1 µg/m³).
Visibility ⁶ ,	Mostly good, with 4 days fair.	'Good' every day except for: <ul style="list-style-type: none"> • Saturday 1 March 2025 which had 'fair' Visibility (1.57 10⁻⁴m⁻¹). • Thursday 10 April 2025 which had 'fair' Visibility (1.82 10⁻⁴m⁻¹). • Friday 11 April 2025 which had 'fair' Visibility (2.27 10⁻⁴m⁻¹). • Saturday 12 April 2025 which had 'fair' Visibility (2.31 10⁻⁴m⁻¹).

⁵ Data download facility | NSW Dept of Planning, Industry and Environment

⁶ In NSW, visibility (or NEPH) is reported in units of 10⁻⁴ m⁻¹. This means that a NEPH value of 1.5 should be read as 1.5x10⁻⁴ m⁻¹. NSW has adopted a 1-hour visibility standard of 2.1x10⁻⁴ m⁻¹, which corresponds to a visual distance of approximately 18.6 km. This means that NEPH > 2.1 will trigger 'POOR' (or worse) air quality due to reduced visual range (<18.6 km)

4 MONITORING RESULTS

4.1 Air quality criteria

4.1.1 Criteria for PM_{2.5}, PM₁₀, NO₂ and CO

The National Environment Protection Measure for Ambient Air (Air NEPM)⁷ has established new national standards for assessment of air quality for NO₂ and CO, which came into effect 13 May 2021. These criteria are detailed in Table 4-1. The air quality data at MIP was assessed against the new criteria from June 2021.

Table 4-1: Monitoring criteria (January 2025 for PM_{2.5} and the remaining criteria applied from June 2021)

Monitoring focus	Averaging period	Criteria / Trigger / Goal
PM _{2.5} *	24-hour average	20 µg/m ³
	Annual average	7 µg/m ³
PM ₁₀	24-hour average	50 µg/m ³
	Annual average	25 µg/m ³
NO ₂	1-hour average	0.12 ppm
	Annual average	0.03 ppm
CO	1-hour average	NA
	8 -hour average	9.0 ppm

*The criteria for PM_{2.5} changed from 25 µg/m³ to 20 µg/m³ for the 24-hour averaging period and from 8 µg/m³ to 7 µg/m³ for the annual average on 1 January 2025. The standards for PM_{2.5} have not changed, only the goal has changed

4.1.2 Dust deposition

Dust deposition data from ten DDGs located around MIP is provided by SERS. Seven DDGs have been operational since May 2021 and another three were added in November 2024 to provide representative dust deposition across the entire MIP.

NSW DCCEEW has set the criteria for dust deposition rates, and these are provided in Table 4-2.

Table 4-2: Dust deposition criteria

Averaging Period	Maximum increase in deposited dust* level	Maximum total deposited dust level
Annual	2 g/m ² /month (incremental)	4 g/m ² /month (cumulative)

* Deposited dust is assessed as insoluble solids. This is the mass of the insoluble portion of the deposited matter, as defined under AS 3580.10.1: 2016.

⁷ <https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/standards-and-goals>

4.2 Dust deposition gauge results

The results of the collection period 24 October 2024 to 29 April 2025 as provided by SERS is shown in Table 4-3.

Table 4-3: Dust deposition (insoluble solids g/m²/month) results from 24 October 2024 to 29 April 2025

Date	Stage 1 DDG 1	Stage 2 DDG 1	Stage 2 DDG 2	Stage 2 DDG 3	Stage 2 DDG 4	Stage 2 DDG 5	Stage 2 DDG 6	MPW1	MPW2	MPW3	Average
November 2024	2.2	1.1	0.8	1.1	0.9	0.8	0.5	3.6	9.7	3.7	2.4
December 2024	3.0	1.3	1.1	2.0	1.6	0.7	5.5	4.2	13.0	3.4	3.6
January 2025	N/A*	0.2	1.3	3.2	0.7	0.8	2.0	1.8	1.3	0.9	1.4
February 2025	2.7	0.2	0.3	1.4	0.4	0.5	<0.1	2	8.7	1.3	1.8
March [#] 2025	N/A**	0.1	0.3	0.2	0.3	<0.1	0.2	1.5	4.2	1.1	0.9
April 2025	N/A**	1.6	0.9	0.8	0.3	<0.1	1.0	2.9	3.0	1.1	1.3

NOTE: Bold/grey indicates an exceedance of the criteria.

* Stage 1 DDG 1 was unable to be collected during the reporting period.

** Stage 1 DDG 1 was removed from site and is no longer providing data.

[#] Two reports were used to capture the entire month of March

As shown in Table 4-3, there were six individual gauge exceedances between November 2024 and April 2025. The majority of these occurred at MPW2, which is located adjacent to an area of the site that is still under construction. These results may have been impacted by construction activities.

4.3 Continuous monitor results

Monitoring data for PM_{2.5}, PM₁₀, NO₂ and CO for the reporting period have been summarised into tables and graphs and are provided in [Appendix A](#). The following sections summarise the results for this 6-month reporting period.

4.3.1 Annual exceedances

Twelve months of air quality monitoring are provided graphically and in table form in [Appendix A](#).

AQM04 only had 58% availability for PM_{2.5} and PM₁₀ in July 2024 and 85% availability for PM_{2.5} and PM₁₀ in August 2024, however, the monitor had 100% availability for NO₂ and CO during these months and high availability for the remaining 12 months. All other monitors had an average availability of 99% during the reporting period.

See Table 2-1 for the monitoring station availability (%) over a 12-month period.

4.3.1.1 PM_{2.5} and PM₁₀ Monitoring

The 12-month rolling annual average for the period May 2024 to April 2025 for all four monitors combined was below the annual average criteria (i.e. 7.0 µg/m³ for PM_{2.5} and 25.0 µg/m³ for PM₁₀) for each month.

As of April 2025, the 12-month rolling annual average for all four monitors was 4.7 $\mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ and 12.3 $\mu\text{g}/\text{m}^3$ for PM_{10} .

See [Appendix A.1](#) and [Appendix A.2](#) for more details.

4.3.1.2 NO₂ Monitoring

The 12-month rolling annual average for all four monitors for the period May 2024 to April 2025 was below the annual average criteria (0.03 ppm) for each month.

As of April 2025, the 12-month rolling annual average for NO₂ for all four monitors is 0.007 ppm, well below the annual average criteria of 0.03 ppm.

4.3.1.3 CO

CO does not require annual reporting.

4.3.2 24-hour exceedances

4.3.2.1 PM_{2.5} Monitoring

A review of the data for the reporting period (November 2024 to April 2025) did not identify any exceedance of the 24-hour average criteria (20 $\mu\text{g}/\text{m}^3$) for $\text{PM}_{2.5}$ for the 6-month reporting period.

4.3.2.2 PM₁₀ Monitoring

A review of the data for the reporting period (November 2024 to April 2025) did not identify any exceedance of the 24-hour average criteria (50 $\mu\text{g}/\text{m}^3$) for PM_{10} for the 6-month reporting period.

4.3.3 NO₂ 1-hour exceedances

No exceedance of NO₂ 1-hour criteria (0.12 ppm / 120 ppb) were observed during the 6-month reporting period.

4.3.4 CO 8-hour exceedances

No 8-hour criteria exceedances for CO occurred during the 6-month reporting period.

4.4 Complaints

One complaint was made relating to air quality in December 2024. The complaint related to dust and an increase in the complainant's pool cleaning. No other formal complaints were received during the reporting period relating to air quality.

4.5 Ad-hoc monitoring

No ad-hoc monitoring was undertaken during this reporting period.

5 CONCLUSION

This six-monthly operational air quality report covers the period November 2024 to April 2025 (inclusive).

The following summarises the monitoring results for this reporting period:

Data summary

- The criteria for PM_{2.5} changed from 25 µg/m³ to 20 µg/m³ for the 24-hour averaging period and from 8 µg/m³ to 7 µg/m³ for the annual average on 1 January 2025. It should be noted that the standards for PM_{2.5} have not changed, only the goal has changed.
- The rolling annual average for all four monitors combined was below the annual average criteria (7.0 µg/m³ for PM_{2.5} and 25.0 µg/m³ for PM₁₀) for each month during the reporting period.
- There were no exceedances of the PM_{2.5} 24-hour average criteria (20 µg/m³) during the 6-month reporting period.
- There were no exceedances of the PM₁₀ 24-hour average criteria (50 µg/m³) during the 6-month reporting period.
- There were no exceedances of NO₂ 1-hour criteria (0.12 ppm / 120 ppb) during the 6-month reporting period.
- There were no exceedances of the CO criteria (9.0 ppm) during the 6-month reporting period.
- Seven DDGs were installed in May 2021 and another three DDG's were added in November 2024 to the MPW. However, Stage 1 DDG 1 was removed in the first quarter of 2025 resulting in nine DDGs across the MIP as of April 2025.

Exceedances

There were six individual gauge exceedances of the dust deposition (insoluble solids) 2 g/m²/month (incremental) criteria between November 2024 to April 2025. The majority of these occurred at MPW2, which is located adjacent to an area of the site that is still under construction. These may have impacted by construction activities. To prevent further exceedances the following measures (but not limited to) could be applied, if not already:

- Reduce areas of exposed soil
- Use of water suppression if earthworks or dust generating activities are occurring e.g. watercarts, water misters
- Staging of works to be intermittent, particularly during periods of high wind and dry conditions.

Complaints

One complaint relating to air quality was received during the reporting period (December 2024). The complaint was addressed promptly and the matter closed. No other complaints relating to air quality were received during the reporting period.

Recommendation

It is recommended that monitors continue to be calibrated annually as per operational requirements and device specifications. The monitors were last calibrated in March 2024, over a year ago. Calibration should occur as soon as possible.

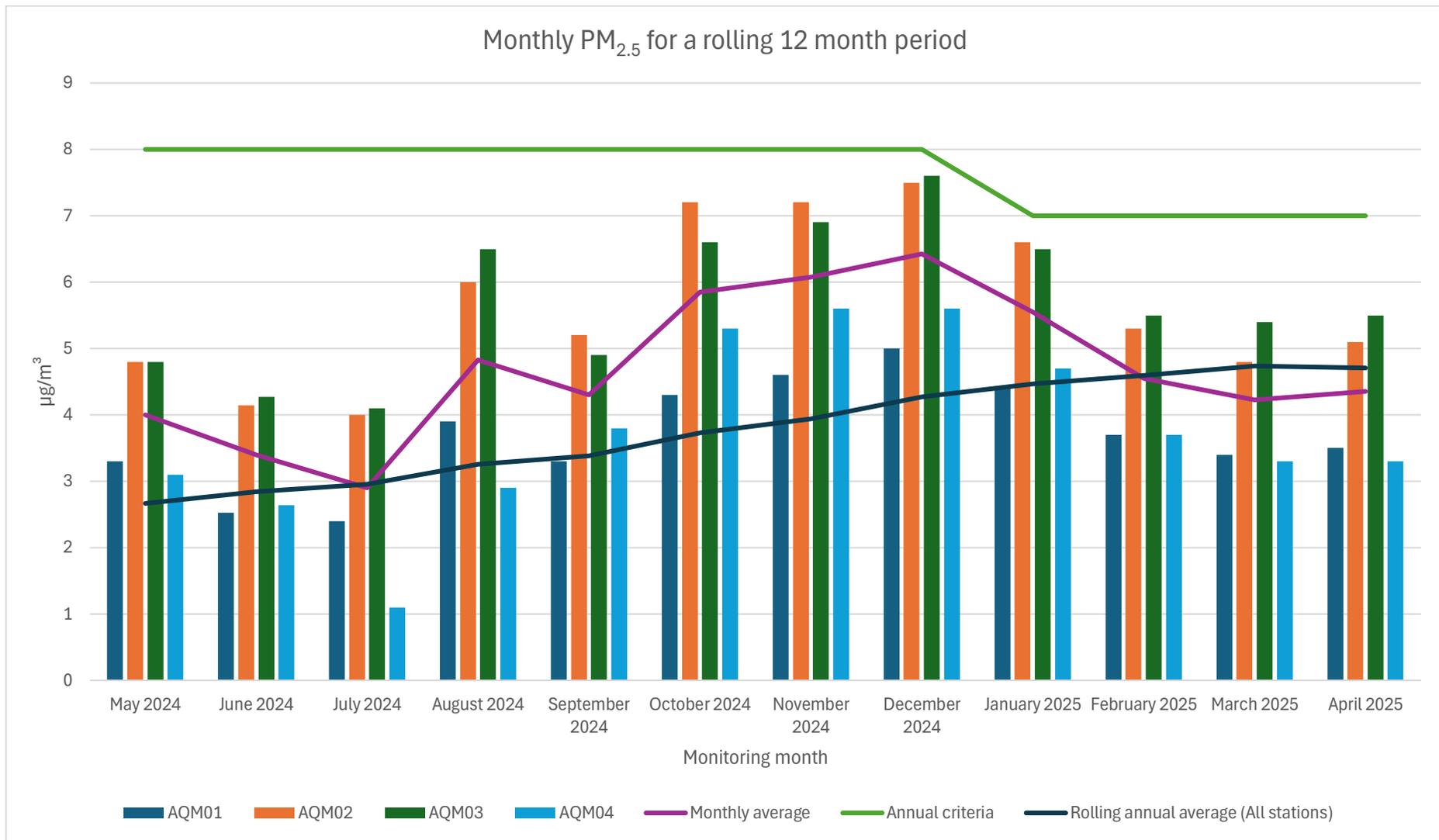
APPENDIX A **MONITORING DATA**

Appendix A.1: Rolling 12-month particulate data (PM_{2.5})

Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	µg/m ³	µg/m ³	µg/m ³					
May 2024	3.3	4.8	4.8	3.1	4.0	2.7	8.0	No exceedance of annual average criteria.
June 2024	2.5	4.1	4.3	2.6	3.4	2.8	8.0	No exceedance of annual average criteria.
July 2024	2.4	4.0	4.1	1.1	2.9	3.0	8.0	No exceedance of annual average criteria.
August 2024	3.9	6.0	6.5	2.9	4.8	3.3	8.0	No exceedance of annual average criteria.
September 2024	3.3	5.2	4.9	3.8	4.3	3.4	8.0	No exceedance of annual average criteria.
October 2024	4.3	7.2	6.6	5.3	5.9	3.7	8.0	No exceedance of annual average criteria.
November 2024	4.6	7.2	6.9	5.6	6.1	3.9	8.0	No exceedance of annual average criteria.
December 2024	5.0	7.5	7.6	5.6	6.4	4.3	8.0	No exceedance of annual average criteria.
January 2025	4.4	6.6	6.5	4.7	5.6	4.5	7.0	No exceedance of annual average criteria. The annual criteria/goal for PM _{2.5} changed from 8 µg/m ³ to 7 µg/m ³ from 1 January 2025.
February 2025	3.7	5.3	5.5	3.7	4.6	4.6	7.0	No exceedance of annual average criteria.
March 2025	3.4	4.8	5.4	3.3	4.2	4.7	7.0	No exceedance of annual average criteria.
April 2025	3.5	5.1	5.5	3.3	4.4	4.7	7.0	No exceedance of annual average criteria.
Rolling 12 month average	3.7	5.7	5.7	3.8	-	-	8.0	No exceedance of annual average criteria.
All months[^]	1.3	3.6	6.6	2.9	3.5	-	8.0	No exceedance of annual average criteria.

Bold/grey indicates an exceedance of the criteria.

[^] All months since May 2020

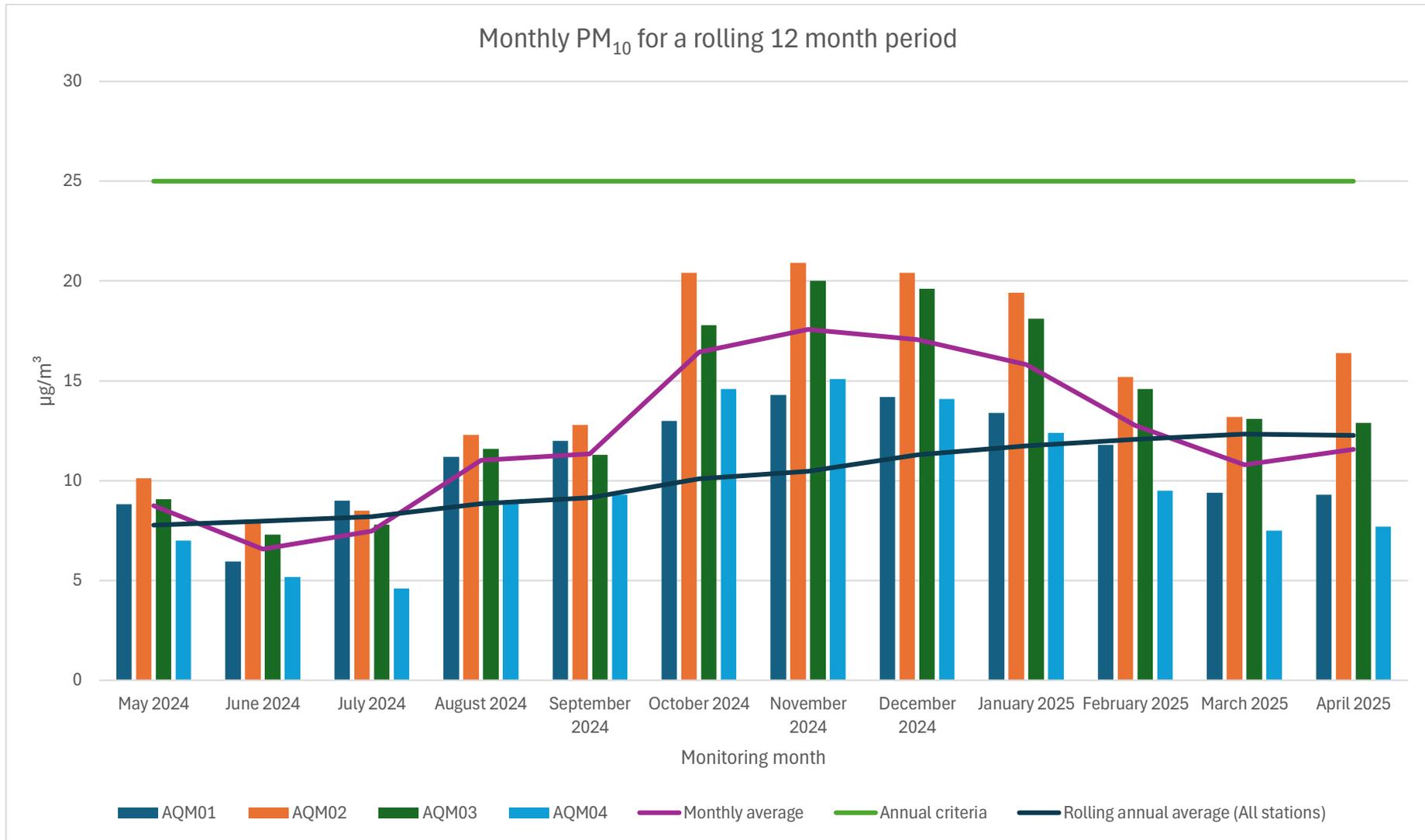


Monthly PM_{2.5} over 12 months including the 6-months for this report

Appendix A.2: Rolling 12-month particulate data (PM₁₀)

Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	µg/m ³	µg/m ³	µg/m ³					
May 2024	8.8	10.1	9.1	7.0	8.7	7.8	25.0	No exceedance of annual average criteria.
June 2024	5.9	7.9	7.3	5.2	6.6	8.0	25.0	No exceedance of annual average criteria.
July 2024	9.0	8.5	7.8	4.6	7.5	8.2	25.0	No exceedance of annual average criteria.
August 2024	11.2	12.3	11.6	9.0	11.0	8.9	25.0	No exceedance of annual average criteria.
September 2024	12.0	12.8	11.3	9.3	11.4	9.1	25.0	No exceedance of annual average criteria.
October 2024	13.0	20.4	17.8	14.6	16.5	10.1	25.0	No exceedance of annual average criteria.
November 2024	14.3	20.9	20.0	15.1	17.6	10.5	25.0	No exceedance of annual average criteria.
December 2024	14.2	20.4	19.6	14.1	17.1	11.3	25.0	No exceedance of annual average criteria.
January 2025	13.4	19.4	18.1	12.4	15.8	11.7	25.0	No exceedance of annual average criteria.
February 2025	11.8	15.2	14.6	9.5	12.8	12.1	25.0	No exceedance of annual average criteria.
March 2025	9.4	13.2	13.1	7.5	10.8	12.3	25.0	No exceedance of annual average criteria.
April 2025	9.3	16.4	12.9	7.7	11.6	12.3	25.0	No exceedance of annual average criteria.
Rolling 12 month average	11.0	14.8	13.6	9.7	-	-	25.0	No exceedance of annual average criteria.
All months [^]	3.8	10.5	21.5	6.5	10.4	-	25.0	No exceedance of annual average criteria.

Bold/grey indicates an exceedance of the criteria, ^ All months since May 2020



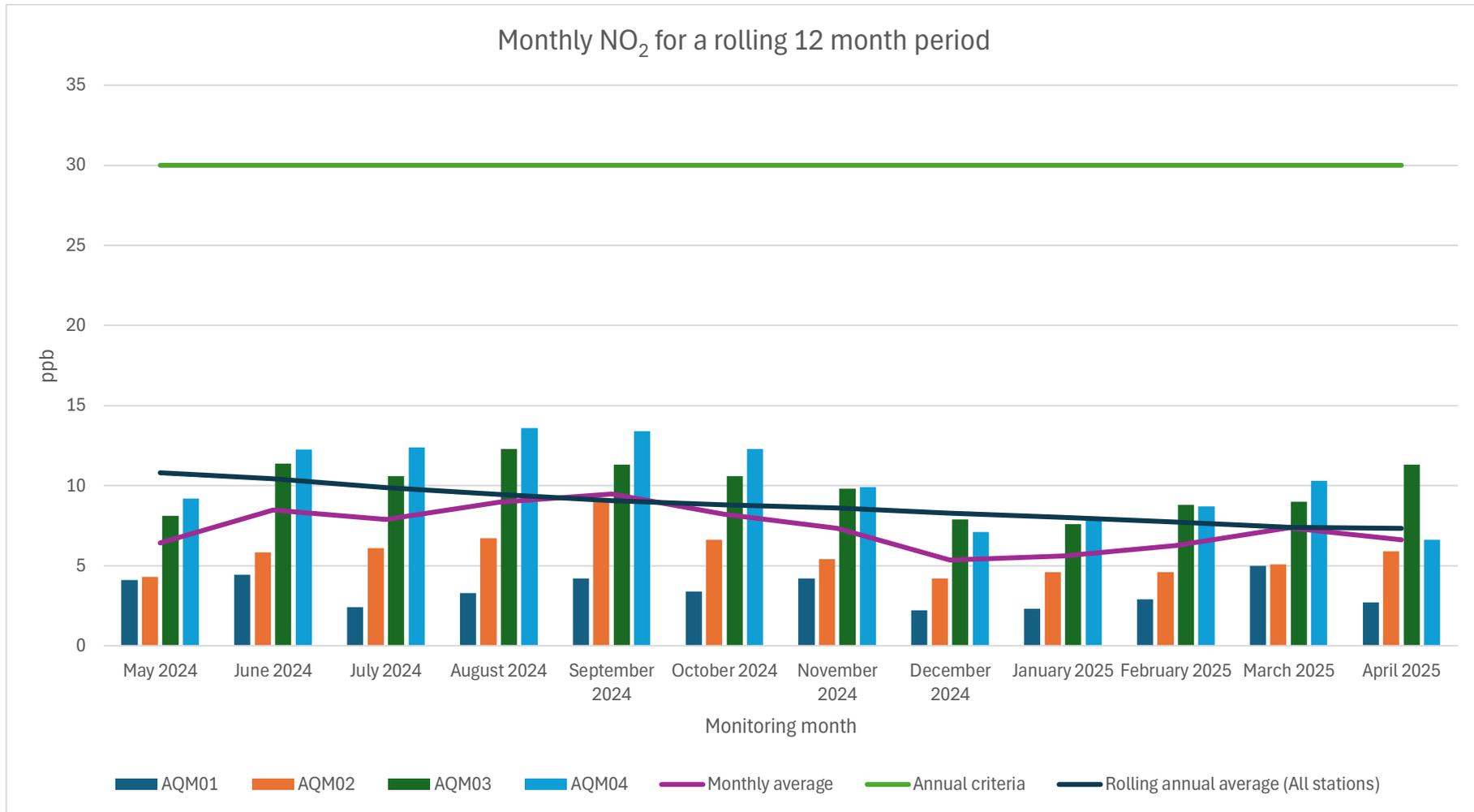
Monthly PM₁₀ over 12 months including the 6-months for this report

Appendix A.3: Rolling monthly and annual particulate data (NO₂)

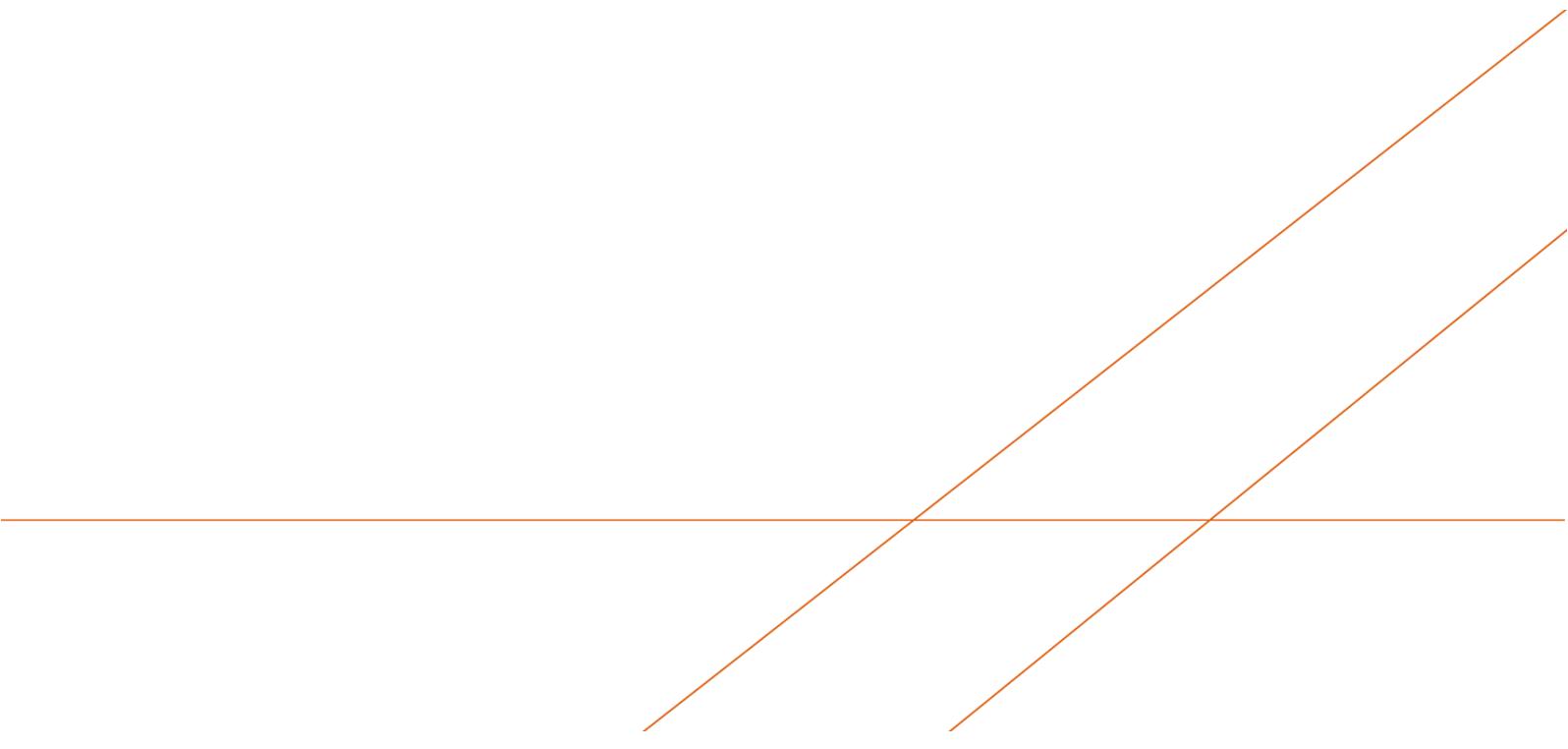
Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	ppb	ppb	ppb	ppb	ppb	ppb	ppm / ppb*	
May 2024	4.1	4.3	8.1	9.2	6.4	10.8	0.03 / 30.0	No exceedance of annual average criteria.
June 2024	4.4	5.8	11.4	12.2	8.5	10.4	0.03 / 30.0	No exceedance of annual average criteria.
July 2024	2.4	6.1	10.6	12.4	7.9	9.9	0.03 / 30.0	No exceedance of annual average criteria.
August 2024	3.3	6.7	12.3	13.6	9.0	9.5	0.03 / 30.0	No exceedance of annual average criteria.
September 2024	4.2	9.0	11.3	13.4	9.5	9.1	0.03 / 30.0	No exceedance of annual average criteria.
October 2024	3.4	6.6	10.6	12.3	8.2	8.8	0.03 / 30.0	No exceedance of annual average criteria.
November 2024	4.2	5.4	9.8	9.9	7.3	8.6	0.03 / 30.0	No exceedance of annual average criteria.
December 2024	2.2	4.2	7.9	7.1	5.4	8.3	0.03 / 30.0	No exceedance of annual average criteria.
January 2025	2.3	4.6	7.6	7.9	5.6	8.0	0.03 / 30.0	No exceedance of annual average criteria.
February 2025	2.9	4.6	8.8	8.7	6.3	7.7	0.03 / 30.0	No exceedance of annual average criteria.
March 2025	5.0	5.1	9.0	10.3	7.4	7.4	0.03 / 30.0	No exceedance of annual average criteria.
April 2025	2.7	5.9	11.3	6.6	6.6	7.3	0.03 / 30.0	No exceedance of annual average criteria.
Rolling 12 month average	0.003 ppm / 3.4 ppb	0.006 ppm / 5.7 ppb	0.010 ppm / 9.9 ppb	0.010 ppm / 10.3 ppb	-	-	0.03 / 30.0	No exceedance of annual average criteria.
All months^	0.007 ppm / 6.8 ppb	0.006 ppm / 5.9 ppb	0.036 ppm / 36.3 ppb	0.011 ppm / 10.9 ppb	0.014 ppm / 14.4 ppb	-	0.03 ppm / 30.0 ppb	No exceedance of average criteria for all sites for all months. However, AQM03 has exceeded the annual average for the period since monitoring began.

Bold/grey indicates an exceedance of the criteria.

*Results are shown in ppb due to reporting output, however the criteria is set in ppm and therefore the equivalent criteria in ppb is also shown. ^ All months since May 2020



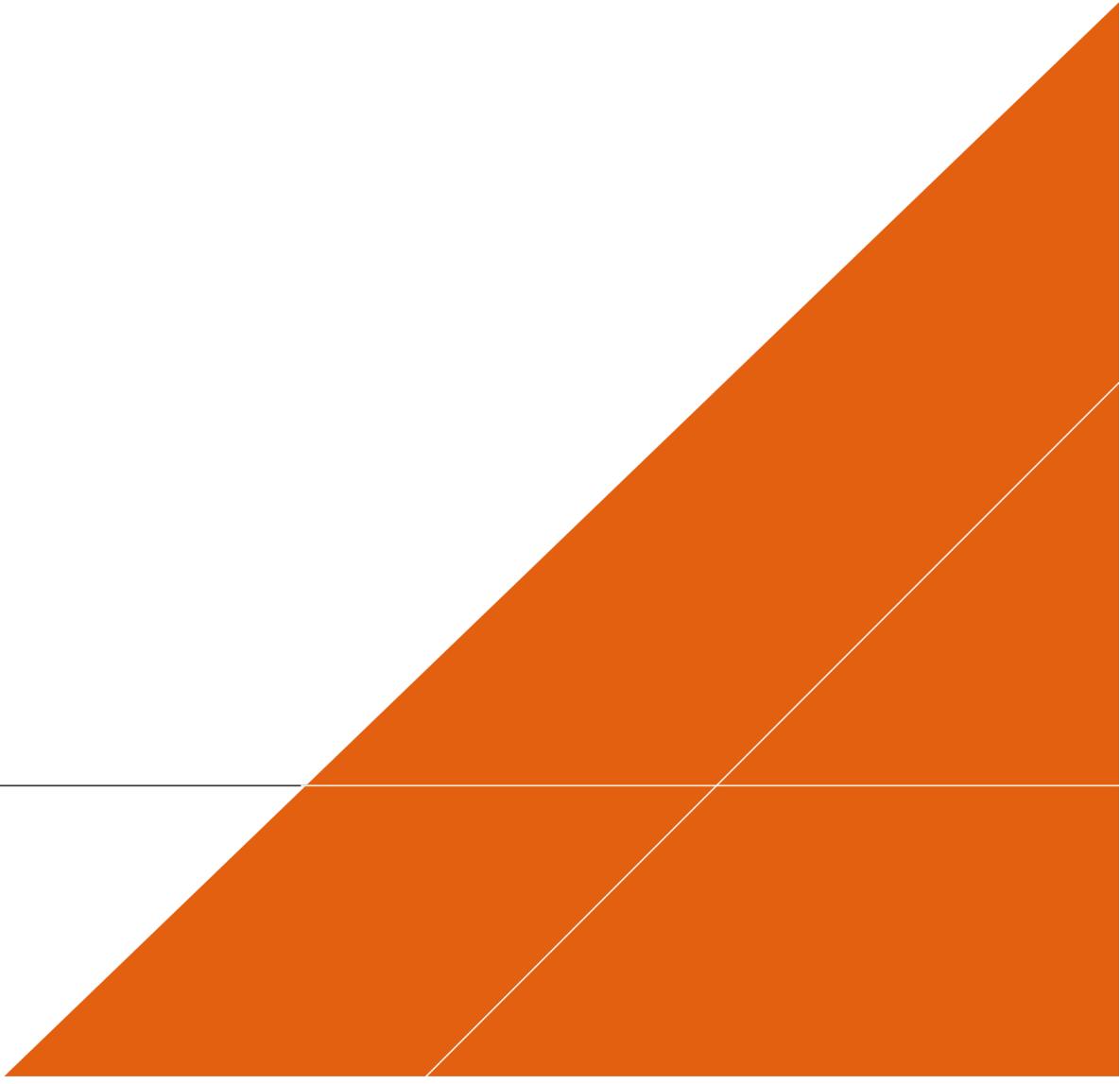
Monthly NO₂ over 12 months including the 6-months for this report



MOOREBANK INTERMODAL PRECINCT – EAST AND WEST PRECINCTS

Operational Air Quality Six Monthly Compliance Report #11
May 2025 – October 2025

14 NOVEMBER 2025



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MOOREBANK INTERMODAL PRECINCT – EAST AND WEST PRECINCTS

Operational Air Quality Six Monthly Compliance Report #11

May 2025 – October 2025

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Report No PREC-ARC-EN-RPT-0015

Date 14/11/2025

Revision Text 001

This report has been prepared for Tactical Group in accordance with the terms and conditions of appointment for MIP (East and West Precincts) Operational Air Monitoring Program dated March 2024. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

REVISIONS

Revision	Date	Description	Prepared by	Approved by
001	14/11/2025	Submitted draft to client for review	SB	HT

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1 INTRODUCTION

1.1 Background

The Moorebank Logistics Park¹ – Precinct East Operational Air Quality Monitoring Programme Framework (OAQMPF - dated 19 March 2020) provided a framework to monitor air quality during operation of the Moorebank Intermodal Precinct (MIP) East Precinct and was developed to support the implementation of the monitoring and reporting requirements identified in the Operational Air Quality Management Plan (OAQMP - Revision 18 dated 20 January 2023). MIP East Precinct (MPE) commenced operation in May 2020.

Operation of the first warehouses at MIP West Precinct (MPW) commenced in April 2024. To support the commencement of operation at MPW, under SSD 7709 Condition of Consent (CoC) B47A a precinct wide OAQMP (POAQMP) that covers both MPE and MPW was prepared and initially approved by the Department on 20 December 2023, with the latest approved revision in November 2024.

The POAQMP now supersedes the OAQMPF (dated 19 March 2020) as per mitigation measure 2B of the Final Compilation of Mitigation Measures (MPE Stage 1) [FCMM]. This Operational Air Quality Six Monthly Compliance Report #11 (this report and Compliance Reports #9 and #10) cover the entire MIP (East and West Precincts). Compliance Reports #1 to #8 only covered MPE.

MIP (East and West Precincts) is managed in accordance with two Operational Environmental Management Plans (OEMP) and sub-plans:

- *Operational Environmental Management Plan Moorebank Logistics Park – East Precinct* (OEMP MPE) Revision 19 dated 20 November 2024 applies to MPE
- *OEMP Moorebank Intermodal Precinct - West Precinct Stage 2* (OEMP MPW) dated 6 May 2024 applies to MPW.

The POAQMP includes requirements from the following approvals:

- **EPBC Act Approval (2011/6229)** Condition of Approval (CoA) 8(f) which requires the implementation of a comprehensive air quality monitoring program (including locations, frequency, and duration)
- **Moorebank East Precinct Stage 1 (SSD 6766):**
 - CoC F4(f)(iv) which requires measurement of air emissions generated by the Facility.
 - FCMM 2C which requires the implementation of an air quality monitoring programme during operation for nuisance dust and air emissions [PM_{10}^2 and nitrogen dioxide (NO_2)].
- **Moorebank East Precinct Stage 2 (SSD 7628):**
 - CoC C21(c)(iii) which requires the submission of six-monthly operational compliance reports for the life of the project.
 - CoC B59(d)(i), (ii), (iii), (iv) and (vii) which require the identification of air quality monitoring methods and implementation of compliance monitoring for all emissions associated with operations of the Facility.
 - FCMM 3C which requires real-time boundary monitoring be undertaken during operation of the Facility.

¹ With LOGOS purchasing the MLP, the MLP will now be referred to as Moorebank Intermodal Precinct (MIP).

² PM_{10} - Particles with a diameter of 10 micrometres or less, which are small enough to pass through the throat and nose and enter the lungs.

- **Moorebank West Precinct Stage 2 (SSD 7709):**

- CoC B47A requires the development of an OAQMP, that covers both MPE and MPW.

In 2022, LOGOS Property took over the management of the warehouse and distribution facilities, as well as the overall management of MPE and MPW. In July 2024, ESR Group acquired the remaining interest in LOGOS, and overall management of the MIP East and West Precinct, is now the responsibility of ESR Australia & NZ (ESR). Qube Logistics will continue to maintain responsibility for the IMEX (Import Export Rail Terminal) and the Rail Link for MPE. This change in ownership does not impact the current reporting period or the current reporting requirements.

1.2 MIP (East and West Precincts) Site operation

1.2.1 MPE

MPE operates 24 hours, 7 days a week (24/7). This currently includes operation of the IMEX terminal, Rail Link, Warehouse 1, Warehouse 3, Warehouse 4, Warehouse 5, Warehouse 6 and Warehouse 7a and 7b. No major construction related activities occurred during this reporting period. Warehouse 2 (Area 5) and the freight village (Area 6) are the last of the areas to be constructed. These are scheduled to be operational by Q4 2026. These activities would be undertaken during standard working hours, unless stated otherwise.

1.2.2 MPW

The MPW Stage 2 development is located west of Moorebank Avenue and involves the construction and operation of a multi-purpose Intermodal (freight) Terminal (IMT) facility, which includes:

- A rail link connection
- Warehousing
- Freight village
- Upgrades to the Moorebank Avenue and Anzac Road intersection and the subdivision of site including ancillary works.

Operation of the IMT facility includes:

- Operation of the rail link to the Southern Sydney Freight Line (SSFL) and container freight movement by truck to and from the MPE Site (included as part of MPE Stage 1 (SSD 6766)).
- A warehousing estate on the northern part of the site servicing the IMT facility, including:
 - six warehouses and associated infrastructure and amenities and
 - a freight village (operating from 7am to 6pm, 7 days/ week) including staff/ visitor amenities.

Currently Warehouses N1, N2, NDC and JN are operational, with the rest of the development still under construction.

MPW Stage 2 has been granted approval to receive imported material outside of standard construction hours, along with specific types of work.

1.2.3 Moorebank Realignment Works

Construction of the Moorebank Realignment (MARW) commenced in March 2025. The Moorebank Realignment works are occurring adjacent north, east and south of MPE, with construction activities including excavation, vegetation clearing and material importation. These activities have the potential to impact on the air quality in the localised area.

1.2.4 MIP Wide

There are also works and activities that occur outside of standard construction hours under specific approvals processes from time-to-time. These can include construction works and activities associated with MPE, MPW and MARW.

Table 1-1 summarises the works, activities and material importation undertaken outside of standard construction hours during the six-monthly reporting period.

Table 1-1: Summary of works outside of standard construction hours

Dates	Activities undertaken
1 April 2025 to 31 October 2025	Moorebank Avenue upgrade and Moorebank Avenue and Anzac Road intersection upgrade
From July 2025	Moorebank Avenue Realignment Works (MARW)
26 July 2025 and 27 July 2025	M5 closure at Moorebank Avenue
30 July 2025 to 17 October 2025	Southern end of Bushmaster Avenue works
October 2025	Works at Bushmaster Avenue south as part of MPW

1.1 Purpose of the report

This six-monthly air quality report has been prepared to meet reporting requirements of SSD 7709 CoC B47A and as detailed in Section 5 of the OAQMPF (March 2020) and Section 4.3 of the POAQMP (November 2024).

This six-monthly air quality report includes:

- A background to the air quality monitors and their locations (Section 2)
- Weather data and regional air quality (Section 3)
- Analysis of the raw data and comparison against identified criteria / trigger level, identification of exceedances, complaints or ad hoc monitoring undertaken (Section 4)
- An overview of any investigations undertaken to determine the cause of the exceedance or complaint (Sections 4.2, 4.3, 4.4 and 4.5).
- A high-level overview of the dust deposition data (Section 4.2).
- Conclusions and recommendations based on the 6-month's data (Section 5)
- Summarised data in graphs and tables (Appendix A).

1.2 Reporting period

MPE commenced operations on 13 May 2020 and MPW commenced operations in April 2024.

This six-monthly air quality report has been prepared to provide an overview of operational air quality results for the six-month operational period from 1 May 2025 to 31 October 2025 (inclusive) to inform the six-monthly operational compliance reports required for the life of the project.

This report will be the eleventh report since MPE operations began in May 2020. Reports #1- #8 were for MPE only, with Reports #9 onwards, including this report #11, combining the operations of MPE and MPW.

1.3 Limitations

All findings contained in this report are based on downloaded monitoring data at the time of writing the monthly reports and information relating to air quality provided by Tactical Group, Envirosuite (Omnis), NEON system (weather monitor), Bureau of Meteorology (BOM) and Site Environmental and Remediation Services (SERS) who manage the dust deposition gauges (DDG). Arcadis do not take responsibility for the accuracy or limitations of the downloaded and provided DDG data.

2 OVERVIEW OF AIR QUALITY MONITORING

2.1 Air quality monitors

The dust and air quality monitoring system installed across the MIP Precincts comprises four Kunak AIR Lite units integrated with Omnis™ software, which is hosted in the cloud.

The Kunak AIR Lite units measure the following dust and air quality parameters:

- NO₂ (range: 0-25 ppb)
- PM₁₀ (particles with have a diameter less than 10 microns)
- PM_{2.5} (range: 0-1000 µg/m³)
- CO (installed since March 2020).

The original air quality monitors installed at the start of the MPE operations were replaced in mid-April 2024 with the Kunak AIR Lite sensors. The Kunak system also measures PM₁ i.e. particulates of less than one micron in size.

2.2 Dust deposition gauges

Seven DDGs were installed across the Precinct in May 2021. Another three DDG's were added to the Precinct in November 2024 and Stage 1 DDG 1 was removed in the first quarter of 2025 due to its location within the IMEX terminal. Therefore, as of April 2025 there are nine DDGs across the Precinct.

The DDG's are currently managed and monitored by Site Environmental and Remediation Services (SERS). SERS provide monthly to quarterly DDG reports which are used to inform the monthly Air Quality Reports.

The DDGs consist of 5-litre glass bottles with 150 mm diameter glass funnels and silicone bungs. The purpose of this sampling is to determine which particles settle from the ambient air over an approximate 31-day sampling period. This equipment is compliant with the Australian Standard AS/NZS 3580.10.1:2016.

2.3 Monitoring locations

The locations of the continuous air quality monitoring stations are identified on Figure 2-1 and the DDG locations are shown on Figure 2-2.

The site boundary is considered representative of the closest receptors (including the adjacent commercial premises). The locations of the continuous air quality monitors means that the construction and operation activities for both MPE and MPW Stage 2 have been captured.

DDG locations were also chosen so that a true representation of dust generated from operational activities at MPE could be established. The additional three DDGs capture construction activities occurring at MPW Stage 2 (see Figure 2-2).

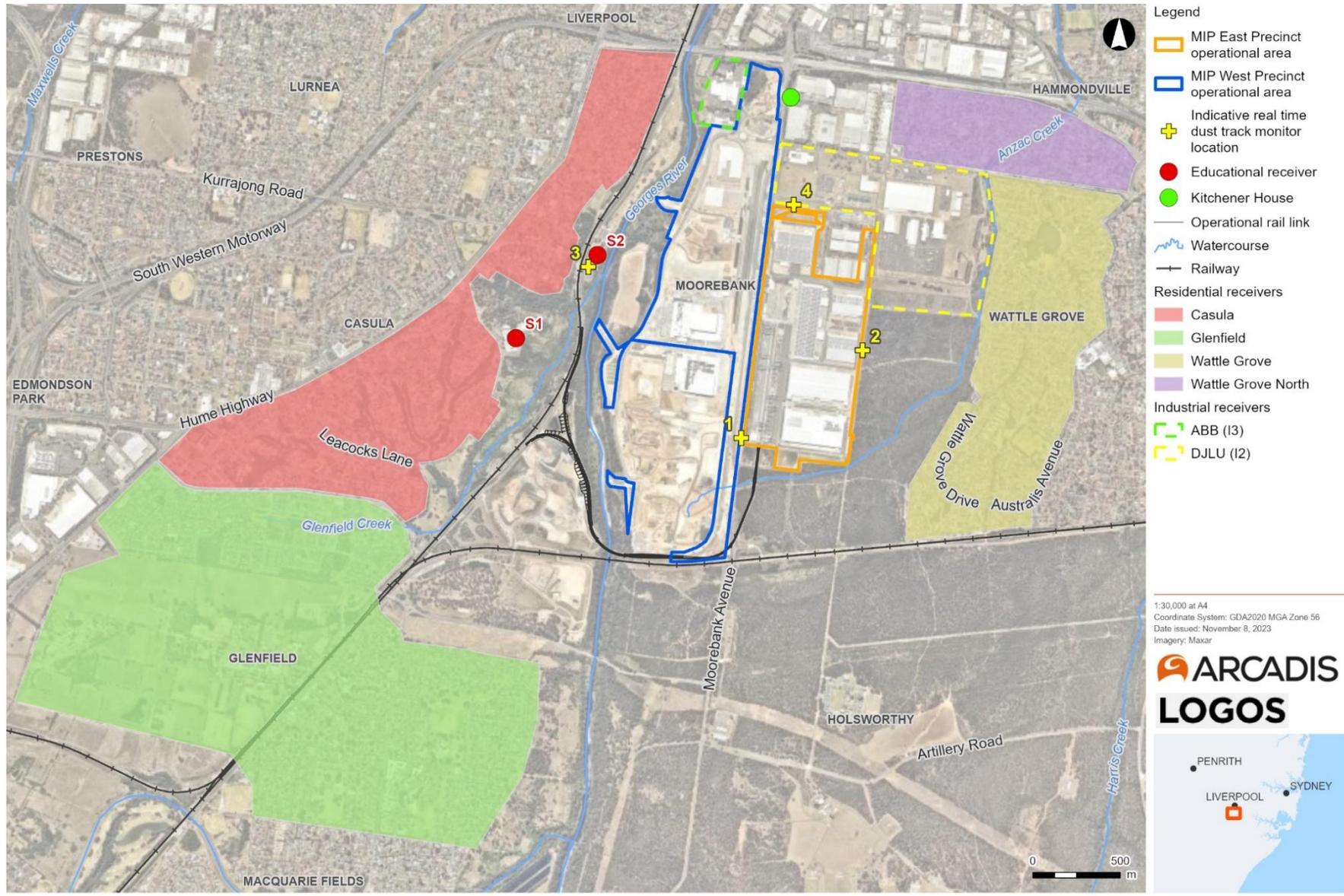


Figure 2-1: Continuous real-time air quality monitors (Source: Arcadis, 2023)



FIGURE 1 Dust Deposition Gauge- Sampling Location map (updated May 2025)

<p>SERS Site Environmental & Remediation Services Tel: +61 (08) 9220 2000 http://www.sers.net.au</p>	CLIENT: Rottnest Island Authority PROJECT: Moorebank Avenue- Dust Deposition monitoring PROJECT No: 162536 BASEMAP: Nearmaps	LEGENDS: DDG Sampling locations	
	SCALE: NTS ISSUE: FINAL DESIGN/DRAWN: RK DATE: May 2025	© SERS Pty Ltd	

Figure 2-2: Location of Dust Deposition Gauges (Source: SERS, November 2025).

Stage 1 (STG 1) refers to MPE Stage 1 and Stage 2 (STG 2) refers to MPE Stage 2

2.4 Air quality monitoring station availability

A summary of availability (time of operation) of the continuous air quality monitoring stations for this reporting period is summarised in Table 2-1, with the most recent calibration date also stated.

Table 2-1: Monitoring station availability (%)

Monitoring station	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	Oct 2025	Average %	Latest calibration date
	% availability each month							
AQM01	100	100	100	98	100	100	100	March 2024
AQM02	100	100	100	98	100	100	100	March 2024
AQM03	100	100	100	98	100	100	100	March 2024
AQM04	100	100	74	98	100	100	95	March 2024

All monitors, except for monitor AQM04, had an average of 100% availability throughout the reporting period. Monitor AQM04 had 74% availability in July 2025 as it was moved to accommodate works for a period during the month.

3 WEATHER

3.1 Meteorological Conditions

3.1.1 Prevailing wind conditions

Prevailing winds influence the dispersion of dust, and other air emissions potentially generated by the Facility. A weather station is located adjacent to Moorebank Avenue at MPW to capture representative conditions at the site. The prevailing wind speed and direction is discussed in more detail below.

3.1.2 Observed wind data

3.1.2.1 Site weather station

The average wind speed and direction data from the site weather monitor from May 2025 to October 2025 is summarised below in Table 3-1.

Table 3-1: Site weather station average wind speed and direction for November 2024 to April 2025

Month	Wind speed (m/s)	Beaufort Wind scale category ³	Wind direction
May 2025	1.2	Light air	Southwest (223°)
June 2025	0.9	Light air	West-southwest (241°)
July 2025	1.1	Light air	Southwest (232°)
August 2025	1.4	Light air	Southwest (235°)
September 2025	1.3	Light air	South-southwest (208°)
October 2025	1.5	Light air	Southwest (213°)

3.1.3 Ambient temperature and rainfall

Ambient temperature and rainfall are recorded at the Bankstown Airport AWS due to the availability of long-term averages for ambient temperature and rainfall which can be compared to the reporting period data. Based on the AWS, the monthly mean temperatures (minimum and maximum) and rainfall (long-term monthly average and total) for the reporting period are summarised in Table 3-2.

Table 3-2: Temperature and rainfall recorded at the Bankstown Airport AWS for the reporting period

Month	Mean minimum temperature (°C)	Mean maximum temperature (°C)	Total rainfall (mm)	Long-term monthly average rainfall (mm)
May 2025	11.9	21.0	209.8	62.7
June 2025	5.2	18.2	7.2	77.0
July 2025	6.3	17.9	91.0	48.7
August 2025	8.4	18.5	242.6	52.3
September 2025	10.1	24.0	64.4	44.7
October 2025	13.6	27.9	16.2	61.0

Source: [Bankstown, NSW - October 2025 - Daily Weather Observations](#)

³ Based on the Beaufort wind force scale which is an empirical measure that relates wind speed to observed conditions at sea or on land (https://en.wikipedia.org/wiki/Beaufort_scale)

Rainfall for the reporting period was mixed throughout the 6-month period. However, May 2025 and August 2025 were well above the long-term monthly average rainfall and June 2025 was well below the long-term monthly average.

3.2 Ambient Air Quality

The NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) uses air quality categories (AQC) for NSW. These categories are based on air quality data readings which are taken continuously from the various monitoring sites throughout NSW and are averaged to give hourly and daily air quality information. NSW DCCEEW use minute data, and report concentrations as hourly and daily averages. All averages are arithmetic means. Air quality data is updated hourly, and a daily air quality forecast is made for the Greater Sydney Metropolitan Region at 4 pm each day.

The AQC is generally used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. The AQC ranges from ‘Good’ to ‘Extremely Poor’ and is summarised in Figure 3-1⁴.

			Air quality categories (AQC)				
Air pollutant	Averaging period	Units	GOOD	FAIR	POOR	VERY POOR	EXTREMELY POOR
Ozone O ₃	1-hour	pphm	<6.7	6.7–10.0	10.0–15.0	15.0–20.0	20.0 and above
	4-hour rolling	pphm	<5.4	5.4–8.0	8.0–12.0	12.0–16.0	16.0 and above
Nitrogen dioxide NO ₂	1-hour	pphm	<8	8–12	12–18	18–24	24 and above
Visibility Neph	1-hour	bsp	<1.5	1.5–3.0	3.0–6.0	6.0–18.0	18.0 and above
Carbon monoxide CO	8-hour rolling	ppm	<6.0	6.0–9.0	9.0–13.5	13.5–18.0	18.0 and above
Sulfur dioxide SO ₂	1-hour	pphm	<13.3	13.3–20.0	20.0–30.0	30.0–40.0	40.0 and above
Particulate matter < 10 µm PM ₁₀	1-hour	µg/m ³	<50	50–100	100–200	200–600	600 and above
Particulate matter < 2.5 µm PM _{2.5}	1-hour	µg/m ³	<25	25–50	50–100	100–300	300 and above

Figure 3-1: Air quality categories

The PM₁₀, PM_{2.5}, NO₂, Visibility and CO air quality data from the Liverpool⁵ monitoring station is reviewed monthly and is summarised for the six-month reporting period in Table 3-3.

⁴ <https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/air-quality-categories>

⁵ Data download facility | NSW Dept of Planning, Industry and Environment

Table 3-3: Summary of AQC from the Liverpool monitoring station for the reporting period

Month	Average for Reporting Period	Comment for reporting period
NO ₂ (ppm) maximum 1 hourly average	Good	'Good' every day
CO (ppm) maximum rolling 8 hourly averages	Good	'Good' every day
PM ₁₀ 24-hour average	Mostly good, with 6 days fair.	'Good' every day except for: <ul style="list-style-type: none"> Monday 2 June 2025, which had a 'fair' reading for PM₁₀ (33.5 µg/m³). Wednesday 3 September 2025, which had a 'fair' reading for PM₁₀ (47.9 µg/m³). Monday 8 September 2025, which had a 'fair' reading for PM₁₀ (37.0 µg/m³). Tuesday 21 October 2025, which had a 'fair' reading for PM₁₀ (34.2 µg/m³). Wednesday 22 October 2025, which had a 'fair' reading for PM₁₀ (42.2 µg/m³). Thursday 23 October 2025, which had a 'fair' reading for PM₁₀ (34.5 µg/m³).
PM _{2.5} 24-hour average	Mostly good, with 2 days fair.	'Good' every day except for: <ul style="list-style-type: none"> Saturday 21 June 2025, which had a 'fair' reading for PM_{2.5} (18.5 µg/m³). Sunday 22 June 2025, which had a 'fair' reading for PM_{2.5} (20.7 µg/m³).
Visibility ⁶ ,	Mostly good, with 4 days fair.	'Good' every day except for: <ul style="list-style-type: none"> Saturday 21 June 2025, which had a 'fair' reading for Visibility (1.94 10⁻⁴m⁻¹). Saturday 12 July 2025, which had a 'fair' reading for Visibility (1.50 10⁻⁴m⁻¹). Saturday 19 July 2025, which had a 'fair' reading for Visibility (2.24 10⁻⁴m⁻¹). Tuesday 22 July 2025, which had a 'fair' reading for Visibility (1.64 10⁻⁴m⁻¹).

⁶ In NSW, visibility (or NEPH) is reported in units of 10⁻⁴ m⁻¹. This means that a NEPH value of 1.5 should be read as 1.5x10⁻⁴ m⁻¹. NSW has adopted a 1-hour visibility standard of 2.1x10⁻⁴ m⁻¹, which corresponds to a visual distance of approximately 18.6 km. This means that NEPH > 2.1 will trigger 'POOR' (or worse) air quality due to reduced visual range (<18.6 km)

4 MONITORING RESULTS

4.1 Air quality criteria

4.1.1 Criteria for PM_{2.5}, PM₁₀, NO₂ and CO

The National Environment Protection Measure for Ambient Air (Air NEPM)⁷ has established new national standards for assessment of air quality for NO₂ and CO, which came into effect 13 May 2021. These criteria are detailed in Table 4-1. The air quality data at MIP was assessed against the new criteria from June 2021.

Table 4-1: Monitoring criteria (January 2025 for PM_{2.5} and the remaining criteria applied from June 2021)

Monitoring focus	Averaging period	Criteria / Trigger / Goal
PM _{2.5}	24-hour average	20 µg/m ³
	Annual average	7 µg/m ³
PM ₁₀	24-hour average	50 µg/m ³
	Annual average	25 µg/m ³
NO ₂	1-hour average	0.12 ppm
	Annual average	0.03 ppm
CO	1-hour average	NA
	8 -hour average	9.0 ppm

4.1.2 Dust deposition

Dust deposition data from DDGs located around MIP is provided by SERS. Seven DDGs have been operational since May 2021 and another three were added in November 2024 and Stage 1 DDG 1 was removed in the first quarter of 2025 due to its location within the IMEX terminal. As of April 2025, nine DDGs provide representative dust deposition across the Precinct

NSW DCCEEW has set the criteria for dust deposition rates, and these are provided in Table 4-2.

Table 4-2: Dust deposition criteria

Averaging Period	Maximum increase in deposited dust* level	Maximum total deposited dust level
Annual	2 g/m ² /month (incremental)	4 g/m ² /month (cumulative)

* Deposited dust is assessed as insoluble solids. This is the mass of the insoluble portion of the deposited matter, as defined under AS 3580.10.1: 2016.

⁷ <https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/standards-and-goals>

4.2 Dust deposition gauge results

The results of the collection period 29 April 2025 to 8 October 2025 as provided by SERS is shown in Table 4-3.

Table 4-3: Dust deposition (insoluble solids g/m²/month) results from 29 April 2025 to 3 November 2025

Date	Stage 2 DDG 1	Stage 2 DDG 2	Stage 2 DDG 3	Stage 2 DDG 4	Stage 2 DDG 5	Stage 2 DDG 6	MPW1	MPW2	MPW3	Average
May 2025	6.0	2.3	4.8	7.2	7.1	5.9	8.5	8.2	7.8	6.4
June 2025	0.9	N/A*	1.0	0.3	0.4	0.5	1.6	4.7	2.1	1.4
July 2025 #	1.8	0.1	1.6	1.5	0.5	7.9	1.6	12.0	2.6	3.3
August # 2025	0.7	0.1	0.6	0.7	0.8	0.7	1.3	6.1	3.9	1.7
September # 2025	0.2	6.0	110.0	5.6	1.1	1.6	0.9	4.9	2.8	14.8
October 2025	<0.1	4.2	2.0	N/A**	N/A**	2.7	1.8	9.4	2.2	3.2

NOTE: Bold/grey indicates an exceedance of the criteria.

* Stage 2 DDG 2 was damaged and unavailable for the reporting period.

** Stage 2 DDG4 and Stage 2 DDG5 were unable to be accessed for the reporting period due to construction activities

Two reports were used to capture the entire month

As shown in Table 4-3, there were eighteen (18) individual gauge exceedances between May 2025 and October 2025.

- May 2025 had the highest number of exceedances for the reporting period. Given the local ambient weather was generally good, and that the average PM_{2.5} and PM₁₀ data for the month (Appendix A) show the particulate data to be well below the criteria, indicate that these exceedances are likely to be attributed to fugitive dust from construction activities across MPW, Moorebank Avenue upgrade works and the commencement of MARW excavation works.
- MPW2 DDG showed the highest rate of exceedance for the reporting period. MPW2 is located adjacent west of an area of the MPW site that is still under construction.
- Exceedances at Stage 2 DDG1, Stage 2 DDG2, Stage 2 DDG4 and Stage 2 DDG6 are likely due to construction activities associated with MARW, where there has been extensive excavations and material importation activities during the reporting period.
- The SERS report for September 2025 notes that the elevated concentrations of insoluble solids at sample location STG 2 DDG 3 are likely attributable to the presence of sand particles within the dust gauge

4.3 Continuous monitor results

Monitoring data for PM_{2.5}, PM₁₀, NO₂ and CO for the reporting period have been summarised into tables and graphs and are provided in [Appendix A](#). The following sections summarise the results for this 6-month reporting period.

4.3.1 Annual exceedances

Twelve months of air quality monitoring are provided graphically and in table form in [Appendix A](#).

All monitors had an average availability of 100% during the reporting period, except for AQM04, which had 95% availability. The lower availability for this monitor was due to it being moved in July 2025 for a period during the month to accommodate works. Overall, there is adequate monitoring available for the reporting period.

See Table 2-1 for the monitoring station availability (%) over a 12-month period.

4.3.1.1 PM_{2.5} and PM₁₀ Monitoring

The 12-month rolling annual average for the period November 2024 to October 2025 for all four monitors combined was below the annual average criteria (i.e. 7.0 µg/m³ for PM_{2.5} and 25.0 µg/m³ for PM₁₀) for each month.

As of October 2025, the 12-month rolling annual average for all four monitors was 4.3 µg/m³ for PM_{2.5} and 11.6 µg/m³ for PM₁₀.

See [Appendix A.1](#) and [Appendix A.2](#) for more details.

4.3.1.2 NO₂ Monitoring

The 12-month rolling annual average for all four monitors for the period November 2024 to October 2025 was below the annual average criteria (0.03 ppm) for each month.

As of October 2025, the 12-month rolling annual average for NO₂ for all four monitors is 0.006 ppm, well below the annual average criteria of 0.03 ppm.

4.3.1.3 CO

CO does not require annual reporting.

4.3.2 24-hour exceedances

4.3.2.1 PM_{2.5} Monitoring

A review of the data for the reporting period (May 2025 to October 2025) did not identify any exceedance of the 24-hour average criteria (20 µg/m³) for PM_{2.5} for the 6-month reporting period.

4.3.2.2 PM₁₀ Monitoring

A review of the data for the reporting period (May 2025 to October 2025) identified three (3) exceedances of the 24-hour average criteria (50 µg/m³) for PM₁₀ for the 6-month reporting period.

- 5 August 2025 (24-hour average of 62.5 µg/m³) at monitor AQM03, mainly between 4am and 10am.
- 5 August 2025 (24-hour average of 68.5 µg/m³) at monitor AQM04, mainly between 4am and 10am.
- 18 September 2025 (24-hour average of 55.4 µg/m³) at monitor AQM02, mainly between 11am and 3pm.

Overview

- The exceedance at AQM03 could be attributed to the ongoing construction activities associated with MPW
- Exceedances at AQM04, could be related to the construction activities for MARW at the intersection of Moorebank Avenue adjacent north of Piccolo Me.

- The exceedance at AQM02 is likely to be related to the construction of MARW due to the proximity of works to the monitor (approximately <50 metres).

4.3.3 NO₂ 1-hour exceedances

No exceedance of NO₂ 1-hour criteria (0.12 ppm / 120 ppb) were observed during the 6-month reporting period.

4.3.4 CO 8-hour exceedances

No 8-hour criteria exceedances for CO occurred during the 6-month reporting period.

4.4 Complaints

One complaint was made relating to air quality in September 2025. The complaint was from tenants at MPE and related to dust generated from MARW. No other formal complaints were received during the reporting period relating to air quality.

4.5 Ad-hoc monitoring

No ad-hoc monitoring was undertaken during this reporting period.

5 CONCLUSION

This six-monthly operational air quality report covers the period May 2025 to October 2025 (inclusive).

The following summarises the monitoring results for this reporting period:

Data summary

- The rolling annual average for all four monitors combined was below the annual average criteria ($7.0 \mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ and $25.0 \mu\text{g}/\text{m}^3$ for PM_{10}) for each month during the reporting period.
- There were no exceedances of the $\text{PM}_{2.5}$ 24-hour average criteria ($20 \mu\text{g}/\text{m}^3$) during the 6-month reporting period.
- There were three (3) exceedances of the PM_{10} 24-hour average criteria ($50 \mu\text{g}/\text{m}^3$) during the 6-month reporting period.
- There were no exceedances of NO_2 1-hour criteria (0.12 ppm / 120 ppb) during the 6-month reporting period.
- There were no exceedances of the CO criteria (9.0 ppm) during the 6-month reporting period.
- Seven DDGs were installed in May 2021. A further three DDG's were added in November 2024 and Stage 1 DDG 1 was removed in the first quarter of 2025. As of April 2025, there are nine DDGs across the Precinct.
- Adequate data availability was provided throughout the reporting period.

Exceedances

There were eighteen (18) individual gauge exceedances of the dust deposition (insoluble solids) $2 \text{g}/\text{m}^2/\text{month}$ (incremental) criteria between May 2025 to October 2025. Analysis of these exceedances revealed that:

- May 2025 had the highest number of exceedances for the reporting period. Given the local ambient weather was generally good, and that the average $\text{PM}_{2.5}$ and PM_{10} data for the month (Appendix A) show the particulate data to be well below the criteria, indicate that these exceedances are likely to be attributed to fugitive dust from construction activities across MPW, Moorebank Avenue upgrade works and the commencement of MARW excavation works.
- MPW2 DDG showed the highest rate of exceedance for the reporting period. MPW2 is located adjacent west of an area of the MPW site that is still under construction.
- Exceedances at Stage 2 DDG1, Stage 2 DDG2, Stage 2 DDG4 and Stage 2 DDG6 are likely due to construction activities associated with MARW, where there has been extensive excavations and material importation activities during the reporting period.
- The SERS report for September 2025 notes that the elevated concentrations of insoluble solids at sample location STG 2 DDG 3 are likely attributable to the presence of sand particles within the dust gauge.

Analysis of the three (3) PM_{10} exceedances revealed that:

- The exceedance at AQM03 could be attributed to the ongoing construction activities associated with MPW
- Exceedances at AQM04, could be related to the construction activities for MARW at the intersection of Moorebank Avenue adjacent north of Piccolo Me.
- The exceedance at AQM02 is likely to be related to the construction of MARW due to the proximity of works to the monitor (approximately <50 metres).

- Out of hours works may have been occurring during times of exceedance.
- Trains were arriving/departing the terminal during times of exceedance on two occasions. However, monitors where exceedances occurred were over 700 metres away from train locations.
- No exceedance dates and times aligned with exceedances at the governments air quality monitoring station at Liverpool, suggesting that exceedances were more likely the result of localised emissions.

Complaints

One complaint relating to air quality was received during the reporting period (September 2025) from the tenants on MPE. The complaint was addressed promptly and the matter closed. No other complaints relating to air quality were received during the reporting period.

Recommendation

To prevent further exceedances the following measures (but not limited to) could be applied, if not already:

- Reduce areas of exposed soil
- Use of water suppression if earthworks or dust generating activities are occurring e.g. watercarts, water misters
- Staging of works to be intermittent, particularly during periods of high wind and dry conditions.

It is recommended that monitors continue to be calibrated every two years as per operational requirements and device specifications. The monitors were last calibrated in March 2024.

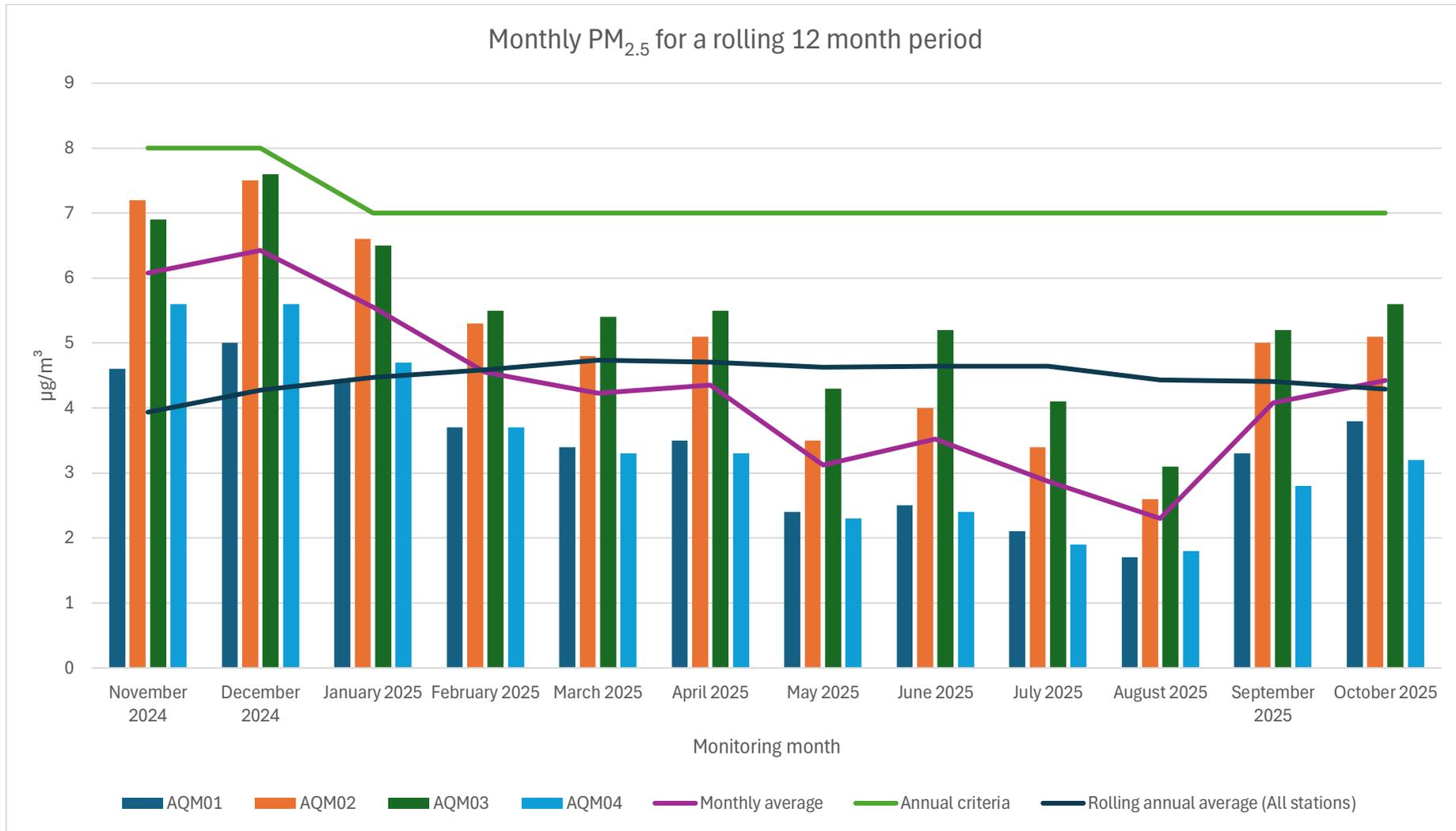
APPENDIX A **MONITORING DATA**

Appendix A.1: Rolling 12-month particulate data (PM_{2.5})

Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	µg/m ³	µg/m ³	µg/m ³					
November 2024	4.6	7.2	6.9	5.6	6.1	3.9	8.0	No exceedance of annual average criteria.
December 2024	5.0	7.5	7.6	5.6	6.4	4.3	8.0	No exceedance of annual average criteria.
January 2025	4.4	6.6	6.5	4.7	5.6	4.5	7.0	No exceedance of annual average criteria. The annual criteria/goal for PM _{2.5} has changed from 8 µg/m ³ to 7 µg/m ³ from 1 January 2025.
February 2025	3.7	5.3	5.5	3.7	4.6	4.6	7.0	No exceedance of annual average criteria.
March 2025	3.4	4.8	5.4	3.3	4.2	4.7	7.0	No exceedance of annual average criteria.
April 2025	3.5	5.1	5.5	3.3	4.4	4.7	7.0	No exceedance of annual average criteria.
May 2025	2.4	3.5	4.3	2.3	3.1	4.6	7.0	No exceedance of annual average criteria.
June 2025	2.5	4.0	5.2	2.4	3.5	4.6	7.0	No exceedance of annual average criteria.
July 2025	2.1	3.4	4.1	1.9	2.9	4.6	7.0	No exceedance of annual average criteria.
August 2025	1.7	2.6	3.1	1.8	2.3	4.4	7.0	No exceedance of annual average criteria.
September 2025	3.3	5.0	5.2	2.8	4.1	4.4	7.0	No exceedance of annual average criteria.
October 2025	3.8	5.1	5.6	3.2	4.4	4.3	7.0	No exceedance of annual average criteria.
Rolling 12-month average	3.4	5.0	5.4	3.4	-	-	8.0	No exceedance of annual average criteria.
All months[^]	1.4	3.6	6.4	2.9	3.5	-	8.0	No exceedance of annual average criteria.

Bold/grey indicates an exceedance of the criteria.

[^] All months since May 2020

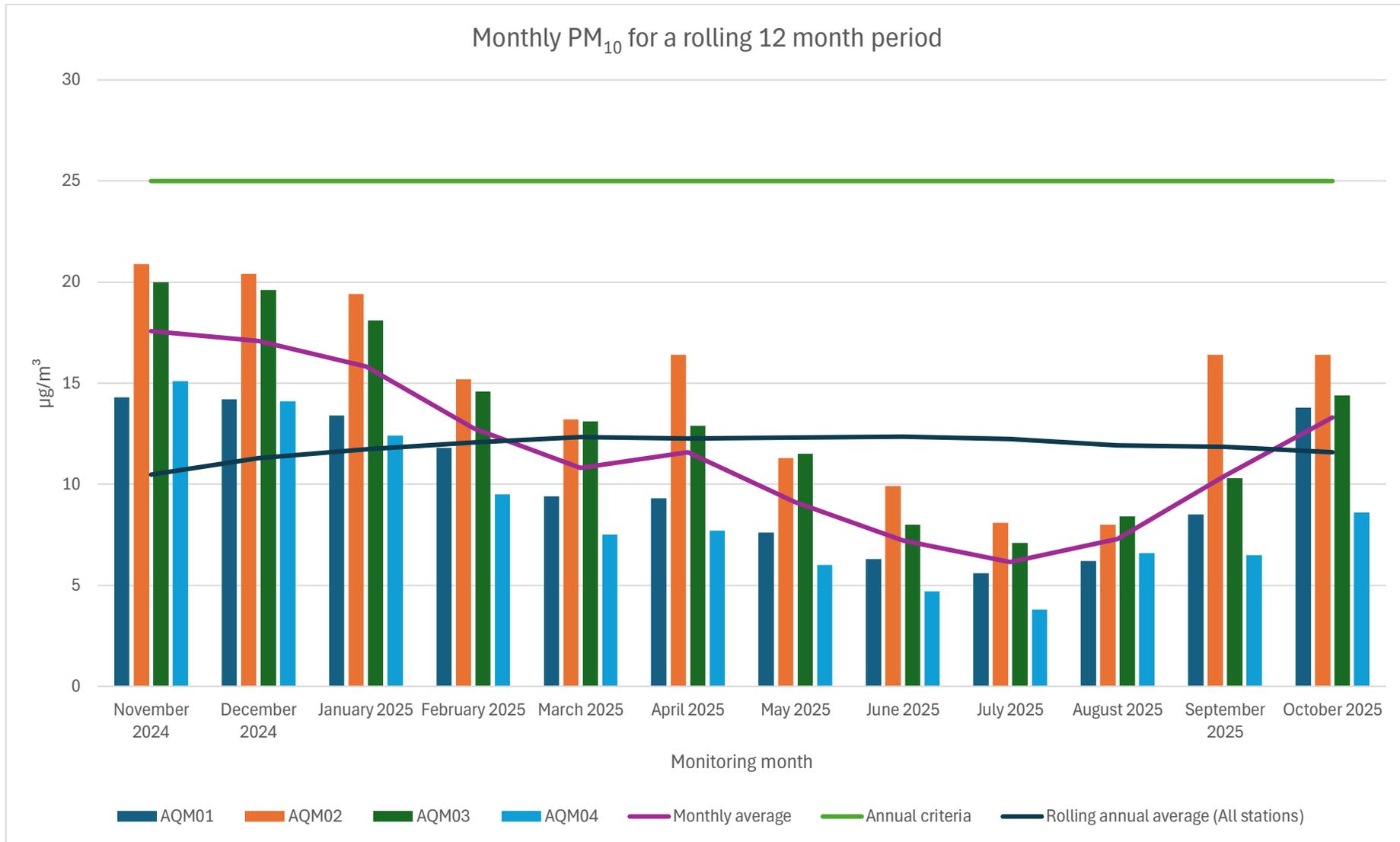


Monthly PM_{2.5} over 12 months including the 6-months for this report

Appendix A.2: Rolling 12-month particulate data (PM₁₀)

Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	µg/m ³	µg/m ³	µg/m ³					
November 2024	14.3	20.9	20.0	15.1	17.6	10.5	25.0	No exceedance of annual average criteria.
December 2024	14.2	20.4	19.6	14.1	17.1	11.3	25.0	No exceedance of annual average criteria.
January 2025	13.4	19.4	18.1	12.4	15.8	11.7	25.0	No exceedance of annual average criteria.
February 2025	11.8	15.2	14.6	9.5	12.8	12.1	25.0	No exceedance of annual average criteria.
March 2025	9.4	13.2	13.1	7.5	10.8	12.3	25.0	No exceedance of annual average criteria.
April 2025	9.3	16.4	12.9	7.7	11.6	12.3	25.0	No exceedance of annual average criteria.
May 2025	7.6	11.3	11.5	6.0	9.1	12.3	25.0	No exceedance of annual average criteria.
June 2025	6.3	9.9	8.0	4.7	7.2	12.4	25.0	No exceedance of annual average criteria.
July 2025	5.6	8.1	7.1	3.8	6.2	12.2	25.0	No exceedance of annual average criteria.
August 2025	6.2	8.0	8.4	6.6	7.3	11.9	25.0	No exceedance of annual average criteria.
September 2025	8.5	16.4	10.3	6.5	10.4	11.9	25.0	No exceedance of annual average criteria.
October 2025	13.8	16.4	14.4	8.6	13.3	11.6	25.0	No exceedance of annual average criteria.
Rolling 12-month average	10.0	14.6	13.2	8.5	-	-	25.0	No exceedance of annual average criteria.
All months [^]	4.2	10.6	20.3	6.5	10.2	-	25.0	No exceedance of annual average criteria.

Bold/grey indicates an exceedance of the criteria, ^ All months since May 2020



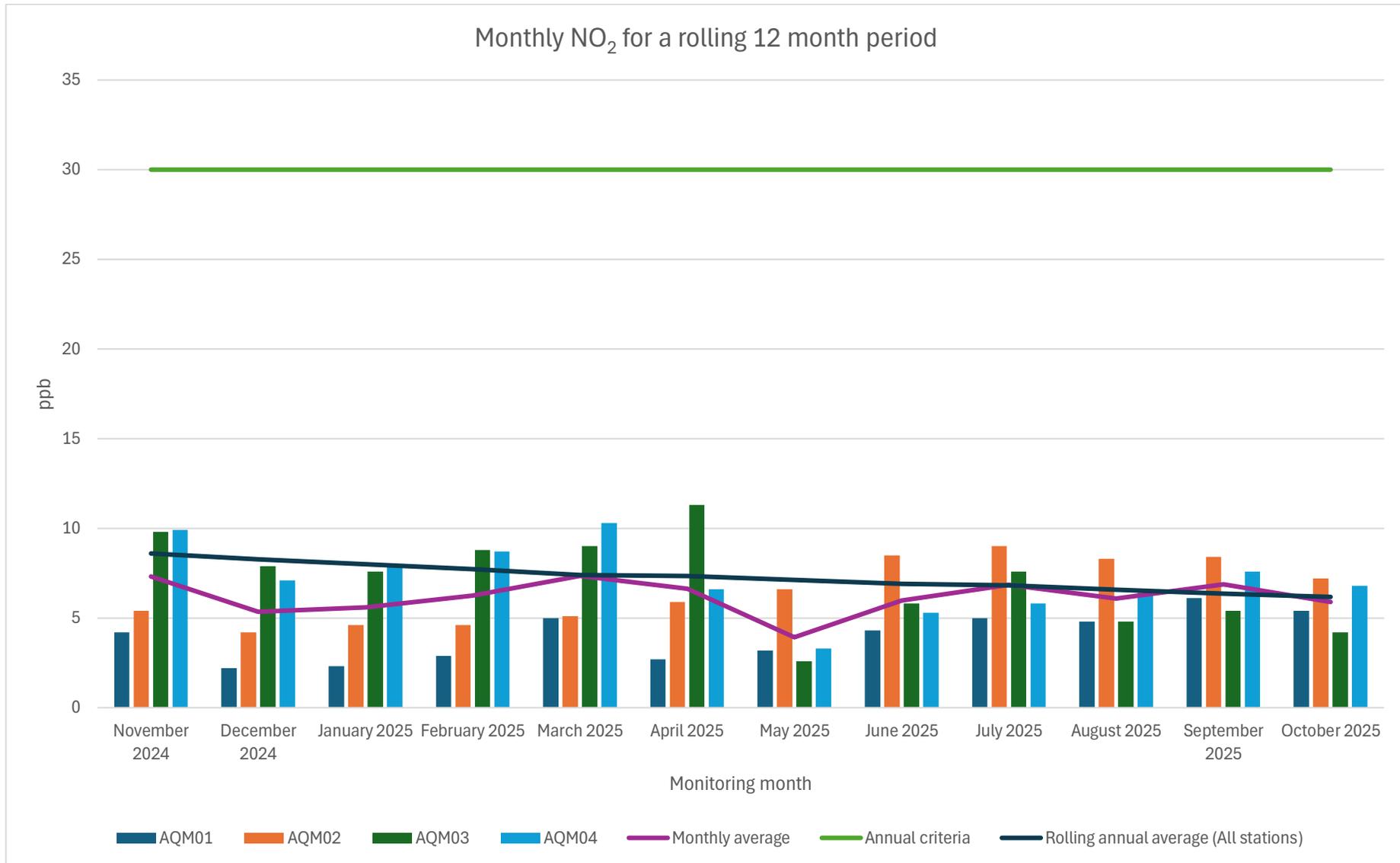
Monthly PM₁₀ over 12 months including the 6-months for this report

Appendix A.3: Rolling monthly and annual particulate data (NO₂)

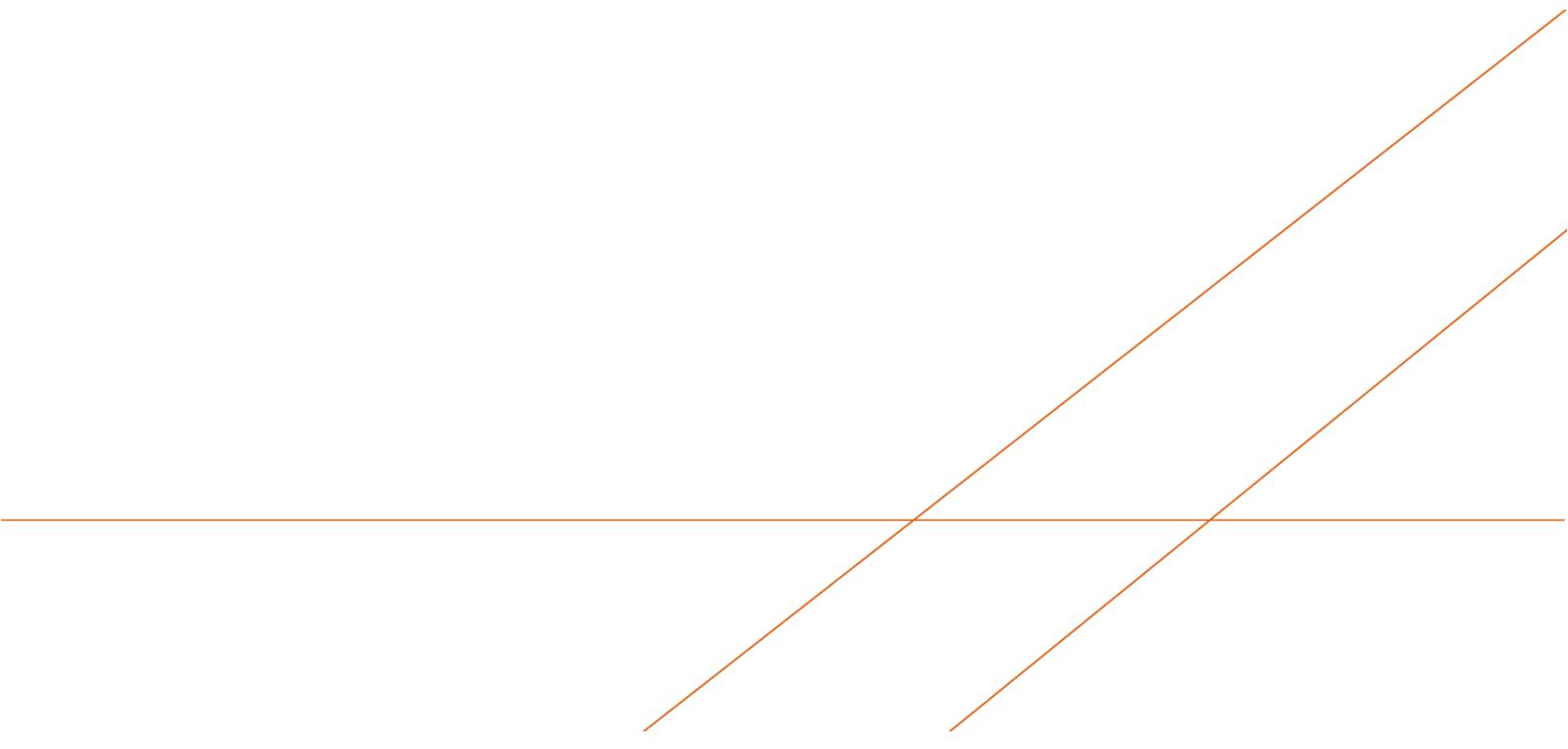
Month	Average AQM01	Average AQM02	Average AQM03	Average AQM04	Months Average All stations	Rolling annual average All stations	Annual average criteria	Comments
	ppb	ppb	ppb	ppb	ppb	ppb	ppm / ppb*	
November 2024	4.2	5.4	9.8	9.9	7.3	8.6	0.03 / 30.0	No exceedance of annual average criteria.
December 2024	2.2	4.2	7.9	7.1	5.4	8.3	0.03 / 30.0	No exceedance of annual average criteria.
January 2025	2.3	4.6	7.6	7.9	5.6	8.0	0.03 / 30.0	No exceedance of annual average criteria.
February 2025	2.9	4.6	8.8	8.7	6.3	7.7	0.03 / 30.0	No exceedance of annual average criteria.
March 2025	5.0	5.1	9.0	10.3	7.4	7.4	0.03 / 30.0	No exceedance of annual average criteria.
April 2025	2.7	5.9	11.3	6.6	6.6	7.3	0.03 / 30.0	No exceedance of annual average criteria.
May 2025	3.2	6.6	2.6	3.3	3.9	7.1	0.03 / 30.0	No exceedance of annual average criteria.
June 2025	4.3	8.5	5.8	5.3	6.0	6.9	0.03 / 30.0	No exceedance of annual average criteria.
July 2025	5.0	9.0	7.6	5.8	6.9	6.8	0.03 / 30.0	No exceedance of annual average criteria.
August 2025	4.8	8.3	4.8	6.4	6.1	6.6	0.03 / 30.0	No exceedance of annual average criteria.
September 2025	6.1	8.4	5.4	7.6	6.9	6.4	0.03 / 30.0	No exceedance of annual average criteria.
October 2025	5.4	7.2	4.2	6.8	5.9	6.2	0.03 / 30.0	No exceedance of annual average criteria.
Rolling 12-month average	0.004 ppm / 4.0 ppb	0.006 ppm / 6.5 ppb	0.007 ppm / 7.1 ppb	0.007 ppm / 7.1 ppb	-	-	0.03 / 30.0	No exceedance of annual average criteria.
All months^	0.007 ppm / 6.7 ppb	0.006 ppm / 6.1 ppb	0.033 ppm / 33.0 ppb	0.010 ppm / 10.3 ppb	0.014 ppm / 13.5 ppb	-	0.03 ppm / 30.0 ppb	No exceedance of average criteria for all sites for all rolling 12-month averages. However, AQM03 has exceeded the average for the period since monitoring began.

Bold/grey indicates an exceedance of the criteria.

*Results are shown in ppb due to reporting output, however the criteria is set in ppm and therefore the equivalent criteria in ppb is also shown. ^ All months since May 2020



Monthly NO₂ over 12 months including the 6-months for this report





APPENDIX E – NOISE MONITORING REPORTS

MOOREBANK PRECINCT WEST (SSD 7709)

B140A Noise monitoring (Year 1)

25 March 2025

The Trust Company (Australia) Limited (ACN 000 000 993) As Trustee of The
Moorebank Industrial Warehouse Trust (ABN 51 402 161 047) c/- ESR
Developments (Australia) Pty Ltd

TM306-22-05F01 MPW B140A Noise monitoring (r2).docx

Document details

Detail	Reference
Doc reference:	TM306-22-05F01 MPW B140A Noise monitoring (r2).docx
Prepared for:	The Trust Company (Australia) Limited (ACN 000 000 993) As Trustee of The Moorebank Industrial Warehouse Trust (ABN 51 402 161 047) c/- ESR Developments (Australia) Pty Ltd
Attention:	Mark Howley (Tactical Group)

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
21.03.2025	Initial issue - Draft	0	1	A. Leslie	A. Leslie	P. Karantonis
25.03.2025	Final	-	2	A. Leslie	A. Leslie	P. Karantonis
File Path: R:\AssocSydProjects\TM301-TM350\TM306 ale Moorebank Intermodal Terminal (LOGOS)\Task22 MPW Monitoring\1 Docs\03 Report\05 B140A Year 1\01 Compliance report\TM306-22-05F01 MPW B140A Noise monitoring (r2).docx						

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1 Introduction

1.1 Monitoring report purpose

Renzo Tonin & Associates was engaged by ESR Developments (Australia) Pty Ltd on behalf of The Trust Company (Australia) Limited (ACN 000 000 993) As Trustee Of The Moorebank Industrial Warehouse Trust (ABN 51 402 161 047) to conduct noise impact monitoring to satisfy the (State Significant Development (SSD) 7709 B140A consent condition (CoC) for the Moorebank Precinct West (MPW), which forms part of the Moorebank Intermodal Precinct (MIP) at Moorebank, NSW.

The purpose of this report is to undertake noise monitoring to assess operational noise levels from the Moorebank Intermodal Precinct (MIP) at No. 9 Casula Road, Casula, to determine the typical operational noise levels at this receiver location, and assess these noise levels against the noise limits in the SSD 7709 Conditions of Consent (CoC) in accordance with the MPW Stage 2 Operational Noise Management Plan¹ (MPW S2 ONMP).

Noise monitoring included both attended and unattended noise monitoring. The attended noise monitoring was undertaken on 3 separate periods, each for 4 hours, during each of the day, evening and night periods. The unattended noise monitoring was required for a period of 7 contiguous days where valid data was measured and not adversely affected by weather, and so unattended monitoring was conducted over a 10 day period.

The following sections detail the applicable noise requirements, measurement methodology, a summary of the key measurement results, and a discussion of the measurements and outcomes and recommendations.

This report has been prepared by a suitably qualified and experienced acoustic engineer. The engineers involved in the monitoring and preparation of the report are of member grade of the Australian Acoustical Society (AAS), are appropriately experienced acoustic engineers employed by a firm being a member of the Association of Australasian Acoustic Consultants (AAAC) and have extensive experience in environmental acoustics.

This report is technical in nature and uses acoustic terminology throughout. APPENDIX A contains a glossary of acoustic terms used in this report.

1.2 Location and project overview

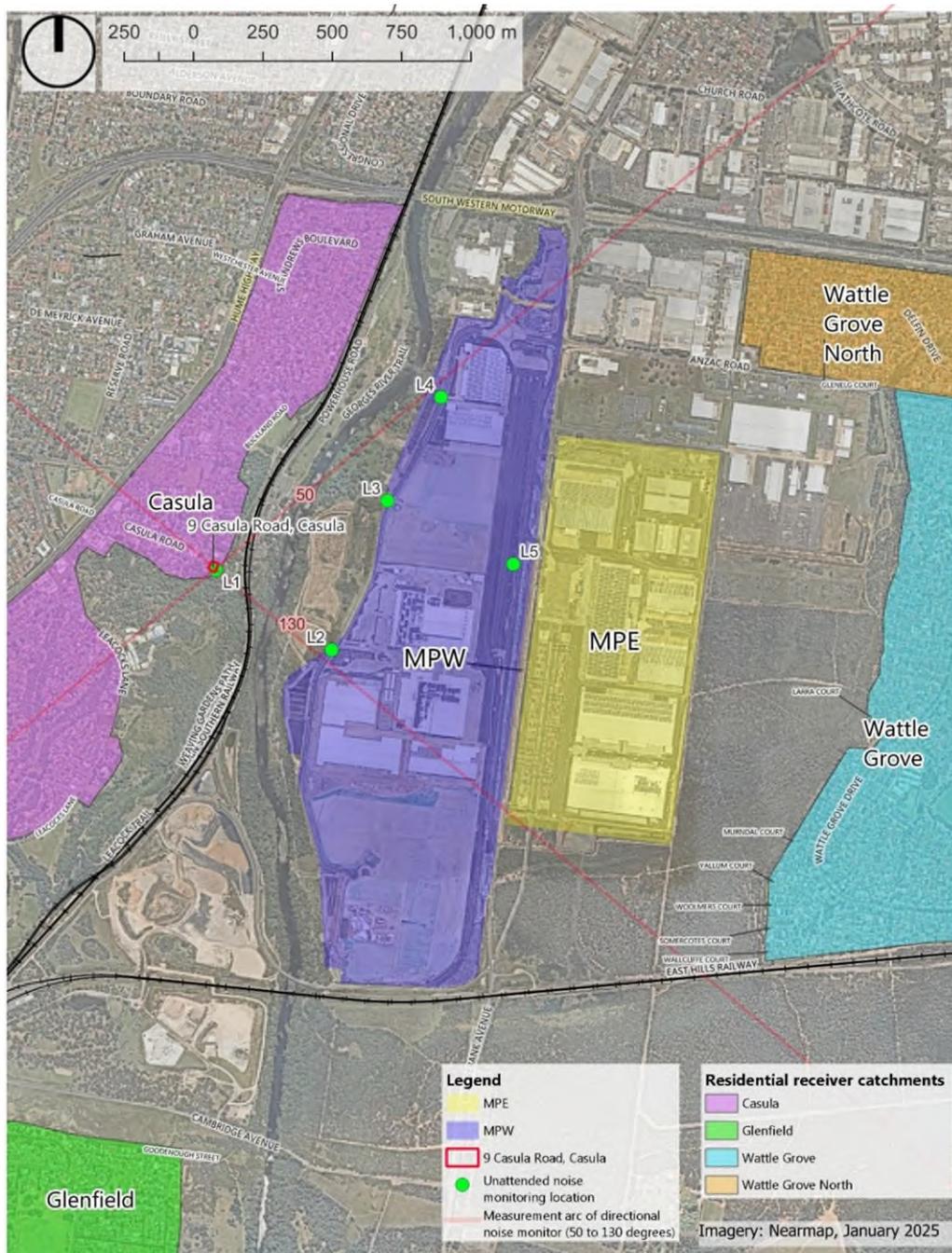
The MIP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MIP is divided into two precincts, Moorebank Precinct East (MPE) and Moorebank Precinct West (MPW), located east and west of Moorebank Avenue respectively, as shown in Figure 1. The Sydney Intermodal

1. 1 Logos, Operational Noise Management Plan Moorebank Logistics Park - West Precinct Stage 2, Report No. J1883240215.4, Revision 4, dated 15/2/2024, available https://moorebankintermodalprecinct.com.au/wp-content/uploads/2024/04/SSD7709-MPW2-ONMP_Rev4_redacted.pdf, accessed 15/10/2024

Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 2 of the MPW development (State Significant Development (SSD) 7709), which comprises the second stage of development under the MPW Concept Approval (SSD 5066).

The location of the Moorebank Intermodal Precinct (MIP) in relation to the nearest residential receivers is shown in Figure 1. The MIP is surrounded by residential areas with receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North, as shown in Figure 1.

Figure 1 - MIP, MPW and MPE precincts and residential receiver catchments



2 Noise monitoring objectives

2.1 CoC B140A requirements

This report has been prepared to address the requirements in SSD 7709 CoC B140A. These requirements state:

B140A. The Applicant is to conduct noise impact monitoring and residual noise impact mitigation in accordance with the following requirements:

(a) the Applicant is to engage a Suitably Qualified and Experienced Acoustic Engineer to undertake a noise survey at R1 No. 9 Casula Road, Casula (or an equivalent location if access is denied). Evidence of access being sought and access being denied must be provided to the Planning Secretary before surveying is undertaken at an equivalent location;

(b) the noise survey must be undertaken not less than three months and not more than six months from commencement of operation;

(c) the noise survey is to be conducted in accordance with the Noise Policy for Industry ((NPfI) EPA 2017) to determine:

i. the LAeq, 15min noise level arising from use of the Precinct in the EPA-defined day, evening and night-time periods (excluding rail operations on the rail link); and

ii. the LAFmax noise level arising from use of the Precinct in the EPA-defined night-time period;

(d) the noise survey must be both attended and unattended. The attended survey must be for a period of 4 contiguous hours in a single day, evening and night-time period conducted on days when the Precinct is likely to be operating at maximum capacity at the time. The unattended survey must be conducted for a period of 7 contiguous days not adversely affected by weather and must include the days of the attended surveys;

(e) a copy of the results of the noise survey must be provided to the Planning Secretary for information within one month of completion of the survey;

(f) if the noise survey identifies an exceedance arising from use of the Precinct of the LAeq, 15min and the LAFmax noise limits specified in condition B140A (the residual noise impacts), the Applicant is to conduct an assessment as follows:

i. outlining and justifying the application of the approach to "sustained" exceedance having regard to the number of observed exceedances;

ii. the identification of the likely source(s) of the residual noise impact;

- iii. an assessment of the significance of the LAFmax noise level events in accordance with Section 2.5 of the NPfI;*
- iv. an assessment of the significance of the residual noise impacts in accordance with Table 4.1 of Section 4 of the NPfI;*
- v. the feasible and reasonable source and pathway noise mitigation measures that have been implemented in respect of the source(s) of the residual noise impacts;*
- vi. any further feasible and reasonable transmission pathway noise mitigation measures which are capable of being adopted to reduce residual noise impacts; vii. feasible and reasonable receiver based treatments which can be offered to affected property owners in accordance with Table 4.2 of Section 4 of the NPfI;*
- viii. an assessment of whether there are additional residential properties in Casula other than R1 which are considered to also be affected by residual noise impacts and the preparation of a list of property addresses of those properties likely to be affected;*
- ix. within 3 months of the attended noise survey, the preparation of a Preliminary Residual Noise Impact Report summarising the findings including a draft Proposal for At Property Noise Mitigation Plan for R1 and submit a copy of the report to the Planning Secretary for information;*

CoC B140A also includes clauses (g) to (k) which are applicable in the case that the noise levels measured from the precinct operations are above both the $L_{Aeq, 15min}$ and the L_{AFmax} noise limits. As this is not the case from the outcomes presented in Section 4 these requirements have not been included.

2.2 Operational noise limits

CoC B140A requires noise monitoring at 9 Casula Road, Casula, which is located within the noise catchment of Casula. The operational noise limits applicable for CoC B140A are presented in Table 4 of SSD 7709 CoC B131 and are reproduced in Table 1.

SSD 7709 CoC B131 details that these noise limits are applicable to noise generated by the overall precinct operations, defined as all activities approved for MPW and MPE.

The $L_{Aeq(15 \text{ minute})}$ criteria are applicable during the NSW Environmental Protection Authority (EPA) defined day, evening and night-time periods and the L_{Amax} sleep disturbance noise limits are applicable during the night-time period. The CoC B131 noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or atmospheric stability category 'F' temperature inversion conditions with no wind.

Table 1 SSD 7709 CoC B131 operational noise limits^{3,4}, dB(A)

Sensitive receiver	Day ²	Evening ²	Night ²	Night ²
	L _{Aeq} , 15 minute	L _{Aeq} , 15 minute	L _{Aeq} , 15 minute	L _{AFmax} ⁵ , Sleep Arousal Screening Level
Wattle Grove (NCA 1)	44	42	42	52
Wattle Grove North (NCA 2)	41	41	41	52
Casula (NCA 3)	46	44	39	52
Glenfield (NCA 4)	49	46	42	52

- Notes:
- The time periods are defined as 7:00am to 6:00pm Monday to Saturday, and 8:00am to 6:00pm on Sundays and Public Holidays; Evening 6.00 pm to 10.00 pm; Night-time 10:00pm to 7:00am Monday to Saturday, and 10:00pm to 8:00am on Sundays and Public Holidays.
 - To determine compliance with the L_{Aeq},15-minute noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 m of a dwelling where the dwelling is more than 30 m from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI). The modification factors in Fact Sheet C of NPfI must also be applied to the measured noise levels where applicable.

To determine compliance with the Night L_{AFmax} Sleep Arousal Screening Level in B131 Table 4 above, noise from the project is to be measured at 1 m from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).

Noise limits apply under the following meteorological conditions:
 - wind speeds up to 3m/s at 10 meters above ground level; or
 - atmospheric stability category F (with no wind).
 - B131 notes "The noise generated by the development must not exceed the noise limits in Table 4 which are generated by the overall precinct operations (defined as all activities approved for MPW and MPE)."
 - As per CoC B140, the noise limits apply for noise arising from use of the approved Precinct (MPW and MPE) (excluding rail operations on the rail link).
 - Condition B131 indicates L_{A1, 1minute} as the relevant descriptor of the noise limit, which is inconsistent with the B140A requirements. For consistency with the B140A wording L_{AFmax} has been used for the sleep arousal screening assessment.

2.3 Noise monitoring timing

DPHI was notified that MPW commenced operations late May 2024, following the first warehouse (N2) receiving its occupation certificate 22 May 2024. However, warehouse operations did not commence operations until August 2024. Furthermore, additional warehouse commissioning works were required to be undertaken during early September 2024, and as such typical operations commenced mid-September 2024.

The monitoring is required to quantify the noise from the MIP operations and not the general ambient noise levels. Considering the high traffic level on the nearby roads (M5, Hume Highway) which make it difficult to measure and quantify MIP noise emissions, non-typical operations and ambient noise levels during the December/January holiday period, and high winds and rain forecasts during mid/late January 2025, resulted in the noise monitoring being undertaken early February 2025 to meet the condition timing requirement of monitoring not within 3 months and not more than 6 months from the commencement of operations.

3 Measurement methodology

3.1 Noise monitoring approach

As required by CoC B140A, the noise survey is to be conducted in accordance with the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (EPA 2017) (NPfI).

The NPfI provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. NPfI Section 7.1.1 provides guidance as to how to review noise emissions, which includes direct measurement at a receiver location, direct measurement at alternative or intermediate location/s, unattended monitoring and modelling, in order or preferred to least preferred. It notes that this range of compliance assessment techniques may be used individually, or in combination, to provide a means of determining compliance with a noise limit. At times, the best available compliance assessment methodology will only allow for a balance-of-probabilities type determination of compliance, and repeat assessment may be needed. It also makes clear that *"A noise limit applies to the noise from a particular development/activity and not to general ambient noise. Therefore it is often necessary to use techniques to attempt to separate the noise from a facility versus noise from other sources."*

For the CoC B140A noise monitoring, the following points were considered for the monitoring methodology:

- In the vicinity of Casula residences, previously monitored noise levels (long term noise monitoring stations and noise monitoring surveys) from ambient and background noise sources outside of the MIP, were often found to be at or greater than the noise limits. Such non-MIP noise sources include road traffic from nearby arterial roads (ie. M5 and Hume Highway), freight train and passenger train movements on the adjacent rail line, and other ambient sources (ie. car passbys, birds, etc).
- Background noise levels are controlled by road traffic noise from nearby arterial roads (ie. M5 and Hume Highway), in particular to the north-east of Casula.
- The MIP and its associated noise sources covers a very large area, which is approximately 2km north to south, and 1km east to west, with 9 Casula Road, Casula being offset from the MIP by approximately 500 metres west.
- Moorebank Avenue runs down the middle of the MIP, dividing MPW and MPE and contributing to noise levels at Casula residences. Road traffic noise on this public road is not related to the site and should be excluded from the assessed noise levels when comparing them to the noise limits.

As such, the CoC B140A noise monitoring has used a combination of on-site and at-receiver attended noise measurements including the use of a directional noise monitor, combined with unattended intermediate and receiver noise monitoring locations, to quantify the noise emission performance of the MIP operations.

3.2 Compliance measurement methodology

Consistent with the requirements of SSD 7709 B140A all noise monitoring was performed using the methods and practices outlined in the NPfl.

As the noise limits apply to the noise emissions from the MIP operations only and not to general ambient noise, a range of post processing analysis methods were undertaken to identify sources of noise which were likely MIP operations or non-site operations, so that only sources of noise which likely MIP from the operations could be assessed.

The monitored data was post-processed to determine MIP noise emission levels, through correlation of noise monitoring data, on-site activity logs, cameras and engineers field notes were used to verify periods of on-site activity, and correlate this with audible noise events at 9 Casula Road, Casula.

3.2.1 Methodology

3.2.1.1 Attended monitoring

Attended noise monitoring was undertaken for three separate monitoring periods, each over a period of 4 contiguous hours during each of the day, evening and night periods.

As required by CoC B140A, periods were selected during the week that would likely have MIP operations occurring at the maximum capacity at the time. These periods occurred during the unattended noise monitoring period detailed in Section 3.2.1.2.

All attended measurements were undertaken at 1.5 metres above the local ground level and in the free field. All sound level meters were time-synchronised to allow the on-site and receiver noise measurements to be correlated. A sound recording was made at all measurement locations to allow post-processing of the noise measurement results and to confirm the audibility of on-site noise at residential receivers.

During the attended monitoring, noise observation notes were made concurrently detailing the source or likely source of noise events or periods of noise, typical measured noise levels, and in particular whether likely on-site activities were audible or not, along with the prevailing meteorological conditions. The notes included direction of the audible noise source, approximate level and potential source contribution level in the ambient noise environment. These notes were combined with identification markers being recorded in the monitored data for key types of noise events (ie. site, trains, or periods of dominant non-site noise).

Intermediate noise monitoring was all undertaken supported by time-lapse picture recording and/or video of on-site activities to assist with the analysis. These noise monitors were deployed in the locations shown in Figure 1 with the purpose and installation details included in Table 2.

During periods of audible noise events from the direction of site at the receiver, noise levels were identified. These noise events were then either verified with roaming on-site personnel to confirm if they

correlated with onsite activities at the time, or audibly and visually confirmed as part of post-processing with the onsite noise monitors and cameras, and then further analysed to confirm the at-receiver contribution levels.

The assessment process for the attended noise survey was to firstly identify periods where on-site noise was audible at residential receivers and correlated with observed on-site activities. These periods were marked in the post-processing noise software to assist in quantifying the $L_{Aeq(15\text{minute})}$ noise contribution and L_{Amax} noise event levels from MIP activities. The existing background noise levels were also taken into account, which were periods with no noise generating activities onsite. Periods where local road traffic noise, frog noise, bird noise, aircraft noise or other extraneous noise was influencing the measurement results were excluded from the site noise emission analysis. The periods of audible site noise were then combined and assessed over the 15-minute assessment period, to estimate the $L_{Aeq(15\text{minute})}$ site noise contribution in a conservative manner, with consideration of the various durations of different site activity noise emissions and existing ambient noise levels.

For the night period L_{Amax} assessment, audible site noise events that were identified during the survey were reviewed in the post-processing noise software to confirm the event noise level.

3.2.1.2 Unattended monitoring

The unattended noise monitoring was undertaken for the period between 4th February and 14th February 2025, over a 10 day contiguous period.

The prevailing weather conditions throughout the monitoring period were monitored as per Section 3.4, to determine the prevailing meteorological conditions and periods adversely affected by weather.

Noise monitors were deployed in the locations shown in Figure 1 with the purpose and installation details included in Table 2.

Based upon the results of the attended noise monitoring, in particular the directional noise monitoring, it was concluded that the steady state noise source contribution from MIP operations was negligible at 9 Casula Road, Casula, and so only short term audible noise events should be the focus of any analysis.

The analysis process used the intermediate noise monitoring locations along Bushmaster Avenue, to determine onsite noise events, as this was a closer location to these sources where there was reduced extraneous noise sources (ie. birds, trains and Moorebank Avenue traffic) with improved signal to noise ratio.

For the night periods, the short term noise events were then transferred across from the intermediate monitoring location to the noise monitoring at 9 Casula Road, Casula, to determine if the noise events were audible at this receiver location and to then quantify the noise level at the receiver from this event. Where these events could then be above any noise limits, the audio and onsite video data were reviewed to confirm it they were onsite noise or extraneous noise.

This process was used for the night period to identify in the post-processing noise software to assist in quantifying the $L_{Aeq(15\text{minute})}$ noise contribution from MIP activities. Due to the high existing ambient noise levels during the day and evening periods, a different method was used to estimate the site contribution. A combination of analysis of the monitored noise levels at the intermediate monitoring locations and noise modelling, was used to determine with confidence that the worst case 15-minute period for each day and evening was not above the relevant noise limit in a conservative manner.

3.2.2 Noise monitoring

The following noise monitoring was undertaken, with locations identified in Figure 1.

Table 2 Noise monitors and purpose

Loc. ID	Location	Purpose of noise monitor
Unattended noise monitor		
L1	Receiver (9 Casula Road, Casula)	Continuous noise monitoring throughout 10 day period, to determine at receiver noise levels.
L2	Bushmaster Ave noise wall monitor (north)	Continuous noise monitoring throughout 10 day period, to provide intermediate monitoring point near northern MPW warehouses, to assist with at receiver noise level correlation. Mounted on top of the 5m noise wall to allow for free-field measurements, and recording of noise levels that would be in the path between the receiver and the source.
L3	Bushmaster Ave noise wall monitor (central)	Continuous noise monitoring throughout 10 day period, to provide intermediate monitoring point between MPE and Moorebank Ave to assist with at receiver noise level correlation. Mounted on top of the 5m noise wall to allow for free-field measurements, and recording of noise levels that would be in the path between the receiver and the source.
L3	Bushmaster Ave noise wall monitor (south)	Continuous noise monitoring throughout 10 day period, to provide intermediate monitoring point near southern MPW warehouses, to assist with at receiver noise level correlation. Mounted on top of the 5m noise wall to allow for free-field measurements, and recording of noise levels that would be in the path between the receiver and the source.
L5	Adjacent to Moorebank Avenue	Continuous noise monitoring throughout 10 day period, to assist with removing the contribution from public road traffic noise on Moorebank Avenue from receiver noise levels.
Attended noise monitoring		
L1	Receiver (9 Casula Road, Casula)	Attended noise monitoring using the following equipment: <ul style="list-style-type: none"> • Omni-directional sound level meter • Directional noise monitor ('Barn Owl') Coupled with attended observations during the attended monitoring periods (day, evening and night)
-	Multiple locations	Attended noise monitoring using a hand-held sound level meter to quantify noise emission levels of onsite operations nearby to the source and correlate onsite noise events during the attended noise monitoring period with the receiver engineer.

3.3 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment, monitoring periods and instrument details is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments. Before and after each series of attended measurements, the calibration of the sound level meters was verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Monitoring period used (2025)	Equipment (RTA ref.)	Serial number	Last date calibrated
At-receiver attended noise measurements	4/2 & 6/2	NTi XL2 (XL2-C)	A2A-19156-E0	28/02/2024
	4/2 & 6/2	SoundScience 'Barn Owl'	170723002	10/01/2025
On-site attended noise measurements	4/2 & 6/2	NTi XL2 (XL2-A)	A2A-12270-E0	9/12/2024
Unattended noise monitor (9 Casula Road)	3/2 to 14/2	NTi XL2 (RTA07-044)	A2A-19157-E0	8/03/2024
Unattended noise monitor (Bushmaster Ave, north)	3/2 to 14/2	NTi XL2 (RTA07-049)	A2A-17502-E0	29/03/2023
Unattended noise monitor (Bushmaster Ave, central)	4/2 to 14/2	NTi XL2 (RTA07-046)	A2A-20264-E0	3/04/2024
Unattended noise monitor (Bushmaster Ave, south)	3/2 to 14/2	NTi XL2 (RTA07-047)	A2A-20297-E0	10/04/2024
Unattended noise monitor (Moorebank Avenue)	4/2 to 14/2	NTi XL2 (RTA07-045)	A2A-20397-E0	14/03/2024
Field calibration	3/2, 4/2, 6/2 & 14/2	B&K 4231 (XL2 BOX 2)	2545601	6/01/2025
Field calibration	4/2, 6/2 & 14/2	B&K 4231 (XL2 A)	2677710	6/01/2025

3.4 Meteorological conditions

Meteorological conditions during the period of noise measurement surveys were reviewed to determine the prevailing wind and temperature inversion conditions were appropriate. For a period of the monitoring, data from the MIP meteorological data monitoring station adjacent to Bushmaster Avenue, established in accordance with SSD 7709 (MPW Stage 2) CoC A54, was sourced and reviewed for the prevailing wind and temperature inversion conditions, and rain data sourced from the Bureau of Meteorology (BOM) automatic weather station (AWS) (Holsworthy Aerodrome) (Station 95761), located approximately 5 km south-east from the MIP.

This rain and wind data was used to exclude weather affected data (wind greater than 5m/s or rain) in the unattended noise monitoring presented in APPENDIX D, in accordance with the NPfl.

The noise limits in SSD 7709 are applicable for wind speeds up to 3 m/s (10.8 km/h) at 10 metres above ground level or up to atmospheric stability category F. The monitored wind and sigma-theta data was

used to determine temperature inversion conditions, to determine the periods when the noise limits were applicable during the monitoring period.

3.5 On-site activities during the monitoring period

B140A requires the attended noise monitoring to take place on days when the Precinct is likely to be operating at maximum capacity at the time. It was confirmed with ESR, the operator of MIP, that the operations were typical across MPE and MPW, following the resumption of operations after reduced activities associated with the Christmas/New Year break period.

For the monitoring week and attended noise surveys, historical weekly truck numbers were reviewed, along with the container train schedule, and day, evening and night periods were identified that would correlate with an associated container train arrival and loading period, and periods when there were likely high truck numbers, so to capture when the MIP was likely to be operating at maximum capacity. The status of the various elements of the MIP during the monitoring period are detailed in Table 4.

Table 4 On-site activities during the monitoring period

MIP area/component	Operations during the monitoring period
Interstate terminal (MPW)	Currently no scheduled commercial train operations at INTS. Container truck deliveries to the two northern warehouses, and associated warehouse container deliveries.
IMEX terminal (MPE)	Scheduled commercial train operations occurring, along with associated terminal crane operations. Container truck operations occurring.
MPW South (MPWS)	Under construction, no operations
Woolworths (JR)	In commissioning phase. Not yet operational.
Woolworths (JN)	Operations have just commenced and are at early operational stages. Operational levels low and ramping up.
MPW warehouses - N1 & N2	Typical operations were occurring.
MPE warehouses – E1, E3A/E3B/E4A/E4B/E5/E6/E7	Typical operations were occurring.

Traffic movements associated with the MIP during the monitoring period, with a comparison to previous months are shown in Table 5, demonstrating the monitoring occurred during a period when the MIP was operating at typical maximum capacity at the time.

Table 5 MIP truck movements during the monitoring period compared to recent historical data (average weekday truck movements)

MIP area/ component	Period	Truck movements (average daily movement)		
		November 2024	December 2024	Monitoring period (4/2/25 to 14/2/25)
MPE	Day	867	992	867
	Evening	116	145	116
	Night	272	368	272
MPW	Day	171	213	171
	Evening	8	17	8
	Night	20	28	20

Included in APPENDIX B along with the monitored noise information are the details of the observed activities within the MIP area taking place during the attended monitoring period.

4 Operational noise monitoring survey

4.1 Attended noise monitoring survey

4.1.1 Overview

A summary of the measured energy average (L_{Aeq}) and background (L_{A90}) noise levels at the monitored residential receivers during the attended noise survey are summarised in this section with further detail provided in APPENDIX B.

The noise limits apply to the noise emissions from the MIP operations only and not to general ambient noise. Receiver measured noise levels contain contributions from all noise sources at the receiver, and not only that from the site. In order to assess the noise emissions from the subject site against the appropriate noise limits, the contribution from the site operations in isolation from other noise sources needs to be determined.

Due to the existing levels of non-Project ambient noise (ie. distant road and rail traffic noise and other natural sources (ie. birds)) at the residential receiver, it was necessary to use multiple techniques to separate the noise from Project sources from other noise sources. Section 7 of the NPfI notes that determining the $L_{Aeq(15\text{minute})}$ site noise contribution in situations where the noise environment is influenced by many noise sources] can be a complex process, requiring the use of techniques to separate facility noise from other ambient sources. Professional judgement and multiple techniques have been used to give the necessary level of confidence in the results.

The analysis process detailed in Section 3.2.1.1 was implemented to undertake the assessment against the noise limits.

4.1.2 Measurement locations and time periods

A summary of the attended measurement locations and time periods is provided in Table 6.

Table 6 - Attended noise measurement periods

Location	Assessment period	Measurement period	
		Date	Time period
9 Casula Road, Casula	Day	Thursday 6 th February 2025	8:30am to 12:30pm
	Evening	Tuesday 4 th February 2025	6:00pm to 10:00pm
	Night	Thursday 6 th February 2025	3:00am to 7:00am

4.1.3 Attended measurement noise levels

4.1.3.1 $L_{Aeq(15\text{minute})}$ measured noise levels

Table 7 presents a summary of the measured noise levels during the attended noise monitoring survey, with the full details for each of the noise measurements are included in APPENDIX B. These results present the energy average ($L_{Aeq, 15\text{minute}}$) noise level contribution from the site activities based upon the analysis process detailed in Section 4.1.1 and Section 3.2.1.1. The noise measurements results are grouped into approximate 15-minute measurement durations in accordance with the requirements of the approval conditions.

Table 7 - Summary of attended $L_{Aeq(15\text{minute})}$ measured noise levels

Time (Date)	Measured MIP noise contribution, $L_{Aeq, 15\text{minute}}$ dB(A)	$L_{Aeq, 15\text{minute}}$ noise limit, dB(A) ¹	MIP Noise levels Comply? (Yes/No)
Day (Thursday 6 February 2025)			
8:30 AM to 8:45 AM	≤ 39	46	Yes
8:45 AM to 9:00 AM	≤ 40	46	Yes
9:00 AM to 9:15 AM	≤ 39	46	Yes
9:15 AM to 9:30 AM	≤ 40	46	Yes
9:30 AM to 9:45 AM	≤ 40	46	Yes
9:45 AM to 10:00 AM	≤ 40	46	Yes
10:00 AM to 10:15 AM	≤ 41	46	Yes
10:15 AM to 10:30 AM	≤ 41	46	Yes
10:30 AM to 10:45 AM	≤ 41	46	Yes
10:45 AM to 11:00 AM	≤ 40	46	Yes
11:00 AM to 11:15 AM	≤ 40	46	Yes
11:15 AM to 11:30 AM	≤ 42	46	Yes
11:30 AM to 11:45 AM	≤ 39	46	Yes
11:45 AM to 12:00 PM	≤ 39	46	Yes
12:00 PM to 12:15 PM	≤ 40	46	Yes
12:15 PM to 12:30 PM	≤ 39	46	Yes
Evening (Tuesday 4 February 2025)			
6:00 PM to 6:15 PM	≤ 35	44	Yes
6:15 PM to 6:30 PM	≤ 36	44	Yes
6:30 PM to 6:45 PM	≤ 37	44	Yes
6:45 PM to 7:00 PM	≤ 36	44	Yes
7:00 PM to 7:15 PM	≤ 37	44	Yes
7:15 PM to 7:30 PM	≤ 36	44	Yes
7:30 PM to 7:45 PM	≤ 37	44	Yes
7:45 PM to 8:00 PM	≤ 34	44	Yes
8:00 PM to 8:15 PM	≤ 36	44	Yes

Time (Date)	Measured MIP noise contribution, $L_{Aeq, 15\text{minute}}$ dB(A)	$L_{Aeq, 15\text{minute}}$ noise limit, dB(A) ¹	MIP Noise levels Comply? (Yes/No)
8:15 PM to 8:30 PM	≤ 40	44	Yes
8:30 PM to 8:45 PM	≤ 37	44	Yes
8:45 PM to 9:00 PM	≤ 36	44	Yes
9:00 PM to 9:15 PM	≤ 34	44	Yes
9:15 PM to 9:30 PM	≤ 35	44	Yes
9:30 PM to 9:45 PM	≤ 34	44	Yes
9:45 PM to 10:00 PM	≤ 35	44	Yes
Night (Thursday 6 February 2025)			
3:00 am to 3:15 am	≤ 25	39	Yes
3:15 am to 3:30 am	≤ 26	39	Yes
3:30 am to 3:45 am	≤ 26	39	Yes
3:45 am to 4:00 am	≤ 25	39	Yes
4:00 am to 4:15 am	≤ 25	39	Yes
4:15 am to 4:30 am	- ¹	39	Yes
4:30 am to 4:45 am	- ¹	39	Yes
4:45 am to 5:00 am	≤ 27	39	Yes
5:00 am to 5:15 am	≤ 28	39	Yes
5:15 am to 5:30 am	≤ 29	39	Yes
5:30 am to 5:45 am	≤ 31	39	Yes
5:45 am to 6:00 am	≤ 32	39	Yes
6:00 am to 6:15 am	≤ 33	39	Yes
6:15 am to 6:30 am	≤ 33	39	Yes
6:30 am to 6:45 am	≤ 33	39	Yes
6:45 am to 7:00 am	≤ 33	39	Yes

- Notes:
1. Monitoring paused due to rain
 2. Conservatively estimated as per Section 3.2.1.1.

Additionally, during the attended noise monitoring a directional noise monitor was used to determine the contribution only from the direction of the MIP.

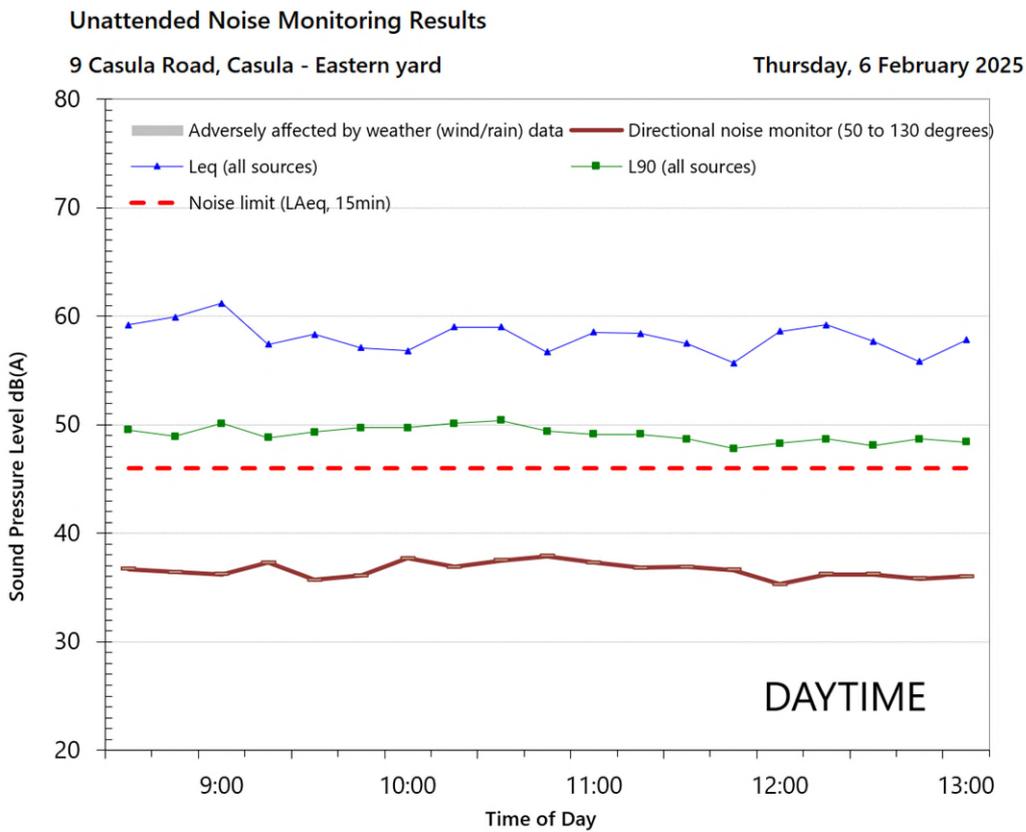
Due to elevated noise levels from short-term and intermittent noise from non-MIP sources in the direction of MIP, including train passbys, birds, and local car passbys, only the steady state noise contribution (ie. noise sources such as mechanical services plant/equipment) could be determined with confidence using the directional noise monitor.

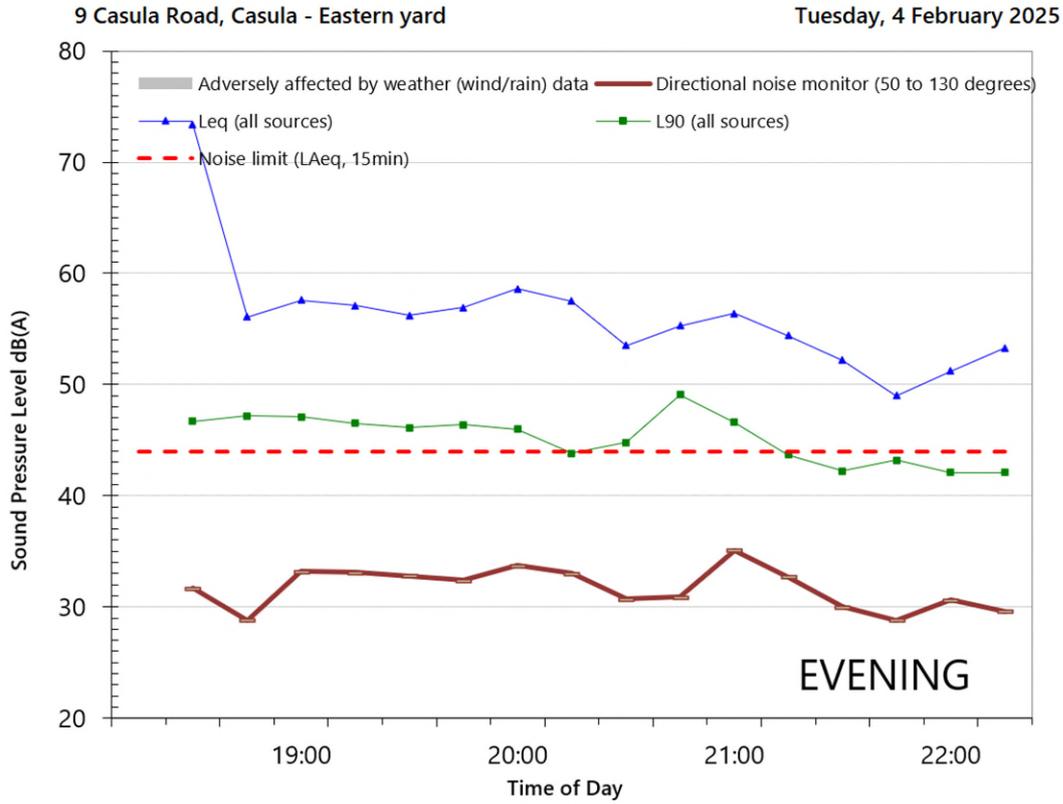
Presented in Figure 2 are the measured L_{Aeq} and L_{A90} noise level contributions from the direction of the MIP, which was between 50 and 130 degrees from the monitoring location, as shown in Figure 1.

Figure 2 shows that the steady-state noise levels (ie. noise sources such as mechanical services plant/equipment) measured over each of the 4 hour periods from the direction of the MIP were substantially below the SSD 7709 noise limits.

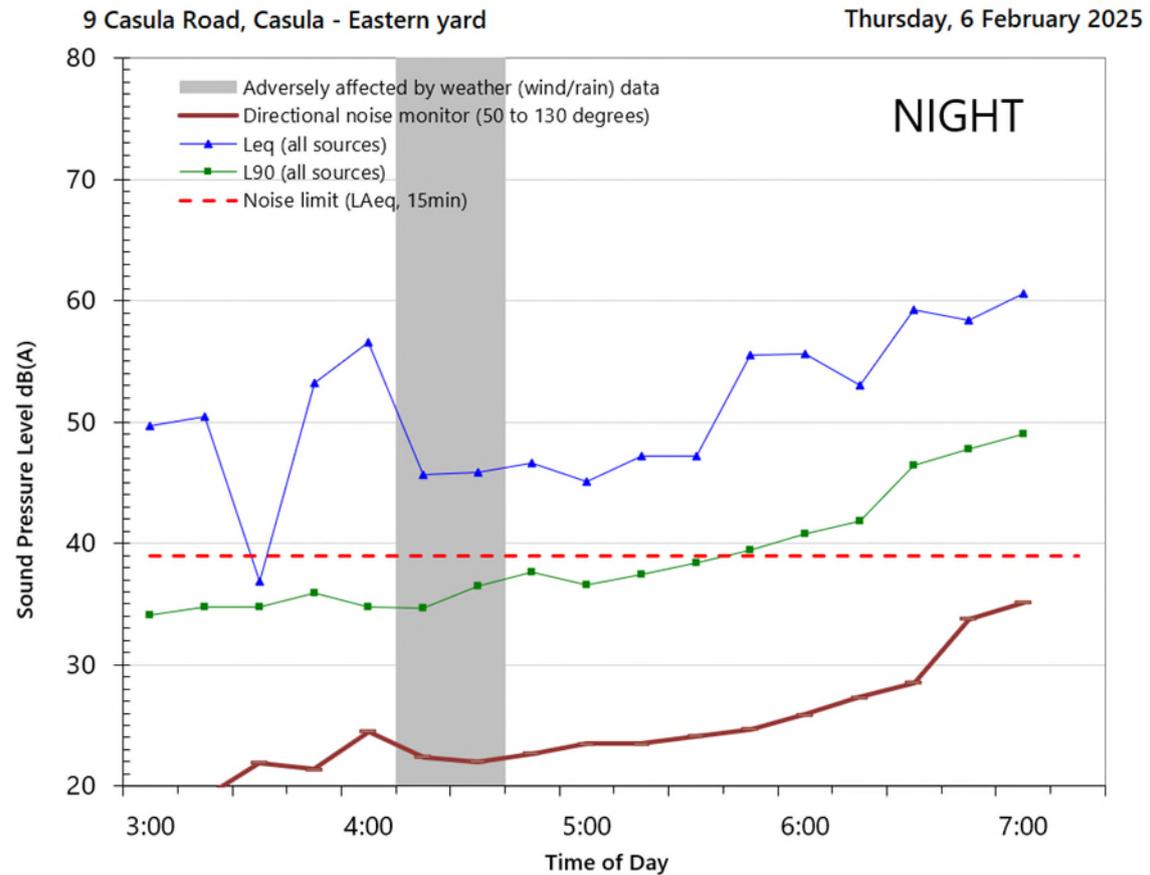
The directional noise monitor has a limit of distinguishing the direction of noise sources when their contribution is more than approximately 10 dB(A) below the noise level from all sources. For each of the day, evening and night graphs shown in Figure 2, the L_{A90} noise level from the direction of the MIP is at or lower than 10 dB(A) below the existing L_{A90} noise level, so potentially the steady state noise contribution in this direction is even lower than the values shown here.

Figure 2 – Directional noise monitor measured L_{A90} , (15 minute) noise levels (MIP direction, 50 to 130 degrees) at 9 Casula Road, Casula - Eastern yard, Thursday 6 February 2025 a) Day, b) Evening, c) Night





Unattended Noise Monitoring Results



4.1.3.2 L_{Amax} noise levels

For the night period the sleep arousal screening level noise limit is also applicable. Table 8 presents the measured L_{Amax} noise levels from MIP operations (not general ambient noise levels) for comparison against the sleep arousal screening level noise limits.

Table 8 - Summary of attended L_{Amax} measured noise levels (Thursday 6 February 2025)

Time	Measured MIP noise contribution, L_{Amax} dB(A)	L_{Amax} noise limit, dB(A) ¹	MIP Noise levels Comply? (Yes/No)
Night			
3:00 am to 3:15 am	≤ 25	52	Yes
3:15 am to 3:30 am	≤ 26	52	Yes
3:30 am to 3:45 am	≤ 26	52	Yes
3:45 am to 4:00 am	≤ 35	52	Yes
4:00 am to 4:15 am	≤ 43	52	Yes
4:15 am to 4:30 am	- ¹	52	Yes
4:30 am to 4:45 am	- ¹	52	Yes
4:45 am to 5:00 am	≤ 39	52	Yes
5:00 am to 5:15 am	≤ 45	52	Yes
5:15 am to 5:30 am	≤ 47	52	Yes
5:30 am to 5:45 am	≤ 50	52	Yes
5:45 am to 6:00 am	≤ 50	52	Yes
6:00 am to 6:15 am	≤ 45	52	Yes
6:15 am to 6:30 am	≤ 48	52	Yes
6:30 am to 6:45 am	≤ 40	52	Yes
6:45 am to 7:00 am	≤ 20	52	Yes

Notes: 1. Monitoring paused due to rain

4.2 Unattended noise monitoring survey

4.2.1 Overview

A summary of the measured noise levels at residential receivers are provided for the survey period. The noise measurement results are shown in the 15-minute measurement periods required by the approval conditions.

The noise limits apply to the noise emissions from the MIP operations only and not to general ambient noise. Receiver measured noise levels contain contributions from all noise sources at the receiver, and not only that from the site.

Like the attended measurement survey, in order to assess the noise emissions from the subject site against the appropriate noise limits, the contribution from the site operations in isolation from other noise sources

needs to be determined. As such, the process detailed in Section 3.2.1.2 was undertaken to determine the likely contribution from the MIP operations during the monitoring period.

Due to the existing levels of non-MIP noise (ie. distant road and rail traffic noise and other natural sources (ie. birds)) at the residential receivers, it was necessary to use multiple techniques to separate the noise from MIP sources from other noise sources. However, unlike the attended noise monitoring period, there is an increased level of uncertainty in estimating the noise level contribution. As such, the analysis focused on whether the site was likely above the applicable noise limits. Where the analysis process determined it was likely that the noise levels were below the applicable noise limits, the level of accuracy of the specific noise levels contribution is reduced.

To determine the measured noise levels' potential to result in sleep disturbance the investigation analysed the maximum noise levels (L_{Amax}) to be assessed against the noise limits. The analysis process identified events that were likely from site using the intermediate monitoring locations.

These were then further investigated for correlation between noise loggers and camera data to provide confidence that these were from site operations and to determine if the L_{Amax} noise levels were above the L_{Amax} noise limits at the residence. These events were also confirmed through listening to recorded noise events.

The $L_{Aeq, 15minute}$ noise level focused on combining audible short term noise events, as this process was deemed appropriate based upon the attended noise survey.

The overall measured noise levels during the monitoring period are presented in APPENDIX C, which includes both site noise and all other noise sources.

4.2.2 Measurement locations and time periods

Unattended noise monitoring was undertaken between Tuesday 4th February 2025 to Friday 14th February 2025 at 9 Casula Road, Casula.

Concurrently additional unattended noise monitoring was undertaken to assist with data correlation at the locations presented in Table 2 and Figure 1.

4.2.3 Unattended monitoring noise levels

4.2.3.1 $L_{Aeq(15minute)}$ measured noise levels

The analysis of $L_{Aeq, 15minute}$ noise emissions was based upon the process detailed in in Section 3.2.1.2. A different process was used during the day and evening period due to the high existing ambient noise levels, compared to the night period.

Table 9 presents a summary of the worst case 15-minute period measured noise levels during the unattended noise monitoring survey. These results present the $L_{Aeq, 15minute}$ noise level contribution from the site activities based upon the analysis process detailed in Section 3.2.1.2. Due to the high range of

noise emission variables and high existing ambient noise levels, especially during the day and evening periods, these noise levels were determined with a focus on if the worst case measured periods were above the appropriate noise levels or not.

As shown in Table 9 all monitored periods were less than the relevant $L_{Aeq, 15\text{minute}}$ noise limits.

Table 9 - Summary of unattended worst case $L_{Aeq, 15\text{minute}}$ measured noise levels noise contribution estimations

Date	Estimated worst case 15-minute MIP noise contribution, $L_{Aeq, 15\text{minute}}$ dB(A) ³			$L_{Aeq, 15\text{minute}}$ noise limit, dB(A)			MIP noise levels comply? (Y/N)		
	Day	Evening	Night ²	Day	Evening	Night	Day	Evening	Night
Tuesday, 4 February 2025	-	≤ 40	< 20	46	44	39	Y	Y	Y
Wednesday, 5 February 2025	< 41	< 35	< 28	46	44	39	Y	Y	Y
Thursday, 6 February 2025	< 42	< 37	< 33	46	44	39	Y	Y	Y
Friday, 7 February 2025	< 42	< 34	< 38	46	44	39	Y	Y	Y
Saturday, 8 February 2025	< 36	- ¹	< 29	46	44	39	Y	Y	Y
Sunday, 9 February 2025	< 34	< 35	< 27	46	44	39	Y	Y	Y
Monday, 10 February 2025	< 41	< 39	< 26	46	44	39	Y	Y	Y
Tuesday, 11 February 2025	< 41	< 37	< 32	46	44	39	Y	Y	Y
Wednesday, 12 February 2025	< 40	< 35	< 36	46	44	39	Y	Y	Y
Thursday, 13 February 2025	< 39	< 36	< 30	46	44	39	Y	Y	Y
Friday, 14 February 2025	-	-	< 25	46	44	39	Y	Y	Y

Notes:

1. Evening period was rain affected period
2. For periods that occurred during the night (10pm to 7am) on that date.
3. Levels are based upon the process detailed in in Section 3.2.1.2.

4.2.3.2 L_{Amax} noise levels

For the night period the sleep arousal screening level noise limit is also applicable. As per the other assessments, the measured L_{Amax} noise levels from MIP operations (not general ambient noise levels) were then compared against the sleep arousal screening level noise limit.

APPENDIX C presents each of the night periods, showing both valid site L_{Amax} noise events, and the other identified L_{Amax} events that were either from extraneous sources, unclassified events below the noise limits, or were outside of the applicable meteorological conditions.

Identified noise events are based upon the process detailed in in Section 3.2.1.2, to flag events that may be similar to short term noise events from site. Each valid measured level represents a L_{Amax} noise level where onsite maximum noise events were identified and correlated with receiver noise levels under the applicable meteorological conditions. Noise events were audible at times at the 9 Casula Road, Casula monitoring location.

Table 10 presents each of the nights, and the total number of identified events, and the number of identified valid events that occurred over each 9 hour night period that were above the noise limit. The graphs of each of the night periods are shown in APPENDIX C. The overall measured noise levels during the monitoring period are presented in APPENDIX C, which includes both site noise and all other noise sources.

Table 10 - Summary of unattended L_{Amax} measured noise levels and associated identified events

Time	Total number of identified L_{Amax} noise events ¹	Number of identified valid L_{Amax} noise events above the 52 dB(A) L_{Amax} noise limit, dB(A) ¹
Night (10:00pm to 7:00am)		
Tuesday, 4 February 2025	13	0
Wednesday, 5 February 2025	73	3
Thursday, 6 February 2025	140	5
Friday, 7 February 2025	136	16
Saturday, 8 February 2025	104	5
Sunday, 9 February 2025	168	0
Monday, 10 February 2025	59	0
Tuesday, 11 February 2025	92	5
Wednesday, 12 February 2025	44	7
Thursday, 13 February 2025	44	5
Friday, 14 February 2025	34	1
Total	907	47

Notes: 1. For periods that occurred during the night (10pm to 7am) on that date.

The majority of valid L_{Amax} noise events were found to comply with the sleep arousal screening level noise limits, except for during periods where loud onsite container handling and associated truck activities were occurring in non-acoustically shielded locations with worst-case meteorological conditions present (inversion or easterly wind components). Of the 907 identified events, only 47 events (5%) were above the noise limit.

As a result of the outcomes of the unattended noise monitoring, mitigation and management measures are recommended in Section 5 to address the identified exceedances.

5 Discussion and recommendations

5.1 Discussion of findings

During the at-receiver monitoring (attended and unattended), there was at times a significant contribution from non-MIP noise sources, such as distant and local road traffic, mainline rail movement noise, other extraneous sources (ie. aircraft) and natural sources (ie. frogs, crickets, birds, etc.). As such, standard industry practices and methods consistent with the NPfl were used to further analyse the noise monitoring data to separate out the MIP operational noise emissions from the general ambient noise.

The measured noise data was analysed with the assistance of onsite intermediate noise monitoring, onsite and receiver observations, onsite cameras and audio monitoring data. This data was used to correlate between onsite noise generating activities and receiver noise levels, to estimate site noise emission levels and identify and confirm onsite noise events in the post-monitoring analysis, so that MIP operational noise emissions could be assessed against the noise limits independent of these extraneous noise sources.

The noise monitoring surveys determined that the noise emissions from MIP operations were less than the SSD 7709 Conditions of Consent (CoC) $L_{Aeq15min}$ noise limits at all surrounding receiver locations for all monitoring periods.

Typically, the maximum noise levels from MIP operations were generally compliant with the L_{Amax} noise limits, however, a number of periods were identified where the L_{Amax} noise levels were above the L_{Amax} noise limit for residences in Casula.

These periods were further investigated, and it was identified that onsite activity generating the noise events were as follows:

- Reach stackers handling containers at the north end of IMEX.
- Truck horn events associated with container handling.
- Reach stacker handling of containers at a MPW warehouse.

As the noise survey found exceedances from the L_{AFmax} noise events, but not the $L_{Aeq15minute}$ noise levels, then the further actions and reporting in B140A(f) to (k) are not required.

However, as exceedances were measured the response process detailed in MPW S2 ONMP Section 4.3, as per MPW S2 ONMP Table 4-1 should be followed.

5.2 Review of residual impacts

As per MPW S2 ONMP Table 4-1, and consistent with the L_{Amax} related items of B140A(f) the residual noise impacts were investigated. The investigation included detailed assessment information covering the maximum noise levels, the extent to which the maximum noise level exceeds the rating background

noise level, the number of times this happens during the night-time period, and consideration of relevant guidance research.

The identified residual noise events were short-term noise events, and did not occur throughout the monitoring period but only at times of worst-case activity noise events and under worst-case meteorological conditions. As such, with appropriate noise management measures implemented these residual noise levels would not be considered a sustained exceedance.

As per the assessment process in NPfl Section 2.5, Table 10 presents the number of noise events that were identified while APPENDIX C shows the distribution of noise events over the various night periods and when they occurred during the week. APPENDIX C and APPENDIX D show the context of the existing noise levels and events that occurred, giving context to the identified noise events within the existing ambient noise environment. A range of existing high noise event levels typically occurred at night not from site operations, but instead from train pass-by events (passenger and freight), loud vehicles (truck, car and motorbike) on nearby major arterial roads (M5 and Hume Highway), and neighbourhood and natural noises (ie. birds). As per observations made during the attended measurements detailed in APPENDIX B, typical train pass-by event noise levels ranged from 63 to 71 dB(A) considering that both freight and passenger trains operate along the rail line adjacent to the Casula residential receivers. The typical $L_{Aeq, 15\text{minute}}$ levels at night range was between 52 to 54 dB(A). As such average typical night period ambient (non-MIP) noise levels are greater than 52 dB(A).

The measured background noise levels show a clear shoulder period is apparent in the noise monitoring data, starting from around 3:00am, but with a more rapid increase from 5:00am/6:00am. The exceedances were identified during a range of different time periods, however, for periods where a number of events were identified such as on 7 February 2025, instead of the night background noise level being 37 dB(A) $L_{A90, 15\text{minute}}$, which occurred around 1:00am, the background noise level at approximately 5:00am when the majority of noise events occurred, was 45 dB(A) $L_{A90, 15\text{minute}}$. This would result in an NPfl sleep disturbance screening level of 60 dB(A) L_{Amax} , of which many identified events were below this level and this would also result in the noise events being less apparent due to this increased background noise.

The NPfl points to the NSW *Road Noise Policy* (RNP) for some guidance on possible impacts. The RNP concludes the following:

From the research on sleep disturbance to date it can be concluded that:

- *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly.*

Although this information is provided with the focus on traffic noise levels, it provides guidance to consider the nature and impact of the monitored noise levels as referenced in the NPfl. On the assumption that there is a 10 dB(A) outside-to-inside noise sound transmission loss through an open window (see NSW RNP, p17), the related references indicate that external traffic noise levels of L_{Amax}

60 to 65 dB(A) are unlikely to cause awakening reactions. The identified valid events were below 65 dB(A) L_{Amax} .

The measurements were undertaken as part of implementing the MPW S2 ONMP. As exceedances from the L_{AFmax} noise limits have been measured, the response process detailed in MPW S2 ONMP Section 4.3 should be followed. This includes identifying the relevant operational personnel to be notified, reviewing the nature of the exceedance and the potential of existing operations for further impacts, further investigating the exceedances, for which a preliminary review has been done in Section 5.1, and determining feasible and reasonable mitigation and management measures to reduce these noise levels and minimise impacts on receivers.

Recommendations to mitigate and manage these identified noise impacts are detailed in Section 5.3.

5.3 Recommendations

As a result of the B140A noise monitoring, the following mitigation and management measures are recommended to mitigate identified exceedances.

Recommended management controls to mitigate identified exceedances

IMEX operations

- Avoid the use of horns from trucks and reach stackers, where practicable and safe, within the IMEX terminal during the night period (10pm to 7am).
- For container handling in the area north of the IMEX terminal, ensure that when container handling and truck loading operations are taking place at night using reach stackers, that there are containers to the west of the container handling operations. These containers are to sufficiently break the line-of-sight between the container handling locations and the residences in Casula. These shielding containers are to be stacked minimum of 2 containers high, and extend either side of the container handling location for a minimum 4 containers in length, considering ground level handling of containers. Operations should also not be at height but rather only ground level handling of containers.

MPW warehouse operations

- Container warehouse transfers at night should be undertaken using combilifts or straddle carriers, instead of reach stackers, unless alternative container handling methodologies are implemented which sufficiently reduce noise levels from these activities.

These control measures should be further investigated to determine the method of implementation, and as part of this implementation process, determine the likely effectiveness of the final approach to confirm that it is expected they appropriately mitigate the identified noise event exceedances.

As per MPW S2 ONMP, following the implementation of these control measures additional monitoring is to be undertaken to verify the effectiveness of the implemented controls and confirm operational noise emissions are achieving the relevant noise limits.

6 Conclusion

Renzo Tonin & Associates was engaged by ESR Developments (Australia) Pty Ltd on behalf of The Trust Company (Australia) Limited (ACN 000 000 993) As Trustee Of The Moorebank Industrial Warehouse Trust (ABN 51 402 161 047) to conduct noise impact monitoring to satisfy the (State Significant Development (SSD) 7709 B140A consent condition (CoC) for the Moorebank Precinct West (MPW), which forms part of the Moorebank Intermodal Precinct (MIP) at Moorebank, NSW.

The purpose of this exercise was to undertake noise monitoring to assess operational noise levels from the Moorebank Intermodal Precinct (MIP) at No. 9 Casula Road, Casula, to determine the typical operational noise levels at this receiver location, and assess their compliance with the noise limits in the SSD 7709 Conditions of Consent (CoC) and consistent with the MPW Stage 2 Operational Noise Management Plan² (MPW S2 ONMP).

The noise monitoring undertaken included both attended and unattended noise monitoring. The attended noise monitoring was undertaken on three separate periods, each for 4 hours during each of the day, evening and night periods. The unattended noise monitoring was for a period of 7 contiguous days where valid data was measured not adversely affected by weather.

During the at-receiver monitoring (attended and unattended), there was at times a significant contribution from non-MIP noise sources, such as distant and local road traffic, mainline rail movement noise, other extraneous sources (ie. aircraft) and natural sources (ie. frogs, crickets, birds, etc.). As such, standard industry practices and methods consistent with the NPfl were used to further analyse the noise monitoring data to separate out the MIP operational noise emissions from the general ambient noise.

The measured noise files were analysed with the assistance of onsite intermediate noise monitoring, onsite and receiver observations, onsite cameras and audio monitoring data. This data was used to correlate between onsite noise generating activities and receiver noise levels, to estimate site noise emission levels and identify and confirm onsite noise events in the post-monitoring analysis, so that MIP operational noise emissions could be assessed against the noise limits independent of these extraneous noise sources.

The noise monitoring surveys determined that the noise emissions from MIP operations were less than the SSD 7709 Conditions of Consent (CoC) $L_{Aeq15min}$ noise limits at all surrounding receiver locations for all monitoring periods.

Typically, the maximum noise levels from MIP operations were generally compliant with the L_{Amax} noise limits, however, a number of periods were identified where the L_{Amax} noise levels were above the L_{Amax} noise limit for residences in Casula.

2. 2 Logos, Operational Noise Management Plan Moorebank Logistics Park - West Precinct Stage 2, Report No. J1883240215.4, Revision 4, dated 15/2/2024, available https://moorebankintermodalprecinct.com.au/wp-content/uploads/2024/04/SSD7709-MPW2-ONMP_Rev4_redacted.pdf, accessed 15/10/2024

As exceedances were measured a further investigation of the identified noise events was undertaken, and recommendations for feasible and reasonable mitigation and management measures included to reduce these noise levels at receivers as required by Section 4.3 of the MPW S2 ONMP.

These control measures should be further investigated to determine the method of implementation, and as part of this implementation process, determine the likely effectiveness of the final approach to confirm that it is expected to appropriately mitigate the identified noise event exceedances. Following the implementation of these control measures additional monitoring is to be undertaken to verify the effectiveness of the implemented controls and confirm operational noise emissions are achieving the relevant noise limits.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).																																														
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.																																														
Assessment period	The period in a day over which assessments are made.																																														
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.																																														
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).																																														
Decibel [dB]	<p>The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:</p> <table border="0"> <tr> <td>threshold of hearing</td> <td>0 dB</td> <td>The faintest sound we can hear</td> </tr> <tr> <td></td> <td>10 dB</td> <td>Human breathing</td> </tr> <tr> <td></td> <td>20 dB</td> <td></td> </tr> <tr> <td>almost silent</td> <td>30 dB</td> <td>Quiet bedroom or in a quiet national park location</td> </tr> <tr> <td></td> <td>40 dB</td> <td>Library</td> </tr> <tr> <td>generally quiet</td> <td>50 dB</td> <td>Typical office space or ambience in the city at night</td> </tr> <tr> <td></td> <td>60 dB</td> <td>CBD mall at lunch time</td> </tr> <tr> <td>moderately loud</td> <td>70 dB</td> <td>The sound of a car passing on the street</td> </tr> <tr> <td></td> <td>80 dB</td> <td>Loud music played at home</td> </tr> <tr> <td>loud</td> <td>90 dB</td> <td>The sound of a truck passing on the street</td> </tr> <tr> <td></td> <td>100 dB</td> <td>Indoor rock band concert</td> </tr> <tr> <td>very loud</td> <td>110 dB</td> <td>Operating a chainsaw or jackhammer</td> </tr> <tr> <td></td> <td>120 dB</td> <td>Jet plane take-off at 100m away</td> </tr> <tr> <td></td> <td>130 dB</td> <td></td> </tr> <tr> <td>extremely loud</td> <td>140 dB</td> <td>Military jet take-off at 25m away</td> </tr> </table>		threshold of hearing	0 dB	The faintest sound we can hear		10 dB	Human breathing		20 dB		almost silent	30 dB	Quiet bedroom or in a quiet national park location		40 dB	Library	generally quiet	50 dB	Typical office space or ambience in the city at night		60 dB	CBD mall at lunch time	moderately loud	70 dB	The sound of a car passing on the street		80 dB	Loud music played at home	loud	90 dB	The sound of a truck passing on the street		100 dB	Indoor rock band concert	very loud	110 dB	Operating a chainsaw or jackhammer		120 dB	Jet plane take-off at 100m away		130 dB		extremely loud	140 dB	Military jet take-off at 25m away
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dB(A)	A-weighted decibels. The A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.																																														
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.																																														

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.
L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L _{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B **Attended noise monitoring details (9 Casula Road, Casula)**

Table 11 - Attended noise measurement results – 9 Casula Road, Casula

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				Yes or No
Day (Thursday 6 February 2025)											
D1	Day	8:30 AM to 8:45 AM	77	61	49	n/a	≤ 39	Wind speed: still Wind Dir: - Temp: 26C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (~58-63dB(A)), distant road traffic (motorbikes), local traffic (cars), train passby (freight), plane flyover, construction noise (MPWS) Background noise levels : Distant traffic (Moorebank Ave + M5), insect noise (cicadas) and almost constant birds. Site noise: Site noise (container handling) just audible on one occasion.	46	Yes
D2	Day	8:45 AM to 9:00 AM	77	60	50	n/a	≤ 39	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (~60-63dB(A)), train passbys (passenger) and station noise, local traffic (cars), construction noise (MPWS) Background noise levels : Distant traffic (Moorebank Ave + M5), insect noise (cicadas) Site noise: Site noise was not audible.	46	Yes
D3	Day	9:00 AM to 9:15 AM	75	58	49	n/a	≤ 39	Wind speed: still Wind Dir: - Temp: 28C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate, train passbys (passenger) and station noise, local traffic (cars), plane flyover Background noise levels : Distant traffic (Moorebank Ave + M5), insect noise (cicadas) Site noise: Site noise was not audible.	46	Yes
D4	Day	9:15 AM to 9:30 AM	74	59	50	n/a	≤ 40	Wind speed: still Wind Dir: - Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (58-60), train passbys (passenger) and station noise, local traffic (cars), helicopter flyover, construction (MPWS) Background noise levels : Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (45-46dB(A)) Site noise: Site noise (container handling) audible on four occasions.	46	Yes
D5	Day	9:30 AM to 9:45 AM	78	58	50	n/a	≤ 40	Wind speed: still Wind Dir: - Temp: 34C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (55-68), train passbys (passenger) and station noise, local traffic (cars), plane flyover, neighbourhood noise (mower) Background noise levels : Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (45-46dB(A)),neighbourhood noise (pressure washer) Site noise: Site noise was not audible.	46	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				Yes or No
D6	Day	9:45 AM to 10:00 AM	73	57	50	n/a	≤ 40	Wind speed: < 0.5 m/s Wind Dir: E Temp: 34C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (60-73), train passbys (passenger) and station noise, local traffic (cars), neighbourhood noise (pressure washer) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (48dB(A)),neighbourhood noise (pressure washer) Site noise: Site noise was not audible.	46	Yes
D7	Day	10:00 AM to 10:15 AM	73	60	50	n/a	≤ 41	Wind speed: < 0.5 m/s Wind Dir: NE Temp: 34C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (56-70), train passbys (freight/passenger) and station noise, local traffic (cars), neighbourhood noise (pressure washer) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (49/50dB(A)), neighbourhood noise (pressure washer) Site noise: Site noise (container handling and truck noise) audible on occasion.	46	Yes
D8	Day	10:15 AM to 10:30 AM	71	59	51	n/a	≤ 41	Wind speed: ~1 m/s Wind Dir: NE Temp: 32C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (60-70), train passbys (freight/passenger) and station noise, local traffic (cars), neighbourhood noise (pressure washer) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (49 dB(A)), neighbourhood noise (pressure washer 48-52 dB(A)) Site noise: Site noise (container handling and truck noise) audible on occasion.	46	Yes
D9	Day	10:30 AM to 10:45 AM	73	57	50	n/a	≤ 41	Wind speed: < 0.7 m/s Wind Dir: NE Wind Dir: - Temp: 34C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (58-69), train passbys (freight/passenger) and station noise, local traffic (cars), helicopter flyover, neighbourhood noise (pressure washer, 52-55 dB(A)), construction (south) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (49 dB(A)) Site noise: Site noise (container handling) audible on occasion.	46	Yes
D10	Day	10:45 AM to 11:00 AM	75	59	49	n/a	≤ 40	Wind speed: < 0.5 m/s Wind Dir: NE Temp: 34C Cloud: 3/8 Rain: nil	Ambient noise levels: Birds dominate (58-73), train passbys (passenger) and station noise, local traffic (cars), helicopter flyover, neighbourhood noise (pressure washer 51/52), construction (MPWS) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (45dB(A)), neighbourhood noise (pressure washer 51/52) Site noise: Site noise (container handling) audible on multiple occasions.	46	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				Yes or No
D11	Day	11:00 AM to 11:15 AM	72	58	49	n/a	≤ 40	Wind speed: 1-1.5 m/s Wind Dir: NE Temp: 33C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (58-67), train passbys (passenger) (~66dB(A)) and station noise, local traffic (cars), helicopter flyover, neighbourhood noise (pressure washer and mower 48dB(A)), construction (MPWS) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (45dB(A)), neighbourhood noise (pressure washer and mower 48dB(A)) Site noise: Site noise (container handling) audible on multiple occasions.	46	Yes
D12	Day	11:15 AM to 11:30 AM	74	58	49	n/a	≤ 42	Wind speed: 1 to 2 m/s Wind Dir: NE Temp: 33C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (58-67), train passbys (passenger) (~66dB(A)) and station noise, local traffic (cars), helicopter flyover, construction (MPWS) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (48dB(A)) Site noise: Site noise (container handling and trucks/truck horns) audible on occasions.	46	Yes
D13	Day	11:30 AM to 11:45 AM	74	56	48	n/a	≤ 39	Wind speed: ~1 m/s Wind Dir: NE Temp: 31C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (58-65), train passbys (passenger) (~63dB(A)) and station noise, helicopter flyover Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (45-50dB(A)) Site noise: Site noise (container handling and trucks/truck horns) audible on occasions.	46	Yes
D14	Day	11:45 AM to 12:00 PM	71	59	48	n/a	≤ 39	Wind speed: still Wind Dir: - Temp: 30C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (58-65), train passbys (passenger/freight) (~65/66dB(A)) and station noise, construction (MPWS) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) Site noise: Site noise (container handling and trucks/truck horns) audible on occasions.	46	Yes
D15	Day	12:00 PM to 12:15 PM	75	60	50	n/a	≤ 40	Wind speed: 0.5 to 1 m/s Wind Dir: - Temp: 32C Cloud: 3/8 Rain: nil	Ambient noise levels: Birds dominate (60-70), train passbys (passenger) (~64dB(A)) and station noise, construction (MPWS) Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (~47dB(A)) Site noise: Site noise (container handling and trucks/truck horns) audible on occasions.	46	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				
D16	Day	12:15 PM to 12:30 PM	75	59	49	n/a	≤ 39	Wind speed: still Wind Dir: - Temp: 29C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (58-62), train passbys (passenger/freight) (~63-68dB(A)) and station noise Background noise levels: Distant traffic (Moorebank Ave + M5), insect noise (cicadas) (~47dB(A)) Site noise: Site noise (container handling and trucks/truck horns) audible on occasions.	46	Yes
Evening (Tuesday 4 February 2025)											
E1	Evening	6:00 PM to 6:15 PM	94	72	45	n/a	≤ 35	Wind speed: <1 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate, train passby (passenger) noise, local traffic movements Background noise levels: Distant traffic (M5) Site noise: Site noise was not audible.	44	Yes
E2	Evening	6:15 PM to 6:30 PM	78	56	46	n/a	≤ 36	Wind speed: <1 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate, train passby (passenger) noise, local traffic movements Background noise levels: Distant traffic (M5) Site noise: Site noise was not audible.	44	Yes
E3	Evening	6:30 PM to 6:45 PM	72	58	47	n/a	≤ 37	Wind speed: <1 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds (~58dB(A)), train passby (passenger/freight) noise (~62-65dB(A)), local traffic movements, plane flyover Background noise levels: Distant traffic (M5) Site noise: Site noise (container handling) audible on one occasion.	44	Yes
E4	Evening	6:45 PM to 7:00 PM	87	58	46	n/a	≤ 36	Wind speed: <1 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate, train passbys (passenger/freight) (~63-68dB(A)) and station noise, helicopter flyover Background noise levels: Distant traffic (M5) (46-50dB(A)) Site noise: Site noise (container handling and trucks/truck horn) audible on a number of occasions.	44	Yes
E5	Evening	7:00 PM to 7:15 PM	72	56	46	n/a	≤ 37	Wind speed: <1.5 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (58-70dB(A)), train passbys (passenger) (~63-65dB(A)) and station noise, local traffic, plane flyover Background noise levels: Distant traffic (M5) (46dB(A)), crickets (52-56dB(A)) Site noise: Site noise (container handling and trucks/truck horn) audible on a number of occasions.	44	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				Yes or No
E6	Evening	7:15 PM to 7:30 PM	72	57	46	n/a	≤ 36	Wind speed: <2 m/s Wind Dir: N Temp: 30C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (58-72dB(A)), train passbys (passenger) (~68/69dB(A)) and station noise, local traffic, plane flyover Background noise levels: Distant traffic (M5) (43-45dB(A)) Site noise: Site noise (container handling and trucks/truck horn) audible on a number of occasions.	44	Yes
E7	Evening	7:30 PM to 7:45 PM	76	59	46	n/a	≤ 37	Wind speed: 1 to 2 m/s Wind Dir: NE Temp: 29C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds dominate (60dB(A)), train passbys (passenger/freight) (~63/70dB(A)) and station noise, local traffic, plane flyover Background noise levels: Distant traffic (M5) (44-46dB(A)) Site noise: Site noise (container handling and trucks/truck horn) audible on a number of occasions.	44	Yes
E8	Evening	7:45 PM to 8:00 PM	77	58	44	n/a	≤ 34	Wind speed: ~1 m/s Wind Dir: NE Temp: 29C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds, train passbys (passenger/freight) (~63-69dB(A)) and station noise, local traffic Background noise levels: Distant traffic (M5) (41-45dB(A)), cicadas (~51dB(A)) Site noise: Site noise (container handling) just audible on one occasion.	44	Yes
E9	Evening	8:00 PM to 8:15 PM	68	54	46	n/a	≤ 36	Wind speed: <2.5 m/s Wind Dir: N Temp: 28C Cloud: 0/8 Rain: nil	Ambient noise levels: Birds, train passbys (passenger) (~63dB(A)) and station noise, loud vehicles on M5, local traffic Background noise levels: Distant traffic (M5) and cicadas (~44-47dB(A)) Site noise: Site noise (truck horns) audible on one occasion.	44	Yes
E10	Evening	8:15 PM to 8:30 PM	70	56	50	n/a	≤ 37	Wind speed: still Wind Dir: - Temp: 28C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger) (~63dB(A)) and station noise, distant freight train, local traffic Background noise levels: Distant traffic (M5) and cicadas (~49-50dB(A)) Site noise: Site noise was not audible.	44	Yes
E11	Evening	8:30 PM to 8:45 PM	73	58	47	n/a	≤ 37	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger) (~63-64dB(A)) and station noise, local traffic Background noise levels: Distant traffic (M5) and frogs/crickets (~47dB(A)) Site noise: Site noise was not audible.	44	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				
E12	Evening	8:45 PM to 9:00 PM	70	54	44	n/a	≤ 36	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger/freight) (~67/68dB(A)) and station noise, loud M5 vehicles, local traffic Background noise levels: Distant traffic (M5) and frogs/crickets (~44-46dB(A)) Site noise: Site noise (container handling and truck horn) audible on one occasion.	44	Yes
E13	Evening	9:00 PM to 9:15 PM	66	53	43	n/a	≤ 34	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger (~67/68dB(A)) and station noise, distant freight train, loud M5 vehicles, local traffic Background noise levels: Distant traffic (M5) and crickets (~43dB(A)) Site noise: Site noise (container handling and truck horns) audible on occasion.	44	Yes
E14	Evening	9:15 PM to 9:30 PM	66	51	43	n/a	≤ 35	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger (~61-65dB(A)) and station noise, local traffic Background noise levels: Distant traffic (M5) and crickets (~43-46dB(A)) Site noise: Site noise (container handling, towards MPW warehouses and IMEX) audible on occasions.	44	Yes
E15	Evening	9:30 PM to 9:45 PM	69	53	43	n/a	≤ 34	Wind speed: still Wind Dir: - Temp: 27C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger (~64-65dB(A)) and station noise, local traffic, plane flyover, loud M5 vehicles (motorbike) Background noise levels: Distant traffic (M5) and crickets (~45-46dB(A)) Site noise: Site noise (container handling, towards MPW warehouses and IMEX) audible on occasions.	44	Yes
E16	Evening	9:45 PM to 10:00 PM	68	54	42	n/a	≤ 35	Wind speed: still Wind Dir: - Temp: 26C Cloud: 0/8 Rain: nil	Ambient noise levels: Train passbys (passenger (~65-68dB(A)) and station noise (motorbike), local traffic, plane flyover, loud M5 vehicles (motorbike) Background noise levels: Distant traffic (M5) and crickets (~44/45dB(A)) Site noise: Site noise (container handling and truck horn) audible on occasions.	44	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				
Night (Thursday 6 February 2025)											
N1	Night	3:00 am to 3:15 am	67	52	35	< 25	≤ 25	Wind speed: still Wind Dir: - Temp: 24C Cloud: 8/8 Rain: nil	Ambient noise levels: Construction noise on railway line, train passby. Background noise levels: Mechanical equipment at Casula Station and insect noise (~35/36dB(A)) Site noise: Site noise was not audible.	39	Yes
N2	Night	3:15 am to 3:30 am	56	38	36	< 26	≤ 26	Wind speed: still Wind Dir: - Temp: 23C Cloud: 8/8 Rain: nil	Ambient noise levels: Distant road traffic (motorbike), construction noise on railway line, train passby. Background noise levels: Mechanical equipment at Casula Station and insect noise (~35/36dB(A)) Site noise: Site noise was not audible.	39	Yes
N3	Night	3:30 am to 3:45 am	71	54	36	< 26	≤ 26	Wind speed: still Wind Dir: - Temp: 23C Cloud: 8/8 Rain: nil	Ambient noise levels: Helicopter, distant road traffic (loud cars), neighbourhood noise (dog barking, local car), train passby (2xpassenger and freight) (~68-70dB(A)), train at station noises Background noise levels: Mechanical equipment at Casula Station and insect noise (~36/40dB(A)) Site noise: Site noise was not audible.	39	Yes
N4	Night	3:45 am to 4:00 am	77	58	35	< 35	≤ 25	Wind speed: still Wind Dir: - Temp: 23C Cloud: 8/8 Rain: nil	Ambient noise levels: Distant road traffic (loud cars/trucks), train passby (passenger) (~68-70dB(A)), train at station noises Background noise levels: Mechanical equipment at Casula Station and insect noise (~35/36dB(A)) Site noise: Site noise (container handling) just audible on one occasion.	39	Yes
N5	Night	4:00 am to 4:15 am	65	47	35	< 43	≤ 25	Wind speed: still Wind Dir: - Temp: 23C Cloud: 8/8 Rain: nil	Ambient noise levels: Local car and station carpark activities, train passby (passenger) (~62/63dB(A)) and train at station noises Background noise levels: Mechanical equipment at Casula Station and insect noise (~35/36dB(A)) Site noise: Site noise (container handling) audible on occasion.	39	Yes
N6	Night	4:15 AM to 4:30 AM	Excluded due to periods of rain								
N7	Night	4:30 AM to 4:45 AM	Excluded due to periods of rain								

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				
N8	Night	4:45 am to 5:00 am	53	42	37	< 39	≤ 27	Wind speed: still Wind Dir: - Temp: 22C Cloud: 8/8 Rain: yes	Ambient noise levels: Local cars and station carpark activities Background noise levels: Mechanical equipment at Casula Station (~35/36dB(A)) and frog and insect noise (~45/46dB(A)) Site noise: Truck movement within MIP just audible, site noise (container handling) audible on one occasion. <i>Paused due to rain at prior to 4:48am and after 4:56am</i>	39	Yes
N9	Night	5:00 am to 5:15 am	65	48	38	< 45	≤ 28	Wind speed: still Wind Dir: - Temp: 22C Cloud: 8/8 Rain: nil	Ambient noise levels: Distant road traffic (motorbike), local traffic (car) and station carpark activities, train passby (passenger) (~64dB(A)) and train at station noises Background noise levels: Mechanical equipment at Casula Station and frog and insect noise (~45/46dB(A)) Site noise: Truck movement within MIP just audible, site noise (container handling and truck horn) audible on occasion.	39	Yes
N10	Night	5:15 am to 5:30 am	67	48	39	< 47	≤ 29	Wind speed: still Wind Dir: - Temp: 21C Cloud: 8/8 Rain: nil	Ambient noise levels: Local traffic (cars), train passby (passenger) (~64dB(A)) and train at station noises, distant road traffic (Hume Highway & M5, motorbike & loud trucks) Background noise levels: Mechanical equipment at Casula Station, distant traffic (Moorebank Ave + M5) (~40dB(A)), and frog and insect noise (~45/46dB(A)) Site noise: Vehicle movements within MIP just audible, site noise (truck horn) audible on one occasion.	39	Yes
N11	Night	5:30 am to 5:45 am	78	59	41	< 50	≤ 31	Wind speed: still Wind Dir: - Temp: 21C Cloud: 8/8 Rain: nil	Ambient noise levels: Birds (kookaburras/crows)(~70-75dB(A)), local traffic (cars) (~49-51dB(A)), train passby (3xpassenger) (~64-65dB(A)), and train at station noises, distant road traffic (Hume Highway & M5, motorbike & loud trucks) Background noise levels: Mechanical equipment at Casula Station, distant traffic (Moorebank Ave + M5) (~40dB(A)), and frog and insect noise (~45/46dB(A)) Site noise: Vehicle movements within MIP just audible, site noise (container handling) just audible on occasions.	39	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				
N12	Night	5:45 am to 6:00 am	71	54	42	< 50	≤ 32	Wind speed: still Wind Dir: - Temp: 21C Cloud: 7/8 Rain: nil	Ambient noise levels: Birds(~45-47dB(A)), local traffic (cars) (~49-54dB(A)), distant aircraft, train passby (3xpassenger) (~69-70dB(A)), and train at station noises, distant road traffic (Hume Highway & M5, motorbike & loud trucks) Background noise levels: Mechanical equipment and music at Casula Station, distant traffic (Moorebank Ave + M5) (~40dB(A)) Site noise: Vehicle movements within MIP just audible, site noise (container handling) faint/just audible on occasions.	39	Yes
N13	Night	6:00 am to 6:15 am	70	53	43	< 45	≤ 33	Wind speed: still Wind Dir: - Temp: 21C Cloud: 6/8 Rain: nil	Ambient noise levels: Birds(~49-63dB(A)), local traffic (cars) (~52dB(A)), train passby (2xpassenger) (~68dB(A)), and train at station noises, distant road traffic (Hume Highway & M5) Background noise levels:Distant traffic (Moorebank Ave + M5) (~42-44dB(A)), almost constant birds Site noise: Vehicle movements within MIP just audible towards MIP south, site noise (container handling) faint/just audible on one occasion.	39	Yes
N14	Night	6:15 am to 6:30 am	82	61	47	< 48	≤ 33	Wind speed: still Wind Dir: - Temp: 21C Cloud: 5/8 Rain: nil	Ambient noise levels: Birds(~50-82dB(A)), local traffic (cars) (~52dB(A)), train passby (4xpassenger and freight) (~68-72dB(A)) and train at station noises, distant road traffic (Hume Highway & M5) Background noise levels: Distant traffic (Moorebank Ave + M5) (~42-44dB(A)) and almost constant birds (~50-55dB(A)) Site noise: Vehicle movements within MIP just audible towards MIP south on one occasion.	39	Yes
N15	Night	6:30 am to 6:45 am	81	59	48	< 40	≤ 33	Wind speed: still Wind Dir: - Temp: 21C Cloud: 4/8 Rain: nil	Ambient noise levels: Birds dominate (~52-70dB(A)), many local cars (~51dB(A)), train passby (7xpassenger) (~62-64dB(A)) and train at station noises, construction noise to south (outside of MIP). Background noise levels: Distant traffic (Moorebank Ave + M5) (~43-45dB(A)) and almost constant birds (~50-55 dB(A)) Site noise: Site noise (truck horn) audible on one occasion.	39	Yes

ID	Period	Measurement assessment period ¹	Measured noise level (15-minute) (all sources), dB(A) ²			Estimated MIP noise contribution, dB(A) ³		Weather conditions	Comments	L _{Aeq,15minute} noise limit, dB(A)	MIP Noise levels Comply ?
			L _{Amax}	L _{Aeq}	L _{A90}	L _{Amax}	L _{Aeq,15-min}				Yes or No
N16	Night	6:45 am to 7:00 am	77	59	49	< 20	≤ 33	Wind speed: still Wind Dir: - Temp: 21C Cloud: 1/8 Rain: nil	Ambient noise levels: Birds dominate (~58-68dB(A)), distant road traffic (motorbikes), local traffic (cars) (~51dB(A)), train passby (2xpassenger) (~63-66dB(A)) and train at station noises Background noise levels: Distant traffic (Moorebank Ave + M5) (~42-44dB(A)) and almost constant birds (~50-55dB(A)) Site noise: Site noise was not audible.	39	Yes

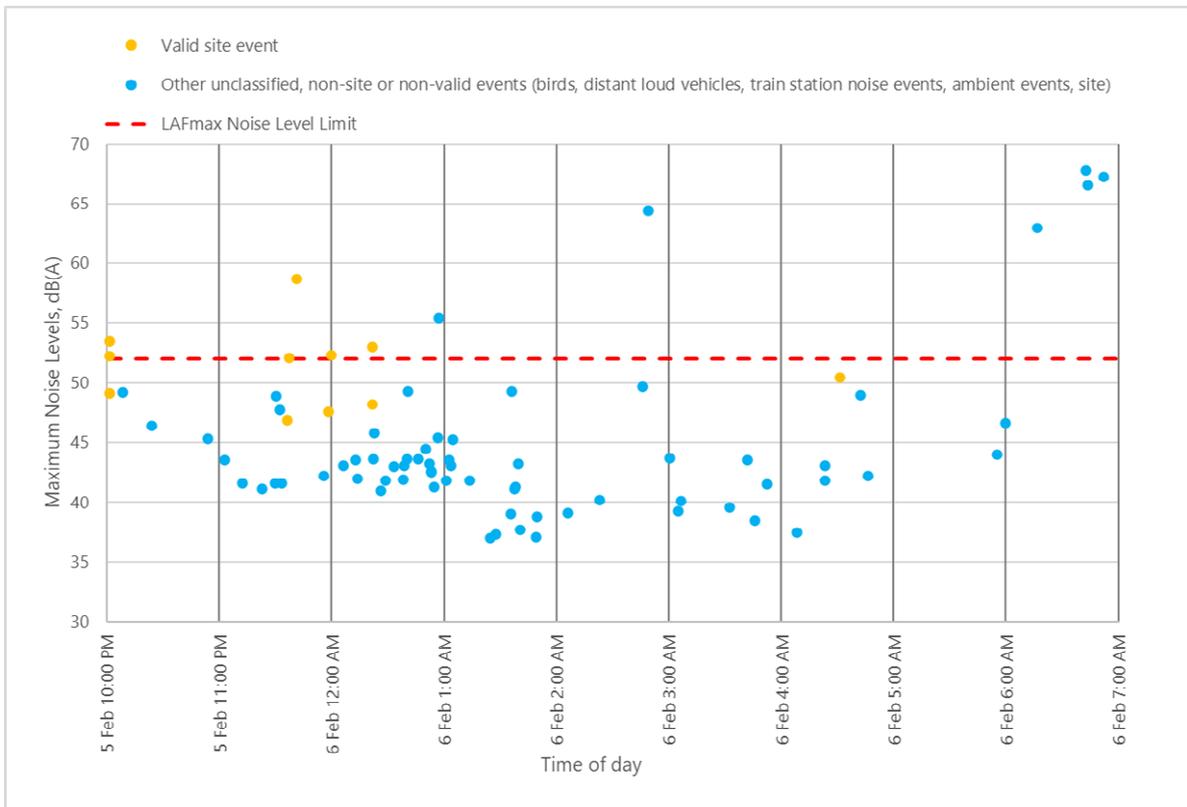
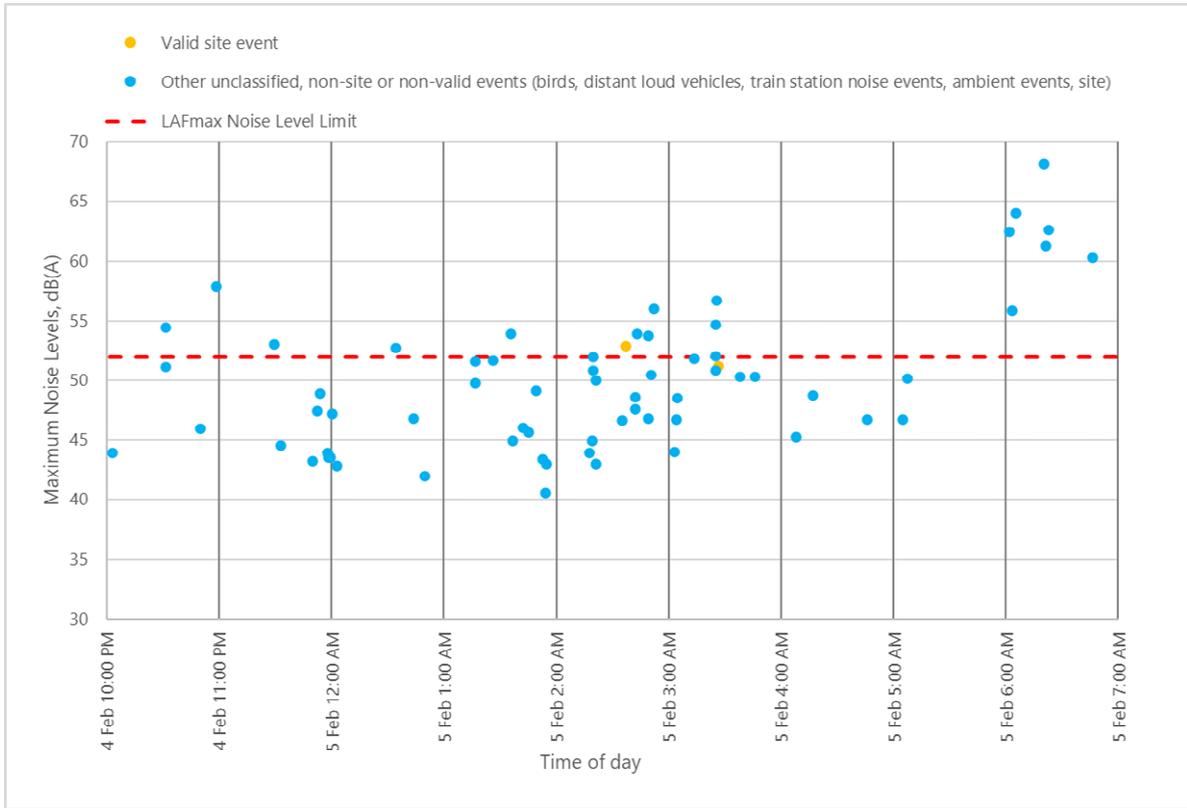
- Notes:
1. 4:15 am to 4:45 am period was excluded due to rain conditions during the measurement
 2. This represents the measured L_{Aeq} noise level associated with all noise sources (including road/rail traffic, natural sources and site noise)
 3. Estimated contribution as per Section 3.2.1.1

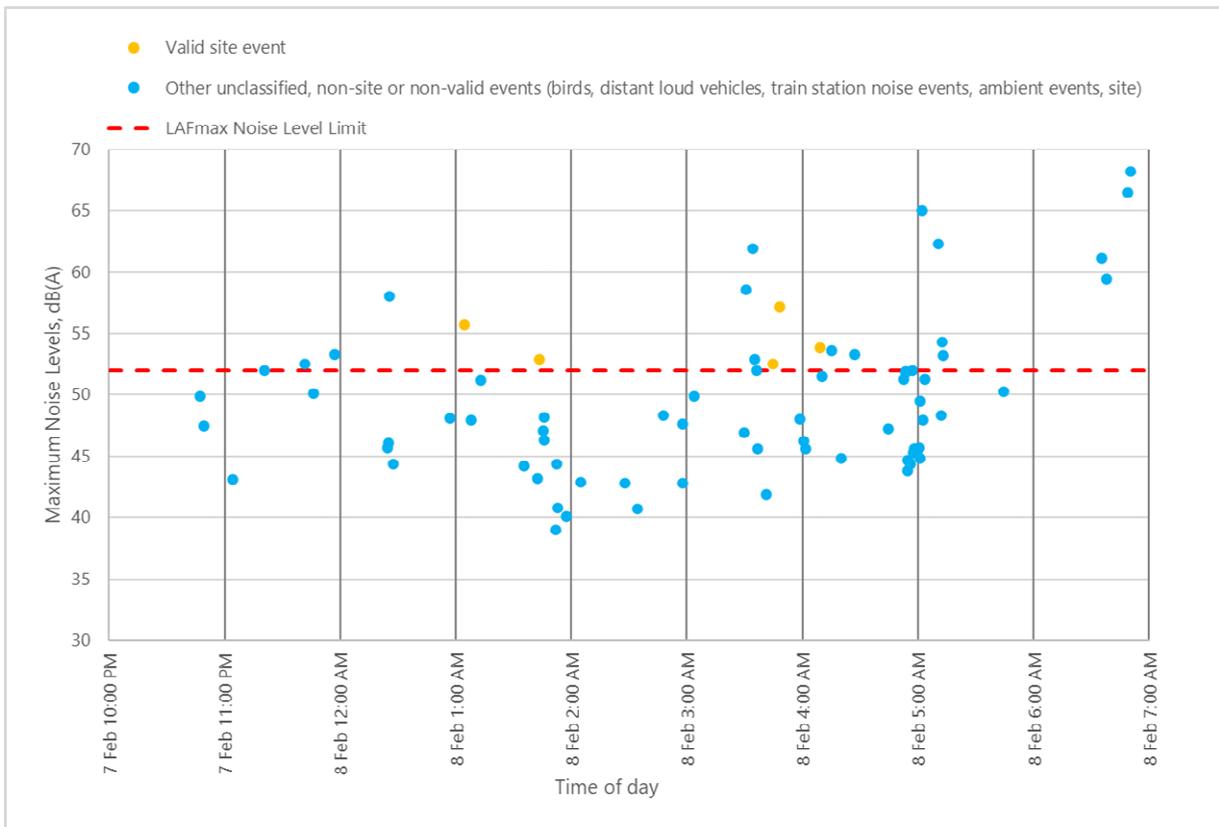
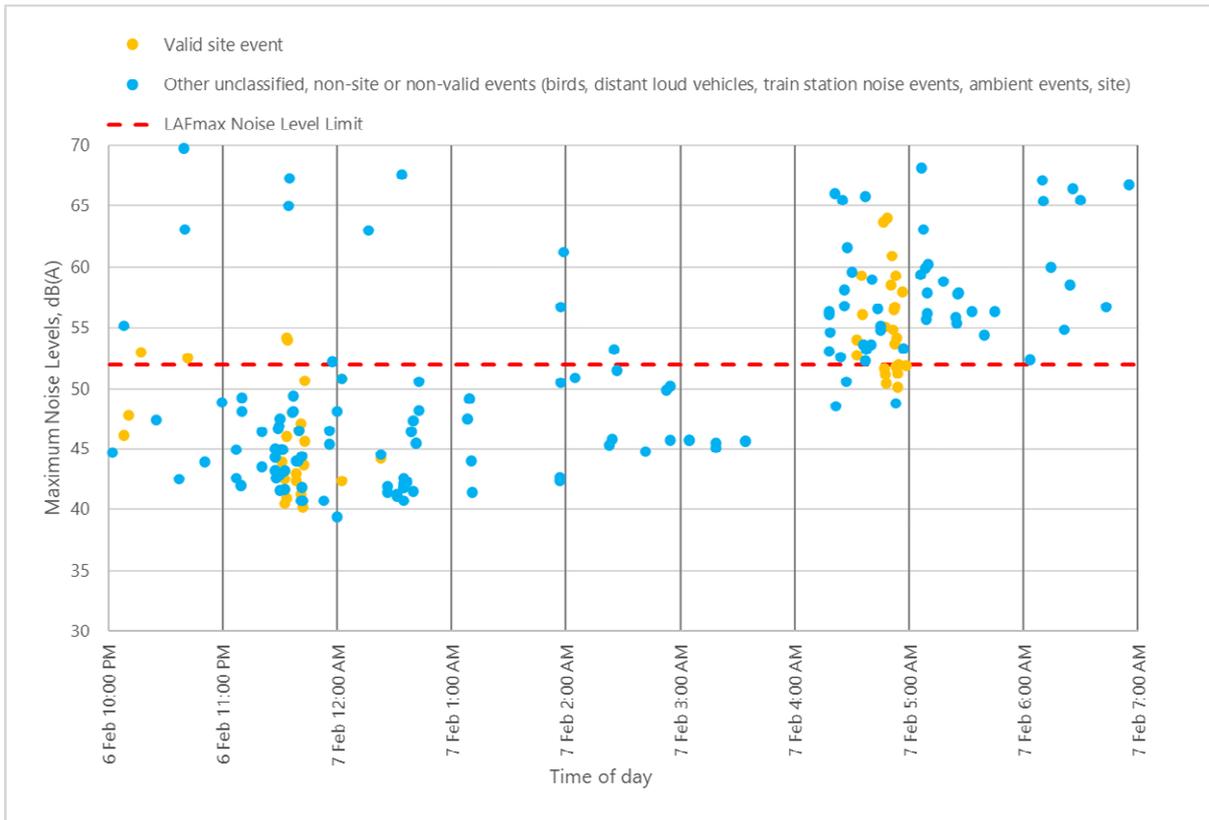
Table 12 - Key observed onsite noise generating site activities during the attended noise monitoring periods

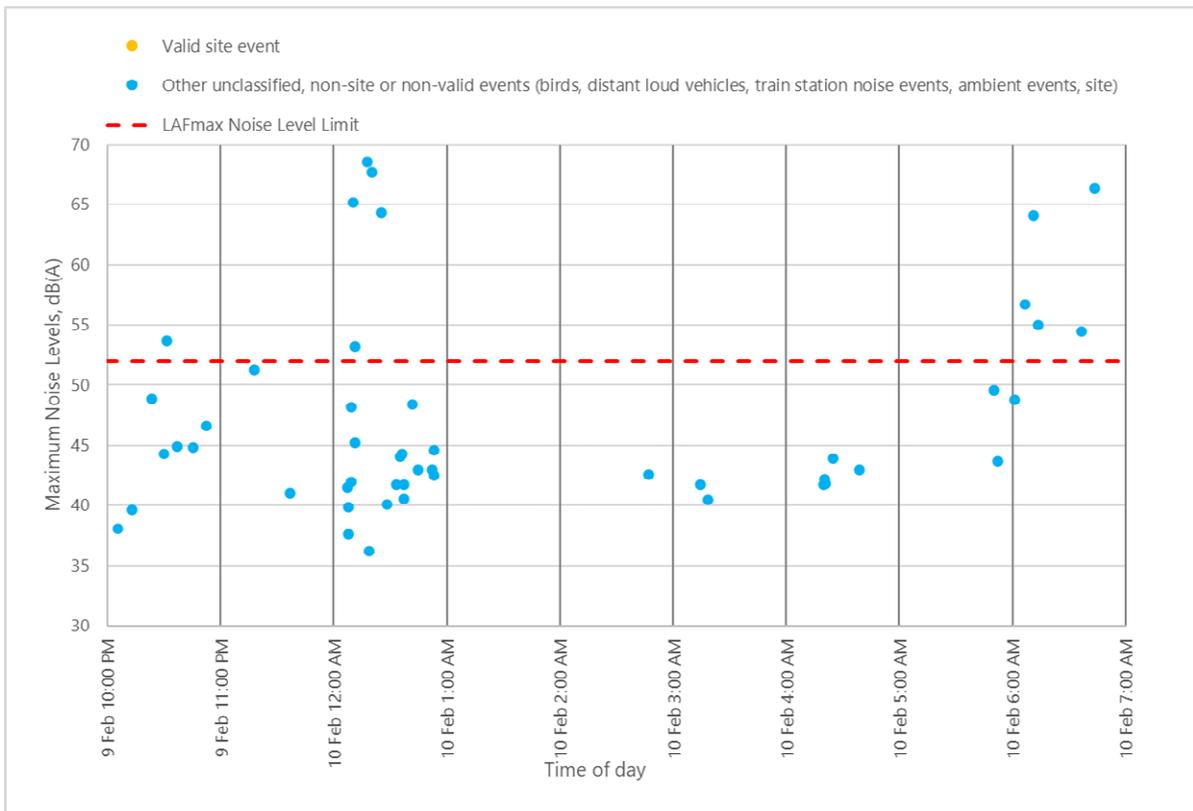
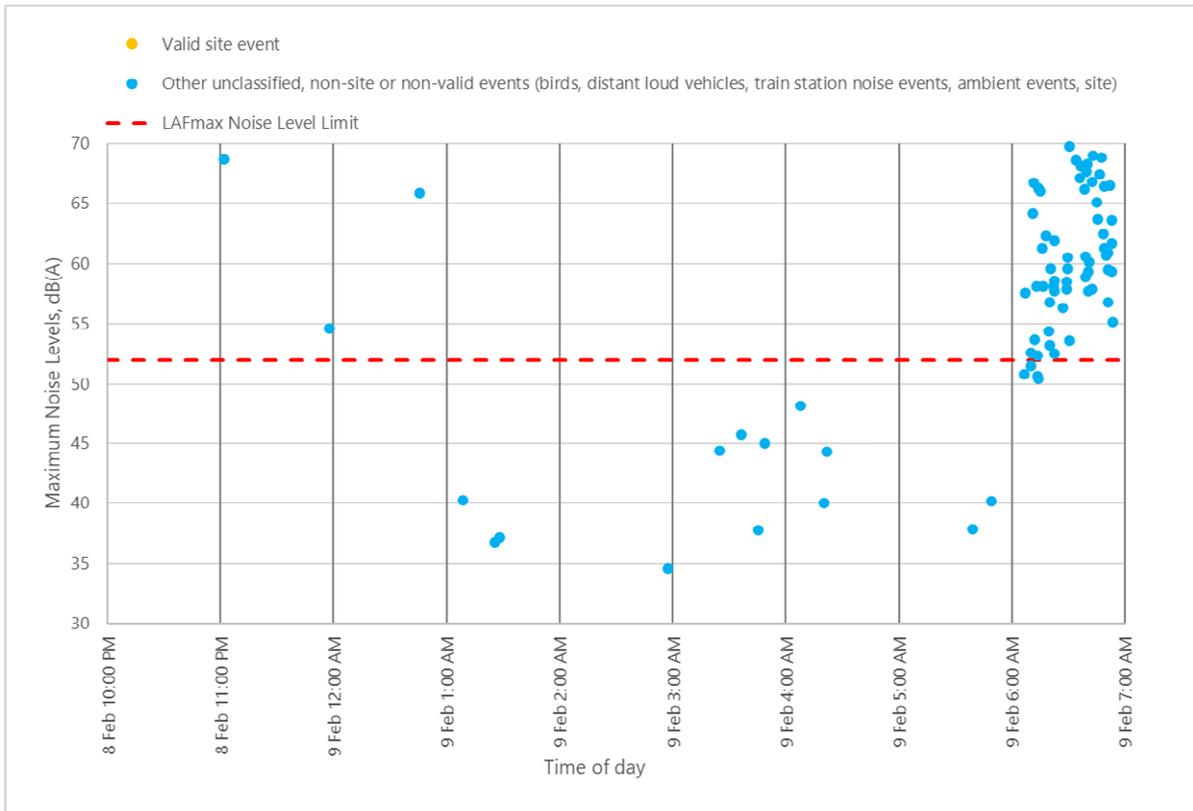
Time (Date)	Key observed onsite noise generating site activities
Day (Thursday 6 February 2025)	
8:30 AM to 8:45 AM	Reach stacker activity at north end of IMEX. Truck activities, and loading and unloading (east IMEX)
8:45 AM to 9:00 AM	Reach stacker activity at north end of IMEX. Truck activities, and loading and unloading (east IMEX)
9:00 AM to 9:15 AM	Truck activities MPE.
9:15 AM to 9:30 AM	Construction west precinct. Intermittent trucks entering JN/JR warehouses. Intermittent reach stacker activity at North IMEX. Truck activities and loading and unloading (east IMEX).
9:30 AM to 9:45 AM	Construction west precinct. Intermittent trucks entering JN/JR warehouses. Intermittent reach stacker activity at North IMEX. Truck activities and loading and unloading (east IMEX).
9:45 AM to 10:00 AM	Construction west precinct. Intermittent trucks entering JN/JR warehouses. Intermittent reach stacker activity at North IMEX. Truck activities and loading and unloading (east IMEX).
10:00 AM to 10:15 AM	MPW warehouse activities. N1/N2 truck loading and unloading via forklifts. Intermittent reach stacker activity related to MPW warehouses.
10:15 AM to 10:30 AM	MPW warehouse activities. N1/N2 truck loading and unloading via forklifts. Intermittent reach stacker activity related to MPW warehouses.
10:30 AM to 10:45 AM	MPW warehouse activities. N1/N2 truck loading and unloading via forklifts. Intermittent reach stacker activity related to MPW warehouses.
10:45 AM to 11:00 AM	Intermittent reach stacker activity related to MPW warehouses. Construction works at MPWS
11:00 AM to 11:15 AM	Intermittent reach stacker activity related to MPW warehouses. Construction works at MPWS
11:15 AM to 11:30 AM	Intermittent reach stacker activity related to MPW warehouses. Construction works at MPWS
11:30 AM to 11:45 AM	Intermittent reach stacker activity at North IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by Reach stacker activity.
11:45 AM to 12:00 PM	Reach stacker activity at North IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by Reach stacker activity.
12:00 PM to 12:15 PM	Reach stacker activity at North IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by Reach stacker activity.
12:15 PM to 12:30 PM	Reach stacker activity at North IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by Reach stacker activity.
Evening (Tuesday 4 February 2025)	
6:00 PM to 6:15 PM	Reach stacker activity at north end of IMEX. Truck activities MPE.
6:15 PM to 6:30 PM	Reach stacker activity at north end of IMEX. Truck activities MPE.
6:30 PM to 6:45 PM	Truck activities MPE.
6:45 PM to 7:00 PM	Reach stacker activity at north end of IMEX.
7:00 PM to 7:15 PM	Reach stacker activity at north end of IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by reach stacker.
7:15 PM to 7:30 PM	Reach stacker activity at north end of IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by reach stacker.
7:30 PM to 7:45 PM	Reach stacker activity at north end of IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by reach stacker.
7:45 PM to 8:00 PM	Reach stacker activity at north end of IMEX. Loading and unloading trucks at northern IMEX. Container handling movements by reach stacker.
8:00 PM to 8:15 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
8:15 PM to 8:30 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.

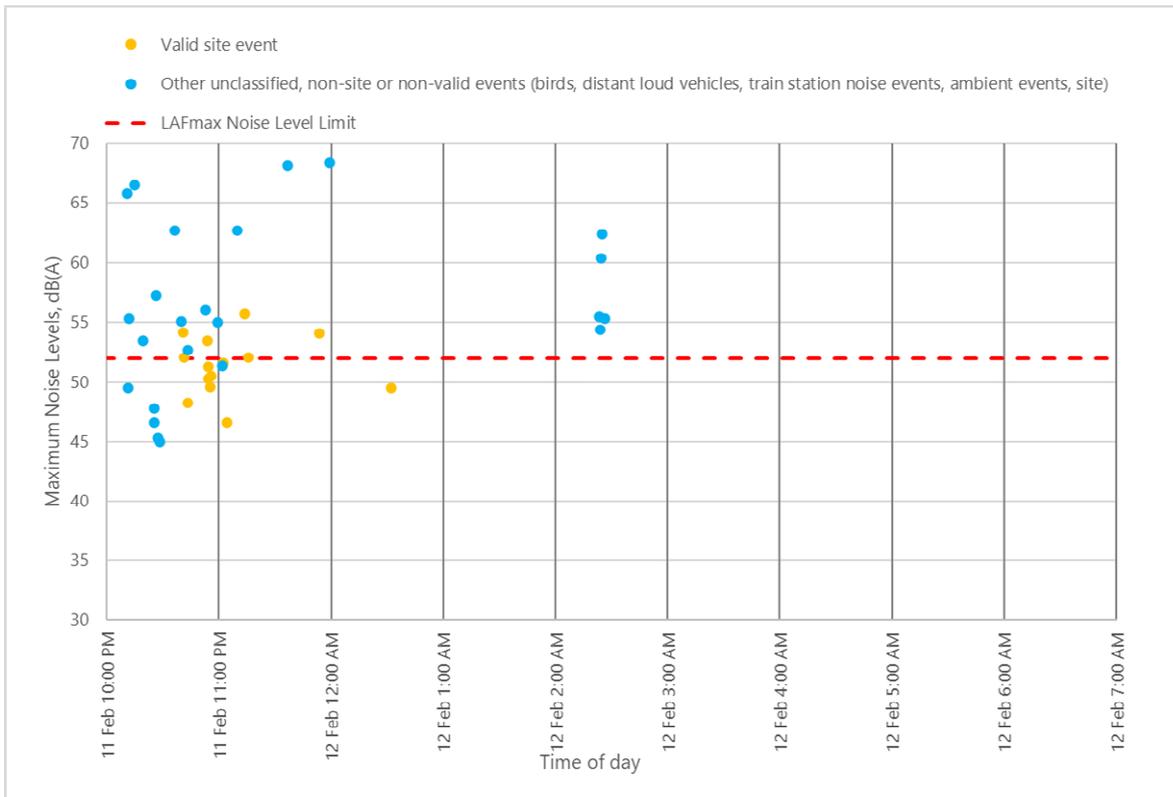
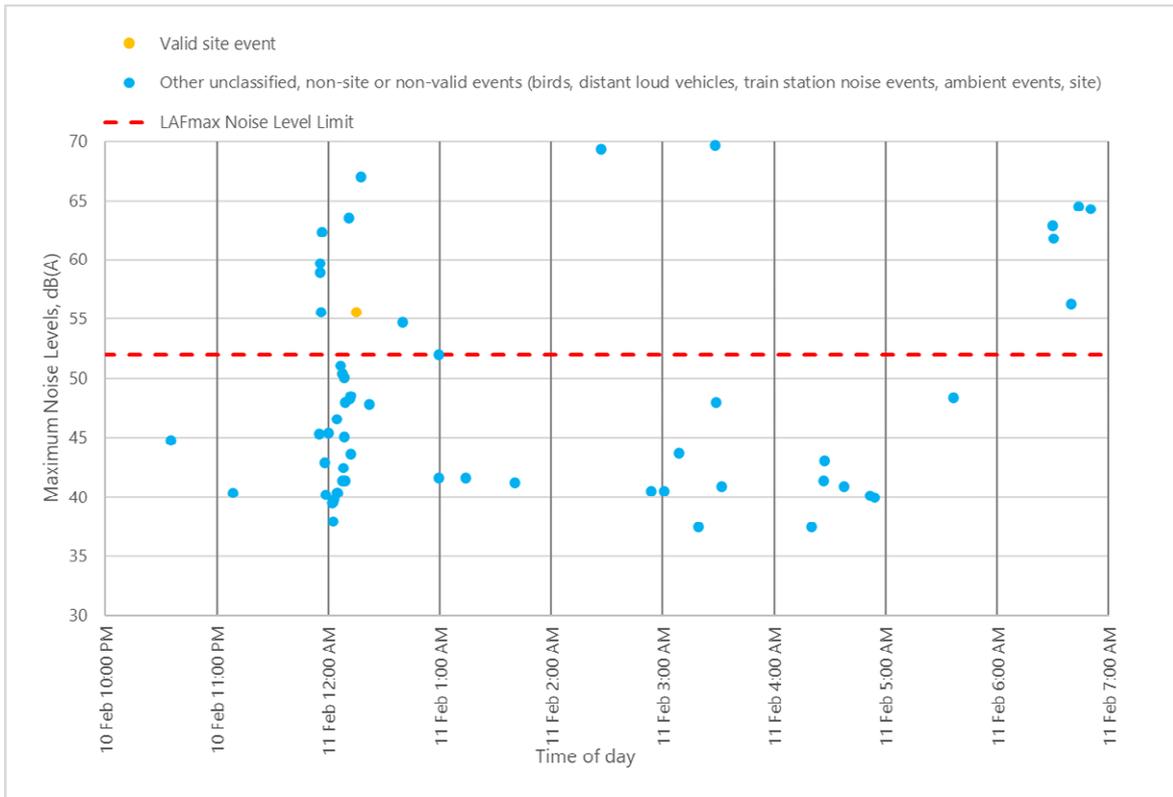
Time (Date)	Key observed onsite noise generating site activities
8:30 PM to 8:45 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
8:45 PM to 9:00 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
9:00 PM to 9:15 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
9:15 PM to 9:30 PM	Intermittent reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
9:30 PM to 9:45 PM	Reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
9:45 PM to 10:00 PM	Reach stacker activity at north end of IMEX. Container handling movements by reach stacker activity.
Night (Thursday 6 February 2025)	
3:00 am to 3:15 am	Occasional truck activities MPE. Reach stacker activity in IMEX. IMEX Automatic crane activities.
3:15 am to 3:30 am	Occasional truck activities MPE. Reach stacker activity in IMEX. IMEX Automatic crane activities.
3:30 am to 3:45 am	Occasional truck activities MPE. Reach stacker activity in IMEX. IMEX Automatic crane activities.
3:45 am to 4:00 am	Truck activities and container loading and unloading (east side of IMEX).
4:00 am to 4:15 am	Truck activities and container loading and unloading (east side of IMEX).
4:15 am to 4:30 am	Truck activities and container loading and unloading (east side of IMEX).
4:30 am to 4:45 am	Truck activities and loading and unloading (east side of IMEX). Intermittent reach stacker container handling at north end of IMEX.
4:45 am to 5:00 am	Truck activities and loading and unloading (east side of IMEX). Intermittent reach stacker container handling at north end of IMEX.
5:00 am to 5:15 am	Truck activities and loading and unloading (east side of IMEX). Intermittent reach stacker container handling at north end of IMEX.
5:15 am to 5:30 am	Truck activities and loading and unloading (east side of IMEX). Intermittent reach stacker container handling at north end of IMEX.
5:30 am to 5:45 am	Truck activities and loading and unloading (east IMEX). Intermittent reach stacker container handling at North IMEX.
5:45 am to 6:00 am	Truck activities and loading and unloading (east IMEX). Reach stacker container handling at North IMEX.
6:00 am to 6:15 am	No MPW warehouse activities. Confirmed no N1/N2 activity. Truck activities, and loading and unloading (east IMEX)
6:15 am to 6:30 am	No MPW warehouse activities. Confirmed no N1/N2 activity. Truck activities, and loading and unloading (east IMEX)
6:30 am to 6:45 am	Trucks entering JN/JR warehouses. No N1/N2 activities. Intermittent Reach stacker container handling at north end of IMEX. Construction works at MPWS.
6:45 am to 7:00 am	Trucks entering JN/JR warehouses. No N1/N2 activities. Intermittent Reach stacker container handling at north end of IMEX. Construction works at MPWS.

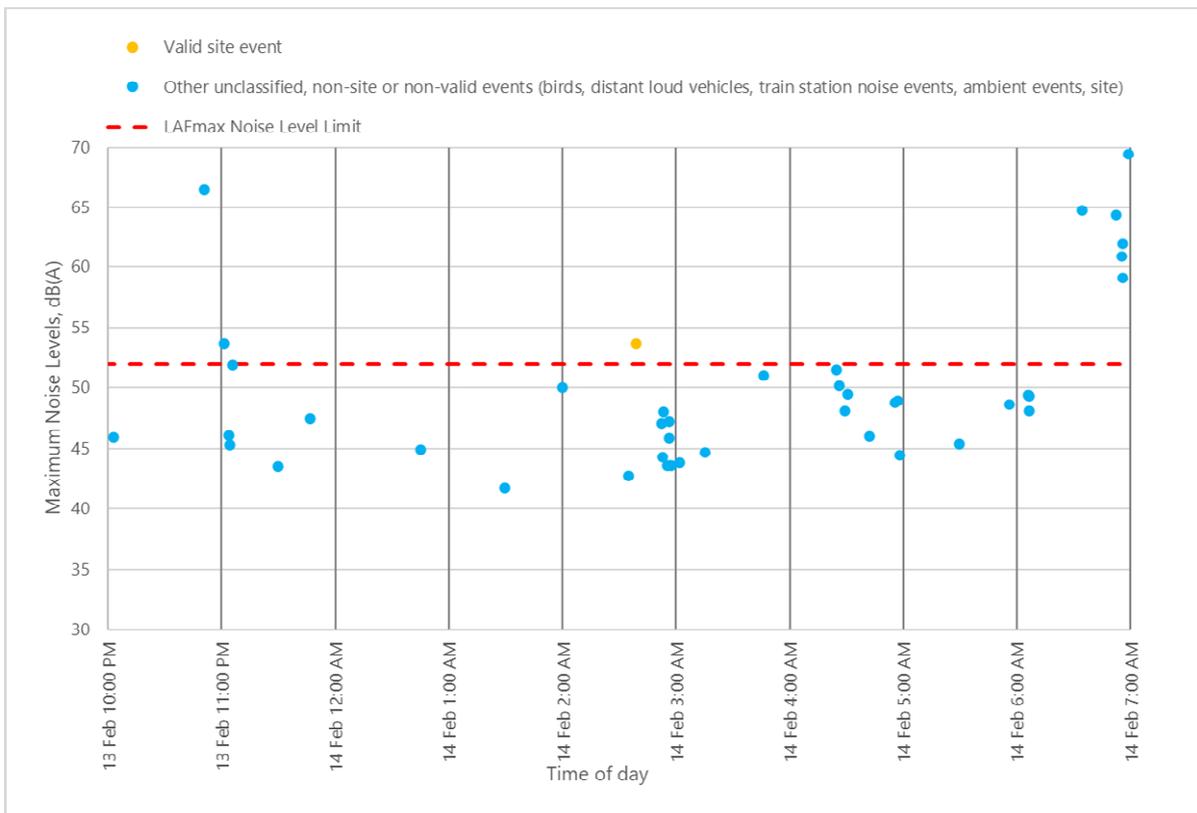
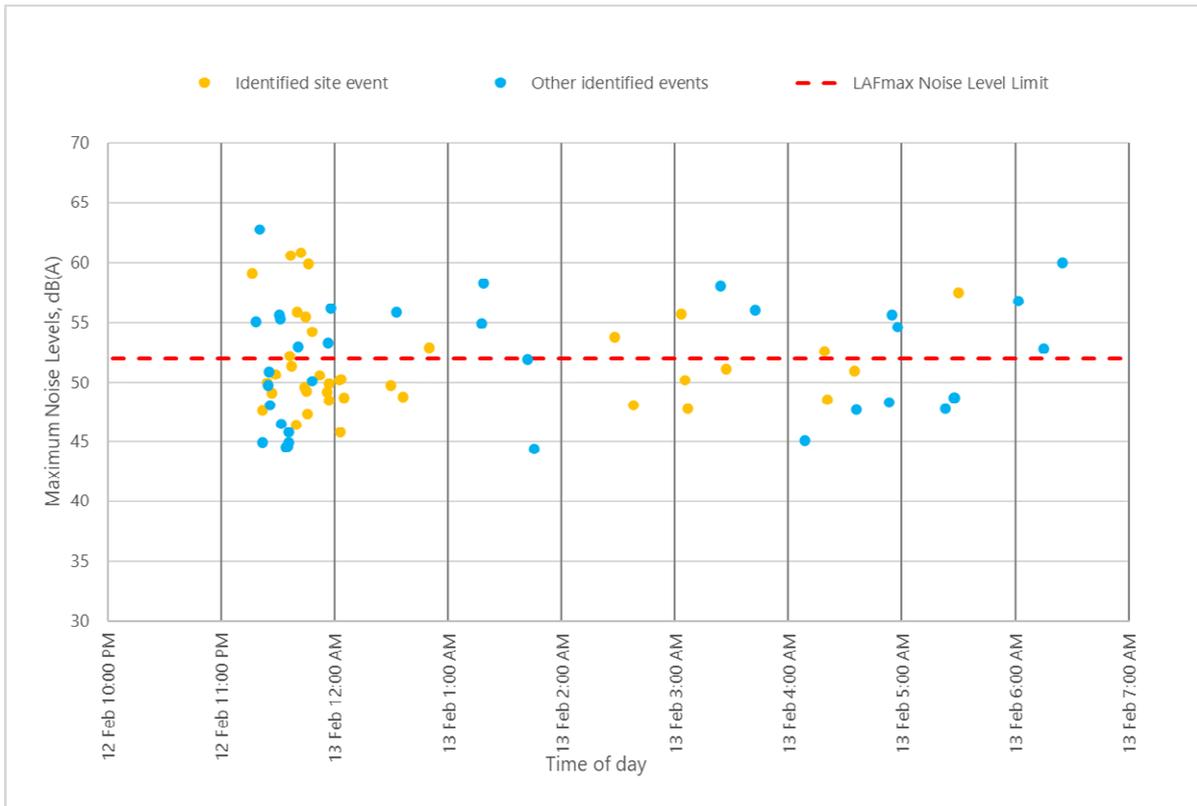
APPENDIX C Unattended noise monitoring data (9 Casula Road, Casula) – noise event identification











APPENDIX D **Unattended noise monitoring data (9 Casula Road, Casula) – noise monitoring graphs**

Dates of Survey: 04/02/2025 - 14/02/2025
Monitoring ID: L1
Address: 9 Casula Road, Casula
Description: Eastern yard

Background & Ambient Noise Monitoring Results

	L _{A90} Background Noise Levels			L _{Aeq} Ambient Noise Levels		
	Day ¹	Evening ²	Night ³	Day ¹	Evening ²	Night ³
Representative Week⁴	47	42	38	58	57	53

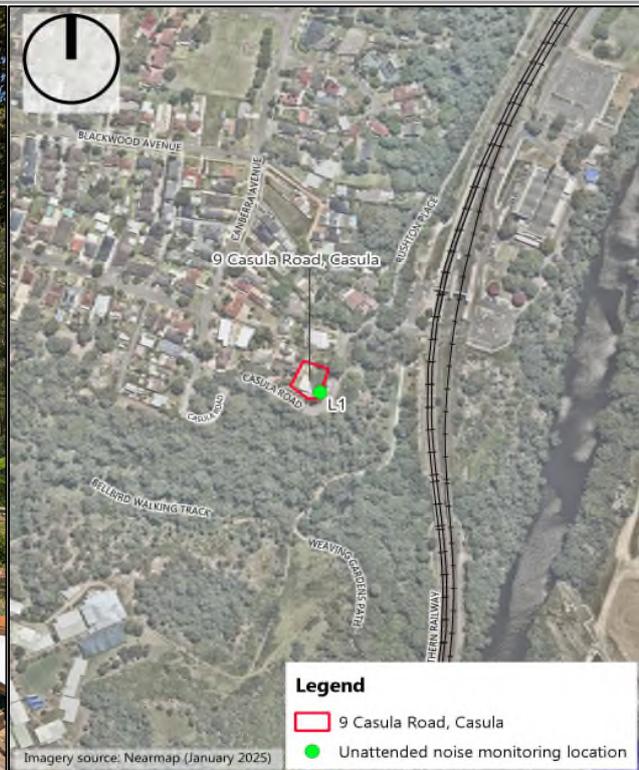
Notes:

1. Day: 7.00am to 6.00pm Monday to Saturday and 8.00am to 6.00pm Sundays & Public Holidays
2. Evening: 6.00pm to 10.00pm Monday to Sunday & Public Holidays
3. Night: 10.00pm to 7.00am Monday to Sunday & Public Holidays
4. Rating Background Level (RBL) for LA90 and logarithmic average for LAeq

Logger location photograph

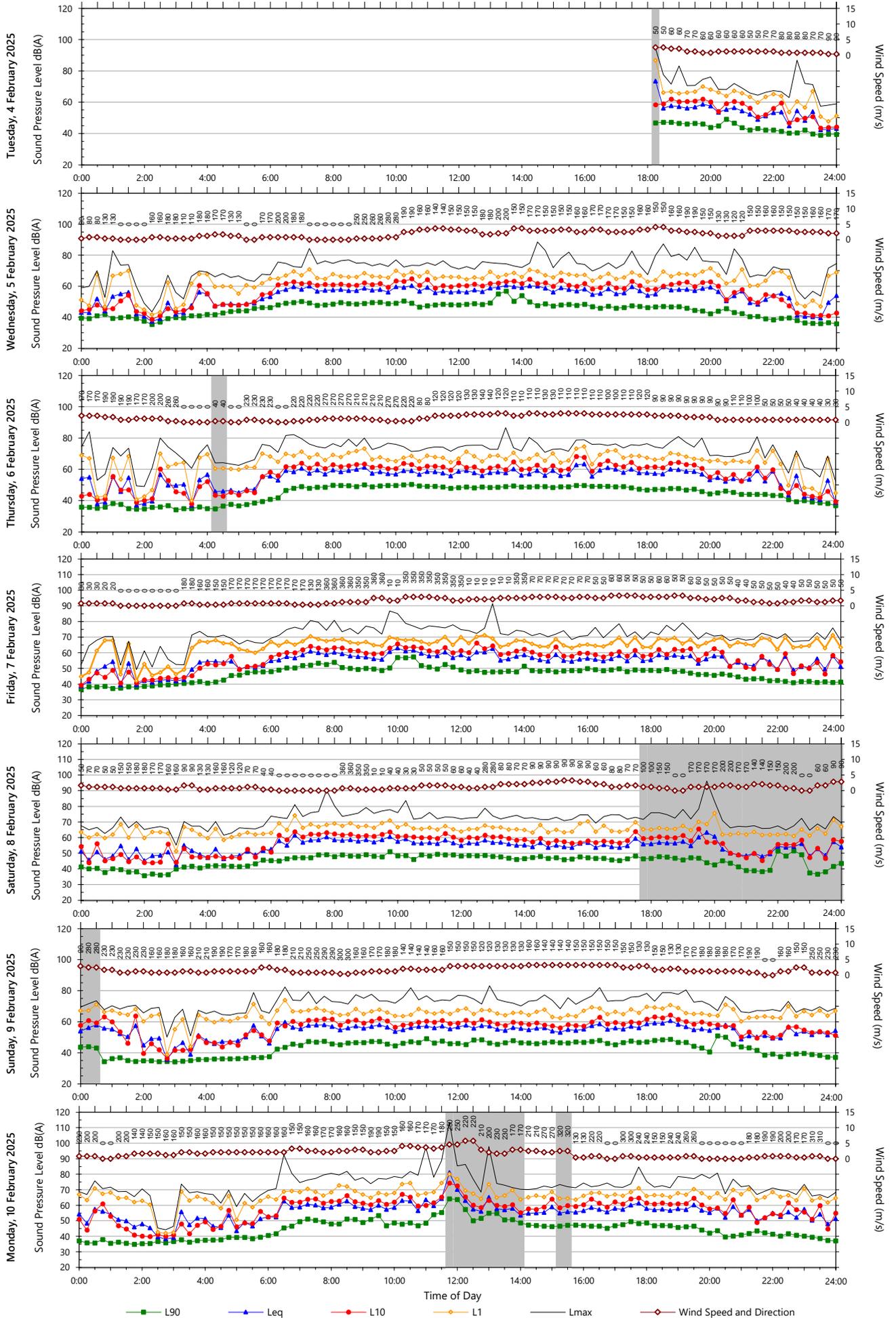


Logger location map



Unattended Monitoring Results

Location: 9 Casula Road, Casula - Eastern yard



Data File: 2025-02-04_SLM_002_123_Rpt_Report.txt

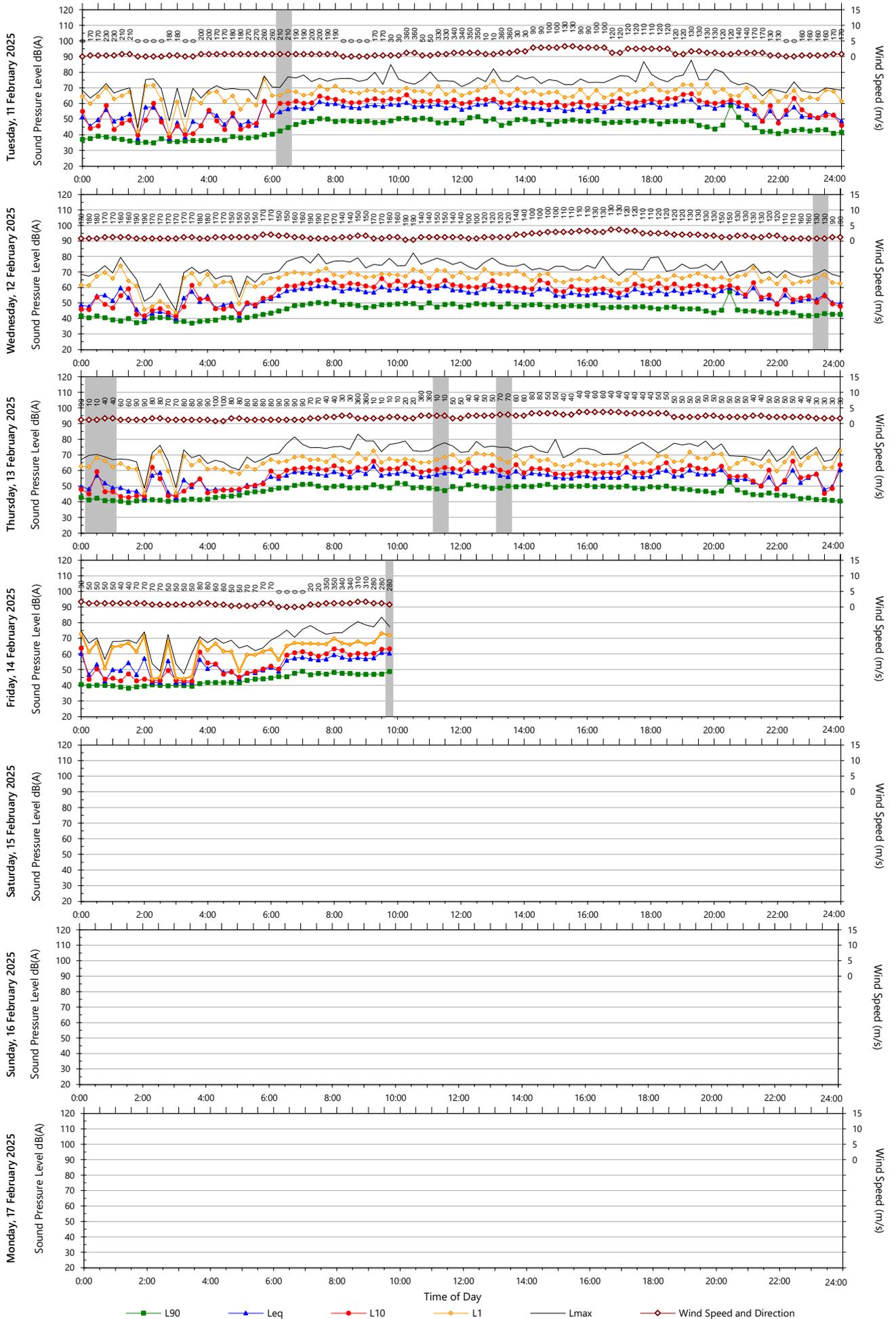
Template: QTE-26 Logger Graphs Program (r47)

Legend: L90 (green square), Leq (blue triangle), L10 (red circle), L1 (orange diamond), Lmax (black line), Wind Speed and Direction (red diamond)

Excluded Data (grey bar)

Unattended Monitoring Results

Location: 9 Casula Road, Casula - Eastern yard



Data File: 2025-02-04_SLM_002_123_Rpt_Report.txt

Template: QTE-26 Logger Graphs Program (r47)

—■— L90
 —▲— Leq
 —●— L10
 —◆— L1
 — Lmax
 —◆— Wind Speed and Direction
 Excluded Data



APPENDIX F – WATER QUALITY MONITORING REPORTS

Moorebank Logistics Park West Precinct

Basin 5 Location

Stormwater Network Water Quality Monitoring
Data & Reporting Spring 2024



Site image: Outlet retention basin 5 MPW (Apical image 09th October 2024)

Prepared for: MID Plumbing P/L SIOMP Moorebank Precinct West

Prepared by: Daniel Anderson (*BEnvSc, MEnvSc*)

Romy Brien (*BSc NRM*)

E-mail: daniel@apical-bushfire.com.au
Phone: 0415617771
PO Box 9 Kiama NSW 2533
ABN: 656 420 10 400

Consulted Documents / database.

Australia and New Zealand Guidelines for fresh and Marine Water Quality (2000)

[NATIONAL WATER QUALITY MANAGEMENT STRATEGY - Australian and New Zealand Guidelines for Fresh and Marine Water Quality \(2000\) - Volume 2 - Aquatic ecosystems](#)

Bureau of Meteorology – Australian Government [Australia's official weather forecasts & weather radar - Bureau of Meteorology \(bom.gov.au\)](#)

Moorebank Intermodal Precinct West – Stage 3 (SSD 10431) | Assessment Report March 2021

<https://moorebankintermodalprecinct.com.au/wp-content/uploads/2023/04/MPW-S3-DPIE-assessment-report-to-IPC.pdf>

WQM Report Western Precinct _Basin 5_Autumn 2024 – Apical Bushfire and Planning - April 2024

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Lot 2 DP 1197707 Part Lot 3 DP 1197707 Part Anzac Road and Moorebank Avenue public road reserves Development: Moorebank Precinct West Stage 2 (MPW Stage 2)

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 10431 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Moorebank Precinct West Stage 3 (MPW Stage 3)

Australian Laboratory Services (ALS) Work Order EW2402561 Certificate of Analysis Water Sample Data 8th Oct 2024.

Liverpool DCP

[Liverpool's Development Control Plans | Liverpool City Council \(nsw.gov.au\)](#)

DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.

<https://environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgt-guidance-pfos-pfoa.pdf>

Development Consent SSD 7709 - Section 4.38 of the Environmental Planning and Assessment Act 1979
<https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2019/05/moorebank-intermodal-precinct-west-stage-2/referral-from-department-of-planning-and-environment/revised-recommended-conditions/mpw-stage-2-recommended-conditions-inclusive-of-edits-191105.pdf>

Glossary

The following definitions apply to terms used in this report. Many of these definitions are consistent with relevant national literature and cited where appropriate.

Current status trigger value

Concentrations of water quality indicators that reflect existing ecosystem condition, and therefore provide a target for ecosystem maintenance and a benchmark against which future water quality trends may be monitored.

Environmental value

Particular values or uses of the environment important for a healthy ecosystem or for public benefit, welfare, safety or health and requiring protection from the effects of pollution or degradation (Environment Australia 2002).

Indicator

A parameter (biological, physical or chemical) used to provide a measure of the quality of water or the condition of an ecosystem (Environment Australia 2002).

Low-risk trigger value

Concentrations (or loads) of key performance indicators [of water quality] at which if not exceeded, there is a low risk that adverse biological effects will occur (ANZECC 2000a).

Median

The middle reading, or 50th percentile, of all readings taken. i.e. of the readings 10, 13, 9, 16 and 11 (re-ordering these to read 9, 10, 11, 13 and 16), the median is 11. The mean (or average), is the sum of all values divided by the total number of readings (which in this case equals 11.8).

Reference condition

Refers to a site which is unmodified or minimally modified from 'natural' condition. Most commonly, reference sites are subject to limited disturbance from human activity. The reference condition then serves as a standard or target against which environmental change in other similar sites can be assessed.

Trigger value

A concentration that, if exceeded, would indicate a potential environmental problem, and so 'trigger' a management response, such as further investigation and/or remedial actions (ANZECC 2000a).

Water quality guideline

A numerical concentration level (e.g. of a contaminant) or narrative statement (e.g. visual appearance of a water body) recommended to support and maintain a designated water use (ANZECC 2000a)

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 3 (the Project) of Moorebank Precinct West (MPW), which comprises the third stage of development within the Moorebank Precinct West under Development Approval SSD-10431.

The proposal is SSD under clause 19 of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, as it is development for the purpose of rail and related transport facilities.

The MPW site is located on the western side of Moorebank Avenue and forms the western section of the Moorebank Intermodal Precinct (Map Image 2).

The MPW site is approximately 2.5 kilometres (km) from the Liverpool city centre, 27 km south-west of the Sydney Central Business District (CBD) and 26 km west of Port Botany.

The MPW site is irregular in shape, approximately 3 km from north to south and 960 m from east to west at its widest point and covers an area of approximately 220 ha. It is situated between the Georges River to the west (with the SSFL running north-south to the west of the river); and Moorebank Avenue to the east.

Works on the MPW site to date have commenced under two current and active development consents:

- MPW Stage 1 early works, which provides demolition, rehabilitation, remediation of contaminated land, and the establishment of construction facilities and access including site security (as part of the SSD 5066 consent)
- MPW Stage 2, which provides for the construction and 24/7 operation of an intermodal facility and associated warehousing (SSD 7709).

This water quality monitoring program is guided by the Stormwater Infrastructure Operation and Maintenance Plan (SIOMP) and is provided to site management on behalf of MID Plumbing.

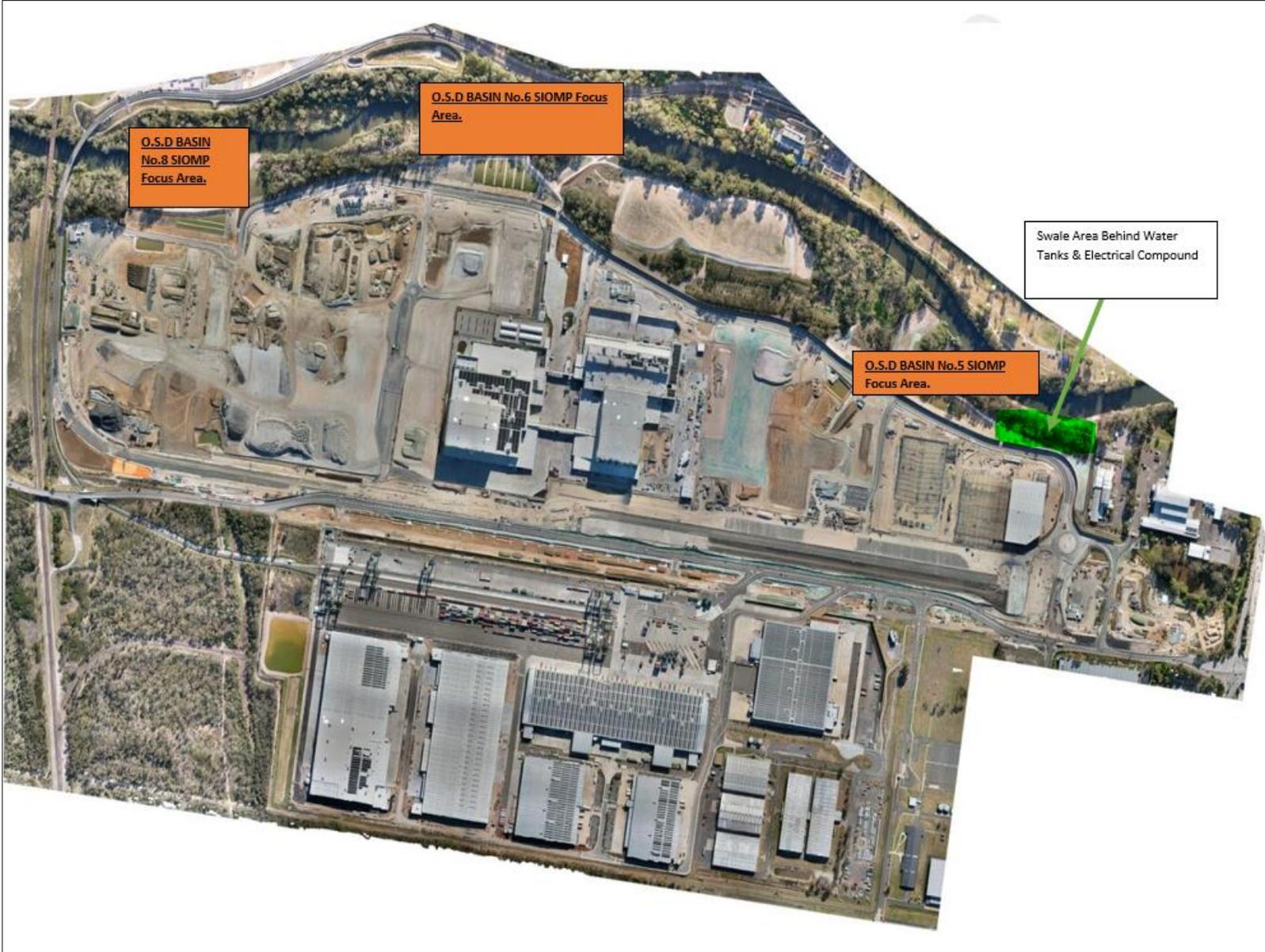
Three onsite bio-retention basins are present within Moorebank Precinct West. This report is in reference to baseline water quality condition reporting for Basin 5 (MPW – north).

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Moorebank Precinct West Stage 2 (MPW Stage 2)

CoC	Requirement
Stormwater Quality Monitoring	
B38.	Stormwater Quality Monitoring Program - Prior to commencement of operation Part of the Operational Environmental Management Plan

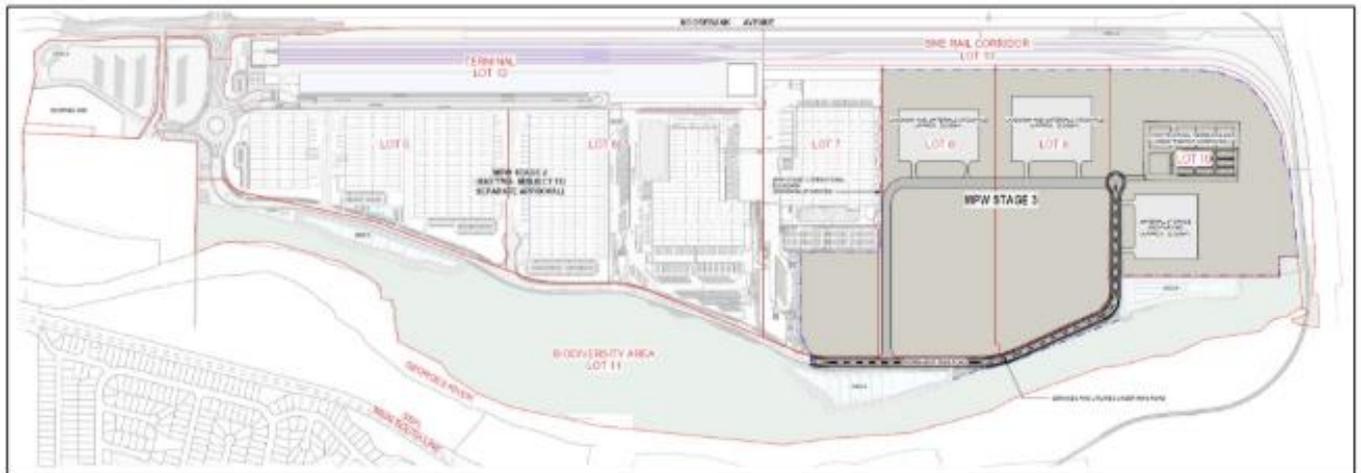
The Stormwater Infrastructure Operation and Maintenance Plan (SIOMP) Moorebank Logistics Park – West Precinct was developed to address the requirements of MPE stage 3 CoCs (SSD 7709). The management plan (SIOMP) identifies the operational drainage and environmental management measures within the stormwater management system that will be applied to activities undertaken across the MLP west Precinct to manage improved water quality objectives and overall functionality of the stormwater detention and drainage network associated with stormwater infrastructure upon the site under the SIOMP.

Map Image 2. Moorebank Precinct West Detention Basins (provided by MID Plumbing)



1.2 Reference information

Map image 4. Moorebank Intermodal Precinct West – Stage 3 State Significant Development Assessment (SSD-10431) March 2021



20. Stormwater Management System or Works

That untreated stormwater is not disposed of into the Georges River or its tributaries.

The likely impact of stormwater disposal on the quality of any receiving waters.

That the levels of nutrients and sediments entering the waterway are not increased by the proposed development.

Whether any proposals to manage stormwater are in accordance with the local council's stormwater management plans and the Managing Urban Stormwater series of documents and meet the local council's stormwater management objectives.

Whether the principles outlined in the *Managing Urban Stormwater Soils and Construction Handbook* (1998) prepared by and available from Landcom and the Department of Housing are followed during each stage of a development (including subdivision).

Detailed stormwater assessments were undertaken as part of MPW Stage 2, and remain applicable to the Stage 3 proposal.

The Department has recommended conditions that would enforce these requirements, by ensuring that appropriate measures are implemented to manage stormwater impacts during construction. In regard to management of stormwater during operation of the MPW site, the MPW Stage 2 proposal incorporates a robust set of conditions to manage the release of stormwater via six onsite detention basins (OSD), a major east-west covered culvert and associated drainage infrastructure.

2. Monitoring Program Methodology

2.1 Monitoring Sites

To support stormwater and drainage management of the facility the MLP West precinct has established a vast stormwater infrastructure system consisting of several Water Sensitive Urban Design (WSUD) functions including raingardens detention basins and bio-swales. These networks are designed to minimise the velocity and peak discharge of stormwater draining from the site and act as onsite detention basins to harvest and sequester potential pollutants generated at the site through designed biological processes.

The stormwater infrastructure system discharges water into the natural drainage system via three outlets:

- **Basin 5 detains water from the northern section of MPW before discharging into Georges River**
- Basin 6 detains water from the mid-section of MPW before discharging into Georges River
- Basin 8 detains water from the southern section of MPW before discharging into Georges River

Monitoring of the discharge points has been established via our ongoing program with MID Plumbing under the SIOMP program (MPE) to collect qualitative data and analyse the performance of the WSUD provisions and to establish any potential trends in water quality readings from the stormwater network discharge points prior to release of water into the natural hydrological systems of Anzac Creek and the Georges River.

This report constitutes the baseline data set for Basin 5 Moorebank Precinct West (MPW).

Table 1. Type of outlet MPW

Discharge Point (see figure 2)	Associated Outlet (see figure 1)	Type of outlet/detention basin
Basin 5	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp
	Georges River	River – natural drainage conveyance
Basin 6	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp
Basin 8	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp

2.2 Water Quality Assessment

Surface water quality data collected at the discharge points is assessed with reference to ANZECC Guidelines (2000) and correlated with baseline Water Quality monitoring results provided by previous condition assessment reports.

By comparing water test data under the program across the testing timeline we can identify and report upon trends, identify exceedances and exclude potential anomalies for datasets.

Table. ANZECC Low Risk Trigger Values

Ecosystem type	Turbidity NTU	EC µS/cm	pH ⁺	DO	TN mg/L	NO _x -N mg/L	NH ₄ ⁺ -N mg/L	TP mg/L	DRP - P mg/L
Upland river	2-25	30-350	6.5-7.5	90-110	0.480	0.190	0.013	0.013	0.005
Lowland river	6-50	125-2200	6.5-8.0	85-110	0.500	0.190	0.020	0.050	0.020

Values for Low Land River Systems as insert above are used as the reference guide to water quality parameter values and overall health and safety statements regarding the quality of discharged water from the SIOMP drainage network.

Annual spring and autumn water quality data presented from Anzac Creek and Georges River testing programs by other scientific consultants may also be cross referenced to the data prepared by Apical under the SIOMP program to establish potential trends in results and identify increases in accumulated pollutants from the site under operational condition, which may appear present within adjacent natural waterways.

Site data was collected in the form of water samples and in field data recordings at the prescribed monitoring points, water samples and water probe readings are undertaken following Australia and New Zealand guidelines for fresh and marine water quality – 2000 (ANZECC Guidelines), In situ water quality parameters relevant to stream health and aquatic assessment profiling were collected in field with a multiparameter hand-held water quality monitoring probe (Aquatroll 600).

Water data is collected, analysed and collated under the same methodologies and process under each testing period, the ensure consistency in the process.

Measures tested and samples taken:

- pH
- Dissolved Oxygen
- Electrical Conductivity
- Water Temperature and
- Turbidity

Water samples are collected at inlet and discharge points (Basin 5, Basin 6 & Basin 8) then sent to Australian Laboratory Services (ALS) for quality testing analysis [Surface water \(alsglobal.com\)](http://www.alsglobal.com).

Water analytical suites / testing parameters are provided to obtain overall water condition results and chemical sampling of collected water is undertaken for a range of nutrients, metals, and hydrocarbons relevant to stream health and aquatic assessment protocol, key nutrients, metals, and pollutants included in the assessment to reflect an overall suite of water quality condition guides which are listed below:

- Total phosphorous
- Total Nitrogen
- Kjeldahl Nitrogen
- Dissolved Metals
- PFAS
- Total Suspended Solids
- Total Hydrocarbons

The raw data results from the lab analysis provided to us by ALS Laboratory Services are presented within this report (see Appendix A).

Key water quality data attributes are recorded, tables and compared against; previous condition baseline data, Liverpool Development Control Plan (DCP) water quality targets, Conditions of Consent B40 and ANZECC Guideline (2000) trigger limits under the condition category -(90% protection criteria for freshwater natural systems).

The water quality guidelines are applied to ensure adjacent natural waterways George River and Anzac creek are not adversely affected by poor water quality discharge from the Moorebank logistics park site and operations.

Trends observed in our datasets are analysed on a temporal scale with any trigger values for specific water quality measures highlighted and presented within the results chapter of each seasonal report. This report provides baseline data for Basin 5 (MPW) from which trend analysis will compound over future reporting periods.

2.3 Data Analysis

The water quality measurements collected are used to assess water quality at each site in terms of health of aquatic ecosystems by comparison with guideline values recommended by the ANZECC and ARM CANZ (2000) guidelines for the protection of lowland streams (i.e. systems at < 150 m altitude) in south-east Australia. This categorisation for stream health is deemed relevant for the description of Anzac Creek, the recipient natural way due to the location in the geomorphic landscape and correlations of expected biophysical health and habitat profiles for similar stream environments.

2.4 Survey dates and personnel

On the 9th October 2024, ecologists from Apical Bushfire and Planning attended Moorebank Precinct West (MPW) to collect water quality data across the testing sites which are located within selected inlet points and discharge points within the stormwater drainage and management system (SIOMP) located within the Moorebank Logistics Park site West (See map image 2).

Inlet and outlet points within the network are representative of variant sites where stormwater will enter a node of the system (as a point source) and then release from the that node of the system at a discharge point. By recording inlet and discharge data water quality can be tracked along the continuum within the system to determine condition changes and overall trends in measured quality at given sites.

This data was collected on behalf of MID plumbing in accordance with 'The Stormwater Infrastructure Operation and Maintenance Plan Moorebank Logistics Park – West Precinct 2020' and in compliance with Condition of Consent B40 (Liverpool City) for the subject site. The results of such monitoring data collection are presented within this report.

2.5 Rainfall

Between the 1st of September and the 30th of September 2024 Moorebank received approximately 36.6mm of rainfall (<http://www.bom.gov.au/climate/dwo/202409/html/IDCJDW2161.202409.shtml>). Between the 1st of October and the 8th of October 2024 Moorebank received approximately 8mm of rainfall.

Figure 1. Bureau of Meteorology Daily Weather Observation Holsworthy September 2024

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9 am				3 pm								
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa				
1	Su	7.3	26.5	0			NW	37	14:12	18.2	41		N	6	1012.6	26.2	18		NW	20	1008.3	
2	Mo	13.4	24.3	0			WNW	74	10:34	23.0	22		NW	20	1008.1	19.5	23		WSW	35	1013.0	
3	Tu	7.9	18.8	0			WSW	48	02:09	12.8	44		WSW	19	1029.5	17.6	32		ESE	13	1028.3	
4	We	2.3	22.9	0			N	37	11:25	10.5	69		W	9	1029.7	21.9	30		NE	15	1023.3	
5	Th	5.5	27.2	0			N	28	10:46	13.9	66	8	Calm	1024.6	27.0	28	7	N	15	1019.3		
6	Fr	10.7	29.4	0			NW	48	14:37	20.5	53		NNW	9	1022.5	29.0	25		NW	22	1017.3	
7	Sa	14.0	24.7	0			SE	43	13:08	23.9	46	6	ESE	11	1021.5	20.1	70	6	ESE	20	1021.2	
8	Su	14.5	20.8	0			SSW	22	07:01	14.9	54	8	WSW	13	1021.3	18.9	44	7	N	9	1016.3	
9	Mo	8.1	24.3	0			WSW	41	11:19	17.4	45		NW	13	1017.8	23.9	31		WSW	19	1014.8	
10	Tu	8.5	22.1	0			ENE	26	14:15	16.6	58		WNW	9	1025.7	20.6	58		E	15	1023.8	
11	We	6.7	26.1	0			S	33	19:53	16.5	75		Calm	1024.7	25.2	35		NNE	9	1019.6		
12	Th	15.2	20.1	0			S	57	15:21	16.9	70	8	S	22	1021.7	17.8	61	1	S	28	1021.8	
13	Fr	10.2	19.3	0			SW	30	09:33	12.9	58	8	WSW	13	1028.4	17.5	48	8	ESE	13	1025.1	
14	Sa	4.8	24.0	0			S	54	21:08	13.8	70		WNW	7	1023.6	23.0	28		W	13	1017.7	
15	Su	6.4	17.0	0			SSW	61	12:36	12.6	46	1	SSW	20	1026.8	15.7	37	7	S	30	1026.0	
16	Mo	3.5	19.9	0			E	31	13:14	11.3	51		WNW	9	1026.6	17.8	38		ESE	17	1022.6	
17	Tu	5.8	22.2	0			SE	30	15:39	14.5	51		W	11	1026.4	21.3	32		NW	13	1020.6	
18	We	4.2	26.1	0			WNW	44	15:12	16.5	37		W	17	1018.0	25.9	12		WNW	20	1011.9	
19	Th	7.9	26.7	0			W	59	15:34	17.3	37		WNW	6	1009.8	25.2	13		W	33	1005.1	
20	Fr	11.3	24.8	0			W	41	08:37	16.5	38		W	22	1010.9	24.4	18		W	17	1006.5	
21	Sa	8.3	24.2	0			WSW	39	16:26	18.6	41		WSW	11	1010.7	23.1	21		WNW	22	1008.5	
22	Su	8.2	25.7	0			WNW	33	13:50	18.8	41		NNW	11	1016.0	25.2	23		WNW	15	1013.1	
23	Mo	6.6	28.7	0			SW	33	16:37	18.6	51		NNW	9	1019.4	28.4	21		WNW	15	1015.0	
24	Tu	11.6	26.7	0			SSE	28	00:13	17.8	65	1	Calm	1021.6	23.0	53	5	E	17	1016.0		
25	We	13.9	26.8	0			W	31	16:29	18.3	64	8	Calm	1014.7	25.3	37	8	W	9	1009.2		
26	Th	10.5	13.5	8.6			S	54	02:38	10.8	91	8	SW	19	1019.2	10.9	89	8	SSW	19	1020.2	
27	Fr	10.2	17.2	12.2			SSE	41	05:24	13.1	83	8	S	15	1027.9	14.6	77	6	S	17	1026.9	
28	Sa	9.8	19.1	7.8			E	35	12:47	17.0	61	8	ESE	20	1029.4	17.4	63	8	ESE	19	1025.8	
29	Su	10.0	21.4	0.6			ENE	26	15:07	17.1	78	3	WSW	9	1023.7	19.7	74	8	NE	9	1019.0	
30	Mo	14.1	20.3	7.4			S	48	11:20	17.5	74	8	SW	17	1019.7	18.4	61	1	SSE	28	1020.2	
Statistics for September 2024																						
Mean		9.0	23.0							16.3	56	6		11	1021.1	21.5	40	6		18	1017.9	
Lowest		2.3	13.5	0						10.5	22	1		Calm	1008.1	10.9	12	1	#	9	1005.1	
Highest		15.2	29.4	12.2						23.9	91	8		#	22	1029.7	29.0	89	8	WSW	35	1028.3
Total				36.6																		

IDCJDW2161.202409 Prepared at 13:00 UTC on Monday 14 October 2024

Figure 2. Bureau of Meteorology Daily Weather Observation Holsworthy October 2024

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am					3 pm							
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				mm	mm	hours	km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa	
1	Tu	7.6	23.0	0.2			E	37	15:50		17.0	65		Calm	1023.5	19.9	59		E	20	1020.9	
2	We	12.9	19.2	5.2			SSE	37	11:23		14.4	94	8	SSE	11	1030.8	18.5	62	6	SSE	19	1029.5
3	Th	11.6	20.9	0.4			E	31	15:08		18.3	60	8	ENE	9	1031.0	18.9	54	1	E	20	1026.6
4	Fr	6.3	24.7	0.2			ENE	24	14:37		16.1	68		NNW	9	1020.8	23.6	46	7	ENE	13	1013.3
5	Sa	13.3	25.9	2.0			WNW	43	10:00		21.8	66	2	WNW	13	1007.6	24.8	30	5	W	19	1005.2
6	Su	10.3	27.4	0			W	46	15:01		18.6	56		NNW	9	1011.1	27.1	27		W	17	1009.9
7	Mo	10.2	29.1	0			SSE	50	22:52		18.5	61	1	NNW	7	1017.9	28.4	28		WNW	19	1014.3
8	Tu	13.9	15.4	0			SSE	54	23:16		14.2	80	8	SSE	19	1023.2	14.3	62	8	SSE	26	1023.0
9	We	11.9	16.8	0			SSE	31	11:14		15.3	60	8	S	17	1026.8	16.6	53	8	SSE	19	1025.4
10	Th	10.4	24.9	0			N	33	11:23		15.9	74		NW	9	1023.8	23.9	45		NNW	11	1018.9
11	Fr	12.5	24.9	0			SSE	31	22:37		18.6	74		WSW	6	1024.3	23.3	59	3	ESE	17	1019.9
12	Sa	14.4	18.8	5.0			SSE	57	00:35		16.0	66	8	SSE	17	1026.6	17.1	49	7	SSE	22	1026.8
13	Su	8.7	21.4	0			E	30	16:00		13.3	76	8	WSW	7	1027.6	20.6	48	8	ENE	15	1022.8
14	Mo	9.0		0							16.2	71	8	W	9	1019.4	15.6	87	8	S	28	1017.4
Statistics for the first 14 days of October 2024																						
Mean		10.9	22.5								16.7	69	6		10	1022.5	20.9	50	6		18	1019.6
Lowest		6.3	15.4	0							13.3	56	1	Calm	1007.6	14.3	27	1	NNW	11	1005.2	
Highest		14.4	29.1	5.2			SSE	57			21.8	94	8	SSE	19	1031.0	28.4	87	8	S	28	1029.5
Total				13.0																		

3. Results

Data results captured by our water quality sampling are presented herein and are representative of baseline water quality results for Moorebank Precinct West Basin 5. Threshold guideline quantitative values for the water quality parameter themes are compared and correlated to ANZECC/ARMCANZ (2000) guidelines under the categorisation thresholds – Waterway benchmark group: ‘The protection of slightly disturbed lowland river ecosystems in southeast Australia’.

As these are the first samples results collected under our scope for the SIOMP-MPW sites, the sampling results presented in this report will be considered for future analysis against subsequent results for use as baseline data for the drainage network SIOMP function.

Triggers Exceedances from both the In-Situ Data and the Laboratory Samples October 2024

Location Basin 5

Dissolved Oxygen (DO %) is at 114.29% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Zinc is at 0.008mg/L which is at the threshold for lowland rivers.

Continue to monitor for trends under future readings.

Literature Review

Peak Nitrogen Values

Nitrogen

Nitrogen has spiked to a level approximately 3 times the ANZECC trigger value for rivers flowing to the coast at this collection point.

<https://www.dcceew.gov.au/environment/protection/npi/resource/student/total-nitrogen-0>

Literature:

In a 1996 paper reported in the Journal of Hydrology B. Arheimer a, L. Andersson a, A. Lepistö b suggest that; Intensively drained catchments showed the quantitatively largest difference between growing and dormant seasons for NH₄ • N concentrations retained within the creek – stream system.

In general, links between nitrogen concentrations and flow/seasons could be related to annual mean temperature, annual mean concentrations and the water regime of the catchments. The geographical heterogeneity of detected links and the still rather low explanation level for the concentration variation, show the importance of a more dynamic approach to nitrogen monitoring and inclusion of reportable weather and flow conditions within the monitoring process.

It is advised that nitrogen levels recorded within the nearby Anzac Creek and potentially extend to nearby River WQ test results be quantified / evaluated and cross referenced with this data, to identify the existence of broader trends in the associated drainage network and recipient natural creek and river systems. Any longer-term trends and general pattern for increased nitrogen will continue to be assessed across future reporting periods. Testing at increased water depth at the source and after activation of the network after rainfall events will help calibrate this result against previous trends of much lower values.

observations suggest that nitrogen and phosphorus loads were driven primarily by surface runoff rather than groundwater discharge to natural streams.

Praktan D. Wadnerkar a, Luke Andrews a, Wei Wen Wong b, Xiaogang Chen a c, Rogger E. Correa a, Shane White a, Perran L.M. Cook b, Christian J. Sanders a d, Isaac R. Santos a e
Paper reported in Science of the Total Environment March 2021 suggest

‘Overall, intensive agricultural land use and episodic rainfall events were the major spatial and temporal drivers of nitrogen loads within a natural water body.’

J. S. Baron, E. K. Hall, B. T. Nolan, J. C. Finlay, E. S. Bernhardt, J. A. Harrison, F. Chan & E. W. Boyer; 2012
Article The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States, suggest

‘Alterations in precipitation amount and dynamics will alter runoff quality, thereby influencing both rates of Nr inputs to aquatic ecosystems and groundwater and the water residence times that affect Nr removal within aquatic systems.

Both infrastructure within the catchment and climate change alter the landscape connectivity and hydrologic residence time that are essential to denitrification process within a drainage system.

While Nr inputs to and removal rates from aquatic systems are influenced by climate and management, reduction of N inputs from their source will be the most effective means to prevent or to minimize environmental and economic impacts of excess Nr.

Of relevance to the subject site could be the accumulation of nitrates from oxides distributed by exhaust fumes from trucks and heavy combustion equipment as Oxides of nitrogen are contained in the exhaust fumes emitted into the atmosphere by cars, aeroplanes, trains and boats. These emissions are dissolved by rain and then enter

streams, lakes and other water bodies.

https://www.dcceew.gov.au/sites/default/files/documents/factsheet-totalnitrogen_0.pdf

What effect does total nitrogen have on the environment?

Total nitrogen can have damaging effects on the environment and particularly on aquatic life (the fish, shellfish and other creatures in our rivers, lakes and oceans) because most nitrogen is leaked into waterways. Total nitrogen can also lead to toxic blue-green algal blooms. Blue-green algae can harm humans and can make both humans and animals very sick. Do you see how important it is to help keep our waterways clean?

<https://nitrogen-generators.com/what-is-the-main-industrial-use-of-nitrogen/#:~:text=Food%20Packaging%3A%20It%20is%20common,snack%20foods%20can%20be%20extended.>

Five (5) Industrial Applications of Nitrogen

While the main industrial use of nitrogen is to create ammonia that is required for fertilizer, explosives, and other materials, it uses go far beyond these applications. From food packaging to pharmaceuticals, nitrogen gas can be found in more places and used for more purposes than you may have realized.

Food Packaging: It is common practice for food processing companies to use compressed nitrogen to displace oxygen in the packaging of perishable foods. Without oxygen, the shelf life of foods such as meats, fruits, vegetables, and various snack foods can be extended. Nitrogen can also add a cushion around food to keep it safe during transport.

Chemical Blanketing: Nitrogen is typically used to prevent fires and explosions in dangerous atmospheres like chemical plants or manufacturing facilities, by lowering the oxygen level below explosive limits.

Electronics: In the process of assembling electronics, nitrogen gas is used when two electronic components are forming a permanent connection, also known as soldering. The gas is used to reduce surface tension so there is a cleaner break away from the site of the electrical bond. Nitrogen gas is also used in a computer's main processing system to prevent it from overheating.

Laboratory: Laboratories require a very specific environment to ensure that tests and results are carried out accurately. Nitrogen gas is used to control oxygen levels, humidity and temperature, and maintain an appropriate atmosphere for highly sensitive procedures and equipment. Additionally, there are various pieces of laboratory equipment that require nitrogen for purging.

Laser Cutting: The application of nitrogen as a purging gas in the steel industry is extremely important. It is used as an assist gas to blow away molten material and achieve a stronger stainless or aluminized steel product that is also more resistant to corrosion.

<https://nigen.com/industries-that-benefit-from-on-site-nitrogen-systems/>

Industries That Benefit from On-Site Nitrogen Systems

Gaseous nitrogen is very useful in large-scale manufacturing and industrial applications. The large volumes of nitrogen gas required for these operations are either sourced from vendors in gas cylinders or generated on-site. In this article, we will highlight critical industrial processes that benefit from on-site nitrogen systems.

Elevation pH values recorded from location Discharge point 6

pH – Acidity, Alkalinity

https://www.umass.edu/mwwp/protocols/rivers/ph_alkalinity_river.html

Alkalinity is a measure of a river's "buffering capacity," or its ability to neutralize acids. Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H⁺ ions and lower the acidity of the water (which means increased pH). They do this usually by combining with the H⁺ ions to make new compounds. Without this acid neutralizing capacity, any acid added to a river would cause an immediate change in the pH.

Measuring alkalinity is important to determining a river's ability to neutralize acidic pollution (as measured by pH) from rainfall or snowmelt. It's one of the best measures of the sensitivity of the river to acid inputs.

Alkalinity comes from rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges. Total alkalinity is measured by collecting a water sample, and measuring the amount of acid needed to bring the sample to a pH of 4.2. At this pH all the alkaline compounds in the sample are "used up." The result is reported as milligrams per liter (mg/l) of calcium carbonate.

3.2 Interpreting Results

Dissolved Oxygen – Measures:

Dissolved oxygen (DO) is oxygen held (dissolved) in the water and available to aquatic organisms.

The amount of dissolved oxygen in a river or stream can tell us a lot about its water quality.

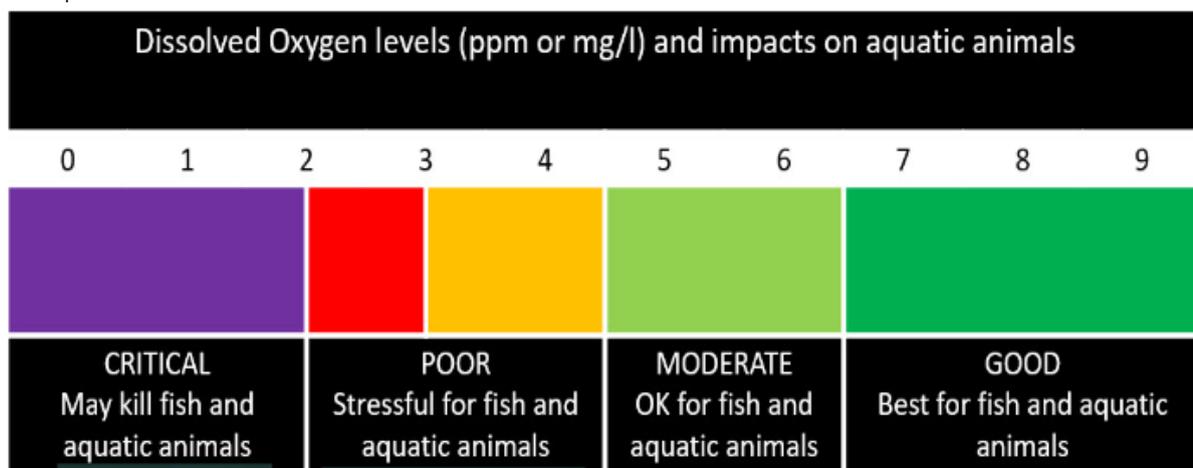
Water will naturally contain a certain amount of dissolved oxygen that is absorbed from the air and produced by plants and algae living in the water.

Temperature has a large effect on the amount of oxygen dissolved in water; cold water can hold higher levels of oxygen than warmer water. Higher water temperatures over summer will cause oxygen levels to drop.

Other factors such as river flow, wind, nutrients and bacterial activity can also affect the amount of dissolved oxygen in waterways.

Dissolved oxygen levels typically range between 5 and 14 mg/L (or ppm).

Example:



Salinity – Measures:

Electrical conductivity is a measure of the saltiness of the water and is measured on a scale from 0 to 50,000 uS/cm. Electrical conductivity is measured in microsiemens per centimeter (uS/cm). Freshwater is usually between 0 and 1,500 uS/cm and typical sea water has a conductivity value of about 50,000 uS/cm. Examples:

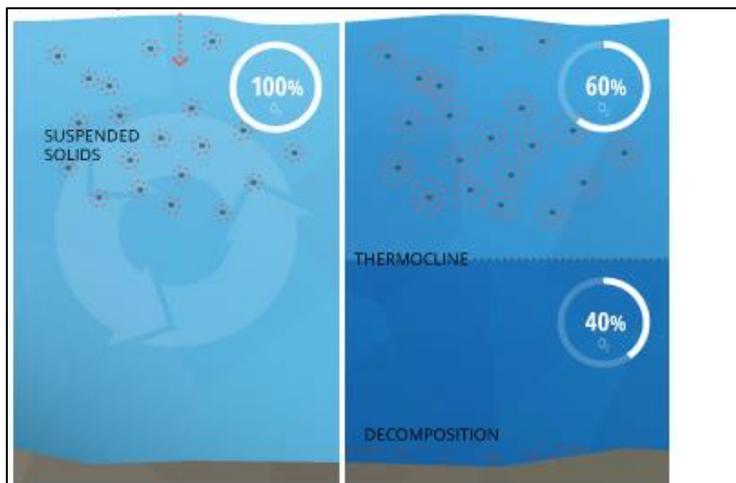
μS/cm	Use
0 - 800	<ul style="list-style-type: none">• Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material)• Generally good for irrigation, though above 300μS/cm some care must be, particularly with overhead sprinklers, which may cause leaf, scorch on some salt sensitive plants.• Suitable for all livestock
800 - 2500	<ul style="list-style-type: none">• Can be consumed by humans, although most would prefer water in the lower half of this range if available• When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants• Suitable for all livestock
2500 -10,000	<ul style="list-style-type: none">• Not recommended for human consumption, although water up to 3000 μS/cm can be consumed• Not normally suitable for irrigation, although water up to 6000 μS/cm can be used on very salt tolerant crops with very special management techniques. Over 6000 μS/cm, occasional emergency may be possible with care• When used for drinking water by poultry and pigs, the salinity should be limited to about 6000 μS/cm. Most other livestock can use water up to 10000 μS/cm

Total Dissolve Solids (TDS) – Measures

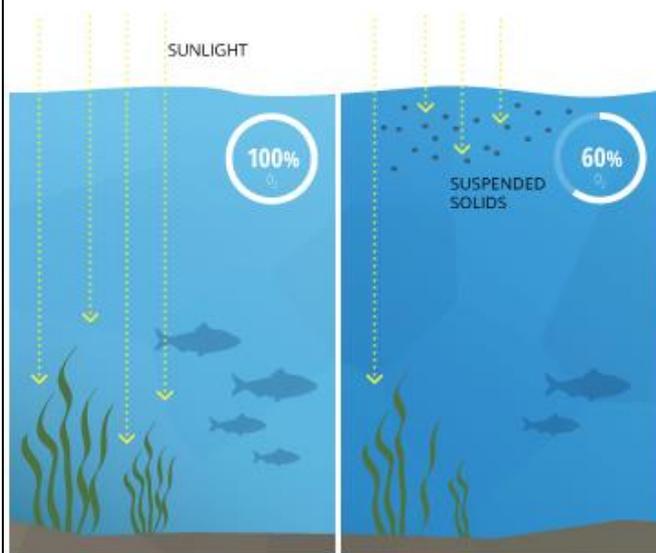
Dissolved solids, smaller than 2 microns, refer to any minerals, salts, metals, in the form of molecules, atoms, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that dissolve in water.

The TDS concentration is the sum of all filterable substances in water that can be determined gravimetrically. However, in most cases, TDS is primarily comprised of ions.

High levels of total suspended solids can affect turbidity, increase water temperatures and decrease dissolved oxygen (DO) levels. This can cause the water to heat up more rapidly because the suspended particles absorb more heat and deplete oxygen, which can adversely affect aquatic life.



Suspended solids can increase the temperature of water as they absorb additional heat from the sun. This can also cause dissolved oxygen levels to drop below the thermocline, creating hypoxic conditions.



Suspended solids, particularly algae, can block sunlight from reaching submerged plants. This can cause dissolved oxygen levels to drop, as the plants rely on respiration (consuming oxygen) instead of photosynthesis.

Turbidity – Total Suspended Solids (TSS)

Turbidity data are reported in Nephelometric Turbidity Units (NTU). To provide a sense of scale, water with a turbidity of 1 NTU is crystal clear, water at 5 NTU has a tiny trace of discoloration, and water at 100 NTU is brown and opaque. The standard is less than 10 NTU for rural streams and rivers and less than 30 NTU for urban lakes and ponds.

Total suspended solids (TSS) are particles that are larger than 2 microns found in the water column. Anything smaller than 2 microns (average filter size) is considered a dissolved solid. Most suspended solids are made up of inorganic materials, though bacteria and algae can also contribute to the total solids concentration.



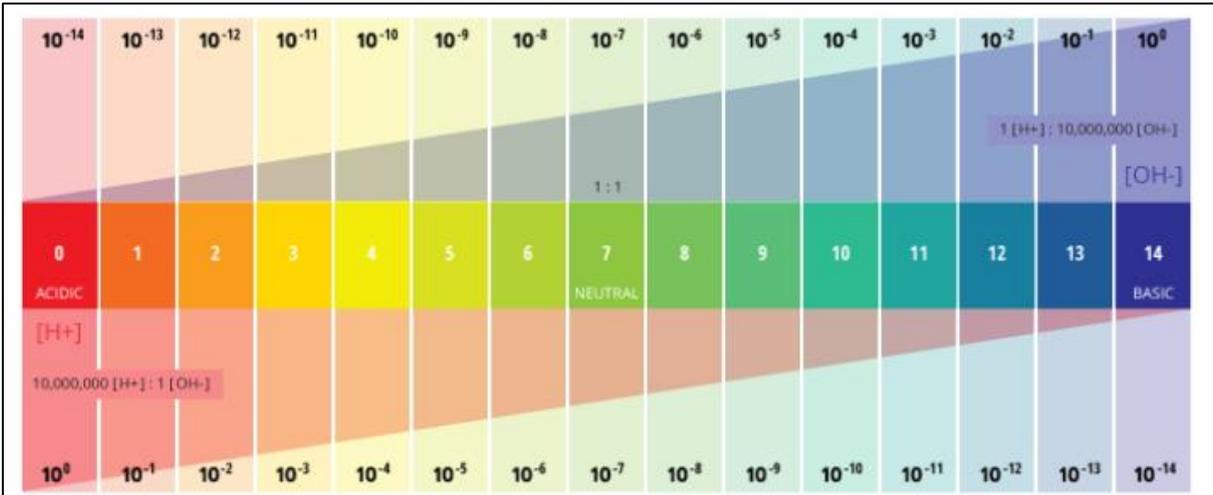
pH – Acidity / Alkalinity – Measures

The pH refers to the degree of acidity or alkalinity of a substance. A pH of 7 is neutral. A value above 7 indicates that the water is more alkaline and a pH below 7 indicates acidic conditions.

A pH of 7 is considered neutral. The logarithmic scale means that each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number. pH stands for the “power of hydrogen”³. The numerical value of pH is determined by the molar concentration of hydrogen ions (H⁺)³. This is done by taking the negative logarithm of the H⁺ concentration (-log(H⁺)).

Standard values for pH readings are expected, pH 6.5–9 for rural streams and rivers and pH 6–9 for urban lakes and ponds.

In freshwater systems pH sets up the conditions for how easy it is for nutrients to be available and how easily things like heavy metals (toxicity for aquatic life) can dissolve in the water. Rivers and lakes generally range between 5 (acidic) and 9 (basic) on the pH scale.



The logarithmic scale of pH means that as pH increases, the H⁺ concentration will decrease by a power of 10. Thus at a pH of 0, H⁺ has a concentration of 1 M. At a pH of 7, this decreases to 0.0000001 M. At a pH of 14, there is only 0.000000000000001 M

Summary of Results

Aquatic ecosystems	
Indicator	Numerical criteria (trigger values)
Total phosphorus	<ul style="list-style-type: none"> • Upland rivers: 20 µg/L • Lowland rivers: 25 µg/L for rivers flowing to the coast; • Lakes & reservoirs: 10 µg/L • Estuaries: 30 µg/L
Total nitrogen	<ul style="list-style-type: none"> • Upland rivers: 250 µg/L • Lowland rivers: 350 µg/L for rivers flowing to the coast; • Lakes & reservoirs: 350 µg/L • Estuaries: 300µg/L
Chlorophyll-a	<ul style="list-style-type: none"> • Upland rivers: not applicable • Lowland rivers: 5 µg/L • Lakes & reservoirs: 5 µg/L. • Estuaries: 4 µg/L.
Turbidity	<ul style="list-style-type: none"> • Upland rivers: 2–25 NTU (see supporting information) • Lowland rivers: 6–50 NTU (see supporting information) • Lakes & reservoirs: 1–20 NTU • Estuaries: 0.5–10 NTU
Salinity (electrical conductivity)	<ul style="list-style-type: none"> • Upland rivers: 30–350 µS/cm • Lowland rivers: 125–2200 µS/cm <p>supporting information</p>
Dissolved oxygen	<ul style="list-style-type: none"> • Upland rivers: 90–110% • Lowland rivers: 85–110% • Freshwater lakes & reservoirs: 90–110% • Estuaries: 80–110% <p>Note: Dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability.</p>
pH	<ul style="list-style-type: none"> • Upland rivers: 6.5–8.0 • Lowland rivers: 6.5–8.5 • Freshwater lakes & reservoirs: 6.5–8.0 • Estuaries: 7.0–8.5 <p>Changes of more than 0.5 pH units from the natural seasonal maximum or minimum should be investigated.</p>

3.1 Key Summary of Results Spring (October) 2024

Dissolved Oxygen (DO %) is at 114.29% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Zinc is at 0.008mg/L which is at the threshold for lowland rivers, however marginally higher in value than the other basin records for this period.

Continue to monitor for trends under future readings.

All other tested attributes are considered to meet the ANZECC guidelines for natural low land rivers – which is applied within the report as a general benchmarking standard.

3.2 Recommendations

There are no water quality management recommendation provided under this reporting period.

STORMWATER DISCHARGE TESTING SITE

BASIN 5 – OUTFLOW

Site image 1. Testing site Basin 5 - Outflow



Table. In-situ data and observations Retention Basin 5 outflow

Moorebank West Precinct - Retention Basin 5 Outflow (MPW 5.2 outflow)			
Date: 09/10/2024	Time: 12:06am	Temp: 26.6°C	Humidity: 53%
Operator: Marco Perry		Coordinates: -33.947085, 150.917653	
Equipment used: Aquatroll 500			
Parameter	Recording	ANZECC ANZECC 2000 Guidelines *Lowland rivers	Triggered? Y/N
Temperature (Celcius)	19.5	Abnormal to seasonal variation	N
Dissolved Oxygen (DO %)	114.29%	*Lowland rivers Lower limit: 85% Upper Limit: 110%	Y – improved quality resultant
Dissolved Oxygen (DO ppm)	10.5ppm	*Lowland rivers Lower limit: 85% Upper Limit: 110%	N
Electrical Conductivity (uS/cm)	7.3 uS/cm	125–2200 uS/cm	N
pH	6.21	Min 6.5 Max 8.5	Y – slight
NTU	6.62	6-50	N

(a) Total phosphorus

MPW 5.2 outflow - Total phosphorous – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results - Total phosphorous:	30 µg/L	25 µg/L for rivers flowing to the coast	Y
Notes: <ul style="list-style-type: none"> Channel Culvert µg/L + microseimens per cm Trigger value 50 µg/L for lowland rivers, trigger value 25 µg/L for rivers flowing to the coast Anzecc Guidelines 2000. Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			

(b) Total nitrogen Total Nitrogen as N (TKN + NOx) by Discrete Analyser

MPW 5.2 outflow - Total nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results -Total nitrogen:	400 µg/L	350 µg/L for rivers flowing to the coast	Y
Notes: <ul style="list-style-type: none"> Total Nitrogen as N (TKN + NOx) by Discrete Analyser Trigger values are based on a low-lying river 			

(c) Kjeldahl nitrogen Total Kjeldahl Nitrogen as N

MPW 5.2 outflow - Kjeldahl nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results – kjeldahl nitrogen:	400 µg/L	-	-
Notes: Total Kjeldahl Nitrogen as N			

d) Dissolved metals;

MPW 5.2 outflow - Dissolved metals – Qube Logistics, Moorebank, NSW			
Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			
Lab results – Dissolved metals:	Measures mg/L	Trigger value ANZECC Guidelines 2000 95% protection criteria	Triggered
Arsenic	<0.001	0.013 mg/L	N
Cadmium	<0.0001	0.0002 mg/L	N
Chromium	<0.001	0.001 mg/L	N
Copper	<0.017	0.0014mg/L	N
Nickel	<0.001	0.011 mg/L	N
Lead	<0.001	0.0034 mg/L	N
Zinc	0.008	0.008 mg/L	Y at trigger value
Mercury	<0.0001	0.0006 mg/L	N
Notes: - ANZECC Guidelines 90% protection criteria.			

(e) PFAS;

MPW 5.2 outflow - PFAS – Qube Logistics, Moorebank, NSW			
PFAS Surrogate	Measure %	95% species protection (DEE 2016)	Exceedance?
Perfluorooctane sulfonic acid (PFOS) µg/L	0.04 µg/L /103%	.13 (µg/L)	N
Perfluorooctanoic acid (PFOA)	0.04 µg/L /101%	220 (µg/L)	N
Notes: This Guidance focuses on PFOS and PFOA as potential indicators of wider contamination by related PFASs. The reasons for this approach include: <ul style="list-style-type: none"> • Most research undertaken on PFASs internationally and in Australia has focused on PFOS and PFOA due to their frequent occurrence in the environment, persistence, and bioaccumulation. • PFOS and PFOA can also be the breakdown endpoint of other precursor products. • PFOS and PFOA are the most commonly encountered PFAS in the environment and wildlife. • Information on other PFASs, of which there are several hundred known, is more limited. • Effective management of PFOS and PFOA may help address potential contamination where other PFASs may also be present. 			

(f) Total suspended solids.

MPW 5.2 outflow - Total suspended solids – Qube Logistics, Moorebank, NSW		EPA exceedance value	Trigger
Lab results – Total suspended solids: mg/L	<5 mg/L	50 mg/L	N
Notes: Total Suspended Solids dried at 104 ± 2°C Total Suspended Solids (TSS)			

(g) Total hydrocarbons

Lab results - Total hydrocarbons:	October Measure ug/L	Baseline monitoring May 2024	Trigger value ANZECC Guidelines 2000 – slightly disturbed lowland river ecosystem	Triggered
Benzene µg/L	<1	<1	1300 µg/L	N
Toluene µg/L	<2	<2	-	N
Ethylbenzene µg/L	<2	<2	-	N
meta- & para-Xylene µg/L	<2	<2	200 µg/L	N
Ortho-Xylene µg/L	<2	<2	470 µg/L	N
Total Xylenes µg/L	<2	<2	-	-
Sum of BTEX µg/L	<1	<1	-	-
Naphthalene µg/L	<5	<5	85 µg/L	N
Notes: <ul style="list-style-type: none">• The data were compared to the default trigger values (DTV) recommended by ANZECC/ARMCANZ (2000) for the protection of slightly disturbed lowland river ecosystems in southeast Australia.• A commonly encountered example of additive toxicity of mixtures is the simple aromatic hydrocarbons commonly associated with contaminated petroleum sites, benzene, toluene, ethyl benzene and xylenes, collectively known as BTEX				

Water Quality Monitoring Comparative Table (Temporal)

Retention Basin 5 MPW. Testing Site MPW 5.2 Outflow

Testing Site MPW 5.2 Outflow	May 2024 baseline	October 2024
pH	6.39	6.21
Dissolved Oxygen - %/L	4.11mg/L	10.5
Actual Electronic Conductivity	0.054945	0.008
Temperature - °C	18.12	19.5
Turbidity	0.03 NTU	6.62
Total phosphorous - mg/L	0.04 mg/L	0.03mg/L
Total nitrogen - mg/L	1.7 mg/L	0.4mg/L
Kjeldahl nitrogen mg/L	1.0 mg/L	0.4mg/L
Dissolved metals		
Arsenic	<0.001	<0.001
Cadmium	<0.0001	<0.0001
Chromium	<0.001	<0.001
Copper	<0.01	0.017
Nickel	<0.001	0.001
Lead	<0.001	<0.001
Zinc	<0.005	0.008
PFAS		
Lab results – SUM of PFAS Micrograms/L	0.13	0.04
SUM of PFHxS & PFOS Microgrms/L	0.04	0.04
Total suspended solids mg/L	6	<5
Total hydrocarbons		
Benzene	<1	<1
Toluene	<2	<2
Ethylbenzene	<2	<2
meta-& para-Xylene	<2	<2
Ortho-Xylene	<2	<2
Total Xylenes	<2	<2
Sum of BTEX	<1	<1
Naphthalene	<5	<5

Appendix A. Raw data tables; source - Australian Laboratory Services

Basin 5: Outflow

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time				09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00	
Compound	CAS Number	LOR	Unit	EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (\$S)	----	5	mg/L	<5	<5	24	<5	1440	
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.002	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	0.008	<0.005	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.06	0.05	0.11	0.03	0.90	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.7	1.0	0.4	2.1	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^A Total Nitrogen as N	----	0.1	mg/L	0.6	0.8	1.1	0.4	3.0	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.03	0.05	0.16	0.03	0.25	
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^A C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time				09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00	
Compound	CAS Number	LOR	Unit	EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005	
				Result	Result	Result	Result	Result	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^A C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
^A >C10 - C40 Fraction (sum)	---	100	µg/L	<100	<100	<100	<100	<100	
^A >C10 - C16 Fraction minus Naphthalene (F2)	---	100	µg/L	<100	<100	<100	<100	<100	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1	
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2	
^A Total Xylenes	---	2	µg/L	<2	<2	<2	<2	<2	
^A Sum of BTEX	---	1	µg/L	<1	<1	<1	<1	<1	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.03	0.06	<0.02	<0.02	
Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.04	0.06	<0.02	<0.02	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.32	0.52	0.02	0.03	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.24	0.56	0.02	0.02	

Analytical Results

Sub-Matrix: WATER
(Matrix: WATER)

				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
				Sampling date / time	09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00
Compound	CAS Number	LOR	Unit		EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005
				Result	Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	<0.02	0.10	<0.02	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	0.05	0.20	<0.02	0.03
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	<0.02	0.02	<0.02	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	0.01	0.03	<0.01	<0.01
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FO SA)	754-91-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFO SA)	31506-32-8	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFO SA)	4151-50-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoethanol (MeFO SE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFO SE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time					09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00
Compound	CAS Number	LOR	Unit		EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFO SAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFO SAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L	<0.01	0.69	1.55	0.04	0.08	
Sum of PFHxS and PFOs	355-46-4/1763-23-1	0.01	µg/L	<0.01	0.56	1.08	0.04	0.05	
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	0.65	1.49	0.04	0.08	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	99.8	99.2	98.1	102	103	
Toluene-D8	2037-26-5	2	%	101	98.3	97.7	102	99.9	
4-Bromofluorobenzene	460-00-4	2	%	96.2	94.6	92.3	94.0	93.6	
EP231S: PFAS Surrogate									
13C4-PFOs	----	0.02	%	98.2	96.9	101	103	103	
13C8-PFOA	----	0.02	%	98.7	97.9	101	101	101	

Chemical	Trigger values for freshwater (μgL^{-1})				Trigger values for marine water (μgL^{-1})			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 ^C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 ^A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin	B	2.6	4.4	6	9 ^A	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 ^C	1000 ^C	ID	ID	ID	ID
Alcohol ethoxylated sulfate (AES)	340	650	850 ^C	1100 ^C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 ^C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons								
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 ^A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH >6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC_{50} data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) — check Section 8.3.7 for spread of data and its significance. 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Sections 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) — check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.

D = Ammonia as TOTAL ammonia as $[\text{NH}_3\text{-N}]$ at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2.

E = Chlorine as total chlorine, as [Cl]; see Section 8.3.7.2.

F = Cyanide as un-ionised HCN, measured as [CN]; see Section 8.3.7.2.

G = Sulfide as un-ionised H_2S , measured as [S]; see Section 8.3.7.2.

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30 mg/L CaCO_3 . These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.

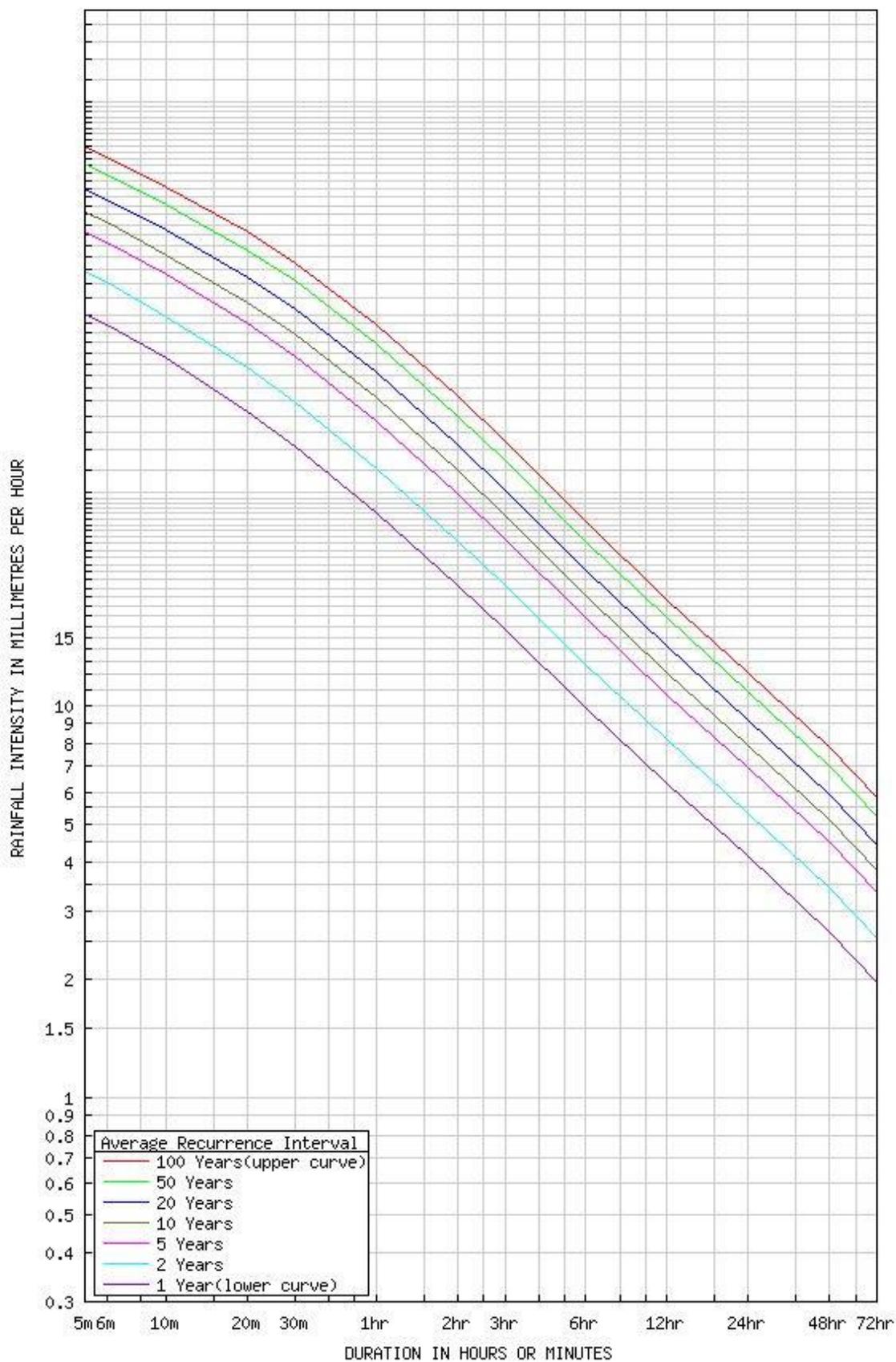
Table 5. Ecological water quality guideline values developed by water regulators

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - technical draft default guideline values for PFOS and PFOA.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The 99% species protection level for PFOS is close to the level of detection. Agencies may wish to apply a 'detect' threshold in such circumstances rather than a quantified measurement.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	Note 3: The WQGs advise ⁴¹ that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Regulators may specify or environmental legislation may prescribe the level of species protection required, rather than allowing for case-by-case assessments.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	As above. Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	

Australian Water Quality Guidelines for Fresh and Marine Waters

Type of indicator	Indicator	Units	Fresh waters	Marine waters
	Dissolved oxygen ²	mg/L	> 6 (> 80–90% saturation)	> 6 (> 80–90% saturation)
	Nutrients/nuisance growths	–	(Section 2.3.3)	(Section 2.3.3)
	pH	–	6.5–9.0	< 0.2 pH unit change
	Salinity	mg/L	< 1000 (about 1,500 µS/cm)	–
	Suspended particulate matter/turbidity	–	< 10% change seasonal mean concentration (see also colour & clarity)	< 10% change seasonal mean concentration (see also colour & clarity)
	Temperature ³	–	< 2°C increase	< 2°C increase
Toxicants				
Inorganic toxicants	Aluminium	µg/L	< 5.0 (if pH ≤ 6.5)	NR
	Aluminium	µg/L	< 100.0 (if pH > 6.5)	–
	Ammonia	µg/L	20.0–30.0 (Table 2.3)	NR
	Antimony	µg/L	30.0	500.0
	Arsenic	µg/L	50.0	50.0
	Beryllium	µg/L	4.0 ⁴	NR
	Cadmium	µg/L	0.2–2.0 ⁵	2.0
	Chromium	µg/L	10.0	50.0
	Copper	µg/L	2.0–5.0 ⁵	5.0
	Cyanide	µg/L	5.0	5.0
	Iron	µg/L	1,000.0 ⁶	NR
	Lead	µg/L	1.0–5.0 ⁵	5.0
	Mercury	µg/L	0.1	0.1
	Nickel	µg/L	15.0–150.0 ⁵	15.0
	Selenium	µg/L	5.0	70.0
	Silver	µg/L	0.1	1.0
	Sulfide	µg/L	2.0	2.0
	Thallium	µg/L	4.0	20.0
	Tin (tributyltin)	µg/L	0.008	0.002
Zinc	µg/L	5.0–50.0 ⁶	50.0	
Organic toxicants	Acrylonitrile	µg/L	NR	NR
	Benzidine	µg/L	NR	NR
	Dichlorobenzidine	µg/L	NR	NR
	Diphenylhydrazine	µg/L	NR	NR
Halogenated aliphatic compounds	Hexachlorobutadiene	µg/L	0.1	0.3
	Halogenated ethers	µg/L	NR	NR
	Isophorone	µg/L	NR	NR
Monocyclic aromatic compounds	Benzene	µg/L	300.0	300.0
	Chlorinated benzenes	µg/L	(Table 2.8)	NR

Appendix C. Intensity Frequency Duration – Average Recurrence Interval Indicator
[Intensity-Frequency-Duration \(bom.gov.au\)](http://Intensity-Frequency-Duration (bom.gov.au))



Moorebank Logistics Park West Precinct

Basin 6

Spring Stormwater Network Water Quality
Monitoring Data & Reporting October 2024



Site image: retention basin 6 MPW (Apical image October 2024)

Prepared for: MID Plumbing P/L

Prepared by: Daniel Anderson (BEnvSc, MEnvSc)

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Office: PO Box 149 Kiama NSW 2533

ABN: 656 420 10 400

Consulted Documents / database.

Australia and New Zealand Guidelines for fresh and Marine Water Quality (2000)

[NATIONAL WATER QUALITY MANAGEMENT STRATEGY - Australian and New Zealand Guidelines for Fresh and Marine Water Quality \(2000\) - Volume 2 - Aquatic ecosystems](#)

Bureau of Meteorology – Australian Government [Australia's official weather forecasts & weather radar - Bureau of Meteorology \(bom.gov.au\)](#)

Moorebank Intermodal Precinct West – Stage 3 (SSD 10431) | Assessment Report March 2021

<https://moorebankintermodalprecinct.com.au/wp-content/uploads/2023/04/MPW-S3-DPIE-assessment-report-to-IPC.pdf>

WQM Report Western Precinct _Basin 6_Autumn 2024 – Apical Bushfire and Planning - April 2024

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Lot 2 DP 1197707 Part Lot 3 DP 1197707 Part Anzac Road and Moorebank Avenue public road reserves Development: Moorebank Precinct West Stage 2 (MPW Stage 2)

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 10431 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Moorebank Precinct West Stage 3 (MPW Stage 3)

Australian Laboratory Services (ALS) Work Order EW2402561 Certificate of Analysis Water Sample Data 8th Oct 2024.

Liverpool DCP [Liverpool's Development Control Plans | Liverpool City Council \(nsw.gov.au\)](#)

DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.

<https://environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgt-guidance-pfos-pfoa.pdf>

Development Consent SSD 7709 - Section 4.38 of the Environmental Planning and Assessment Act 1979

<https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2019/05/moorebank-intermodal-precinct-west-stage-2/referral-from-department-of-planning-and-environment/revised-recommended-conditions/mpw-stage-2-recommended-conditions-inclusive-of-edits-191105.pdf>

Glossary

The following definitions apply to terms used in this report. Many of these definitions are consistent with relevant national literature and cited where appropriate.

Current status trigger value

Concentrations of water quality indicators that reflect existing ecosystem condition, and therefore provide a target for ecosystem maintenance and a benchmark against which future water quality trends may be monitored.

Environmental value

Particular values or uses of the environment important for a healthy ecosystem or for public benefit, welfare, safety or health and requiring protection from the effects of pollution or degradation (Environment Australia 2002).

Indicator

A parameter (biological, physical or chemical) used to provide a measure of the quality of water or the condition of an ecosystem (Environment Australia 2002).

Low-risk trigger value

Concentrations (or loads) of key performance indicators [of water quality] at which if not exceeded, there is a low risk that adverse biological effects will occur (ANZECC 2000a).

Median

The middle reading, or 50th percentile, of all readings taken. i.e. of the readings 10, 13, 9, 16 and 11 (re-ordering these to read 9, 10, 11, 13 and 16), the median is 11. The mean (or average), is the sum of all values divided by the total number of readings (which in this case equals 11.8).

Reference condition

Refers to a site which is unmodified or minimally modified from 'natural' condition. Most commonly, reference sites are subject to limited disturbance from human activity. The reference condition then serves as a standard or target against which environmental change in other similar sites can be assessed.

Trigger value

A concentration that, if exceeded, would indicate a potential environmental problem, and so 'trigger' a management response, such as further investigation and/or remedial actions (ANZECC 2000a).

Water quality guideline

A numerical concentration level (e.g. of a contaminant) or narrative statement (e.g. visual appearance of a water body) recommended to support and maintain a designated water use (ANZECC 2000a)

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 3 (the Project) of Moorebank Precinct West (MPW), which comprises the third stage of development within the Moorebank Precinct West under Development Approval SSD-10431.

The proposal is SSD under clause 19 of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, as it is development for the purpose of rail and related transport facilities.

The MPW site is located on the western side of Moorebank Avenue and forms the western section of the Moorebank Intermodal Precinct (Figure 2). The MPW site is approximately 2.5 kilometres (km) from the Liverpool city centre, 27 km south-west of the Sydney Central Business District (CBD) and 26 km west of Port Botany.

The MPW site is irregular in shape, approximately 3 km from north to south and 960 m from east to west at its widest point and covers an area of approximately 220 ha. It is situated between the Georges River to the west (with the SSFL running north-south to the west of the river); and Moorebank Avenue to the east.

Works on the MPW site to date have commenced under two current and active development consents:

- MPW Stage 1 early works, which provides demolition, rehabilitation, remediation of contaminated land, and the establishment of construction facilities and access including site security (as part of the SSD 5066 consent)
- MPW Stage 2, which provides for the construction and 24/7 operation of an intermodal facility and associated warehousing (SSD 7709).

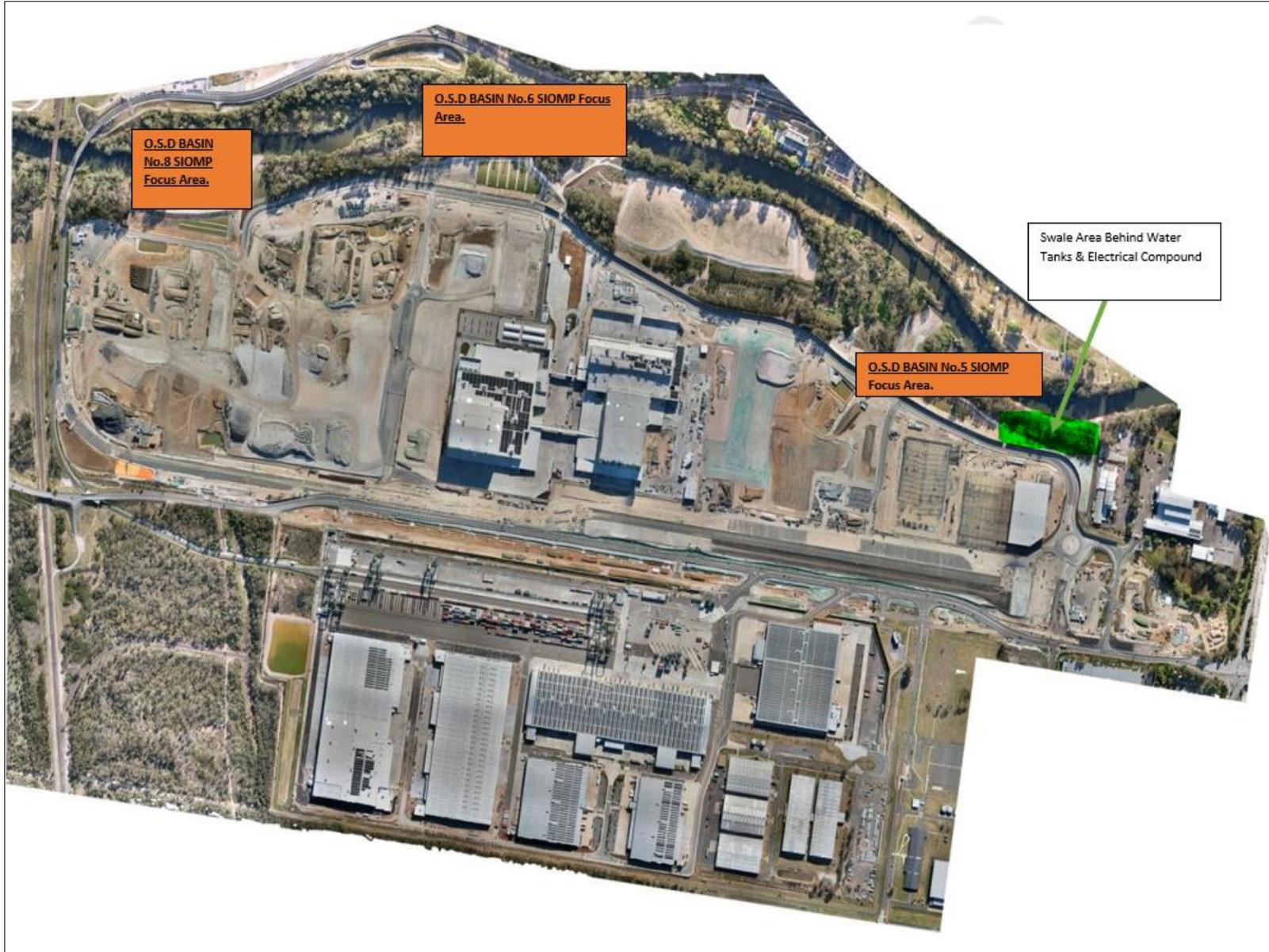
Across the entire precinct there are six onsite detention basins. Bioretention/biofiltration systems also make up the stormwater management infrastructure within the site.

This water quality monitoring program is guided by the Stormwater Infrastructure Operation and Maintenance Plan (SIOPM) and is provided to Qube Holdings Limited (the Applicant) on behalf of MID Plumbing. Three onsite bio-retention basins are present within Moorebank Precinct West. This report is in reference to Basin 6 (MPW – west).

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Moorebank Precinct West Stage 2 (MPW Stage 2)

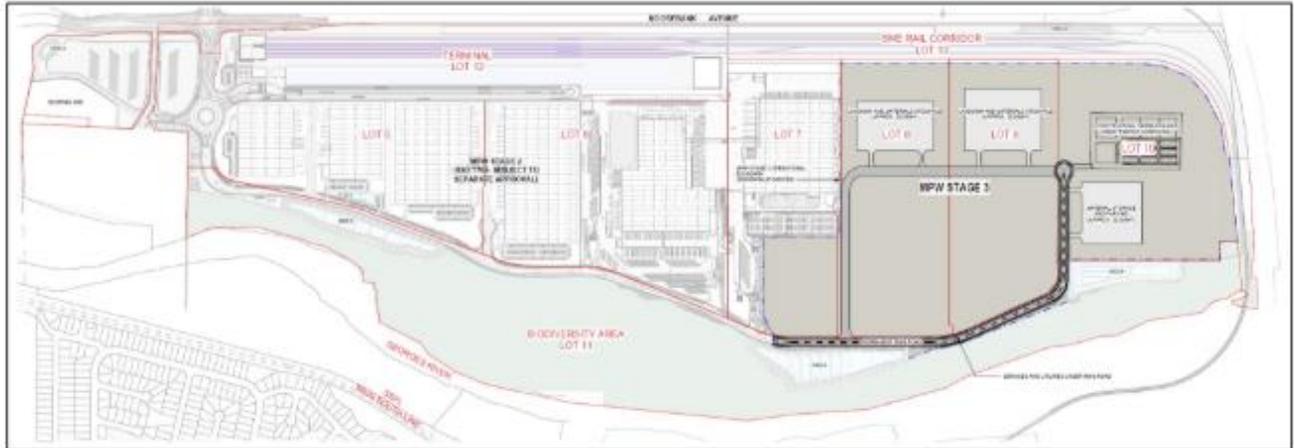
CoC	Requirement
Stormwater Quality Monitoring	
B38.	Stormwater Quality Monitoring Program - Prior to commencement of operation Part of the Operational Environmental Management Plan

Map Image 2. Moorebank Precinct West Detention Basins (provided by MID Plumbing)



1.2 Reference information

Map image 4. Moorebank Intermodal Precinct West – Stage 3 State Significant Development Assessment (SSD-10431) March 2021



20. Stormwater Management System or Works

That untreated stormwater is not disposed of into the Georges River or its tributaries.

The likely impact of stormwater disposal on the quality of any receiving waters.

That the levels of nutrients and sediments entering the waterway are not increased by the proposed development.

Whether any proposals to manage stormwater are in accordance with the local council's stormwater management plans and the Managing Urban Stormwater series of documents and meet the local council's stormwater management objectives.

Whether the principles outlined in the *Managing Urban Stormwater Soils and Construction Handbook* (1998) prepared by and available from Landcom and the Department of Housing are followed during each stage of a development (including subdivision).

Detailed stormwater assessments were undertaken as part of MPW Stage 2, and remain applicable to the Stage 3 proposal.

The Department has recommended conditions that would enforce these requirements, by ensuring that appropriate measures are implemented to manage stormwater impacts during construction. In regard to management of stormwater during operation of the MPW site, the MPW Stage 2 proposal incorporates a robust set of conditions to manage the release of stormwater via six onsite detention basins (OSD), a major east-west covered culvert and associated drainage infrastructure.

2. Monitoring Program Methodology

2.1 Monitoring Sites

To support stormwater and drainage management of the facility the MLP West precinct has established a vast stormwater infrastructure system consisting of several Water Sensitive Urban Design (WSUD) functions including raingardens detention basins and bio-swales. These networks are designed to minimise the velocity and peak discharge of stormwater draining from the site and act as onsite detention basins to harvest and sequester potential pollutants generated at the site through designed biological processes.

The stormwater infrastructure system discharges water into the natural drainage system via three outlets:

- Basin 5 detains water from the northern section of MPW before discharging into Georges River
- Basin 6 detains water from the mid-section of MPW before discharging into Georges River
- Basin 8 detains water from the southern section of MPW before discharging into Georges River

Monitoring of the discharge points has been established via our ongoing program with MID Plumbing under the SIOMP program to collect qualitative data and analyse the performance of the WSUD provisions and to establish any potential trends in water quality readings from the stormwater network discharge points prior to release of water into the natural hydrological systems of Anzac Creek and the Georges River.

Table 1. Type of outlet MPW

Discharge Point (see figure 2)	Associated Outlet (see figure 1)	Type of outlet/detention basin
Basin 5	Inlet	Bio retention
	Outlet	Outlet point
	Georges River	River
Basin 6	Inlet	Bio retention
	Outlet	Outlet point
Basin 8	Inlet	Bio retention
	Outlet	Outlet structure

2.2 Water Quality Assessment

Surface water quality data collected at the discharge points is assessed with reference to ANZECC Guidelines (2000) and correlated with baseline Water Quality monitoring results provided by previous condition assessment reports.

By comparing water test data under the program across the testing timeline we can identify and report upon trends, identify exceedances and exclude potential anomalies for datasets.

ANZECC Low Risk Trigger Values

Ecosystem type	Turbidity NTU	EC µS/cm	pH ⁺	DO	TN mg/L	NO _x -N mg/L	NH ₄ ⁺ -N mg/L	TP mg/L	DRP-P mg/L
Upland river	2-25	30-350	6.5-7.5	90-110	0.480	0.190	0.013	0.013	0.005
Lowland river	6-50	125-2200	6.5-8.0	85-110	0.500	0.190	0.020	0.050	0.020

Values for Low Land River Systems as insert above are used as the reference guide to water quality parameter values and overall health and safety statements regarding the quality of discharged water from the SIOMP drainage network.

Annual spring and autumn water quality data presented from Anzac Creek and Georges River testing programs by other scientific consultants may also be cross referenced to the data prepared by Apical under the SIOMP program to establish potential trends in results and identify increases in accumulated pollutants from the site under operational condition, which may appear present within adjacent natural waterways.

Site data was collected in the form of water samples and in field data recordings at the prescribed monitoring points, water samples and water probe readings are undertaken following Australia and New Zealand guidelines for fresh and marine water quality – 2000 (ANZECC Guidelines), In situ water quality parameters relevant to stream health and aquatic assessment profiling were collected in field with a multiparameter hand-held water quality monitoring probe (Aquatroll 600).

Water data is collected, analysed and collated under the same methodologies and process under each testing period, to ensure consistency in the process.

Measures tested and samples taken:

- pH
- Dissolved Oxygen
- Electrical Conductivity
- Water Temperature and
- Turbidity

Water samples are collected at inlet and discharge points (Basin 5, Basin 6 & Basin 8) then sent to Australian Laboratory Services (ALS) for quality testing analysis [Surface water \(alsglobal.com\)](https://www.alsglobal.com).

Water analytical suites / testing parameters are provided to obtain overall water condition results and chemical sampling of collected water is undertaken for a range of nutrients, metals, and hydrocarbons relevant to stream health and aquatic assessment protocol, key nutrients, metals, and pollutants included in the assessment to reflect an overall suite of water quality condition guides which are listed below:

- Total phosphorous
- Total Nitrogen
- Kjeldahl Nitrogen
- Dissolved Metals
- PFAS
- Total Suspended Solids
- Total Hydrocarbons

The raw data results from the lab analysis provided to us by ALS Laboratory Services are presented within this report (see Appendix A).

Key water quality data attributes are recorded, tables and compared against; previous condition baseline data, Liverpool Development Control Plan (DCP) water quality targets, Conditions of Consent B40 and ANZECC Guideline (2000) trigger limits under the condition category -(90% protection criteria for freshwater natural systems). The water quality guidelines are applied to ensure adjacent natural waterways George River and Anzac creek are not adversely affected by poor water quality discharge from the Moorebank logistics park site and operations.

Trends observed in our datasets are analysed on a temporal scale with any trigger values for specific water quality measures highlighted and presented within the results chapter of each seasonal report.

2.3 Data Analysis

The water quality measurements collected are used to assess water quality at each site in terms of health of aquatic ecosystems by comparison with guideline values recommended by the ANZECC and ARMCANZ (2000) guidelines for the protection of lowland streams (i.e. systems at < 150 m altitude) in south-east Australia. This categorisation for stream health is deemed relevant for the description of Anzac Creek, the recipient natural way due to the location in the geomorphic landscape and correlations of expected biophysical health and habitat profiles for similar stream environments.

2.4 Survey dates and personnel

On October 8th 2024, ecologists from Apical Bushfire and Planning attended Moorebank Precinct West (MPW) to collect water quality data across the testing sites which are located within selected inlet points and discharge points within the stormwater drainage and management system (SIOMP) located within the Moorebank Logistics Park site West (See map image 2.).

Inlet and outlet points within the network are representative of variant sites where stormwater will enter a node of the system (as a point source) and then release from the that node of the system at a discharge point. By recording inlet and discharge data water quality can be tracked along the continuum within the system to determine condition changes and overall trends in measured quality at given sites.

This data was collected on behalf of MID plumbing in accordance with 'The Stormwater Infrastructure Operation and Maintenance Plan Moorebank Logistics Park – West Precinct 2020' and in compliance with Condition of Consent B40 (Liverpool City) for the subject site. The results of such monitoring data collection are presented within this report.

2.5 Rainfall

Between the 1st of September and the 30th of September 2024 Moorebank received approximately 36.6mm of rainfall (<http://www.bom.gov.au/climate/dwo/202409/html/IDCJDW2161.202409.shtml>). Between the 1st of October and the 8th of October 2024 Moorebank received approximately 8mm of rainfall.

Figure 1. Bureau of Meteorology Daily Weather Observation Holsworthy September 2024

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9 am				3 pm								
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa				
1	Su	7.3	26.5	0			NW	37	14:12	18.2	41		N	6	1012.6	26.2	18		NW	20	1008.3	
2	Mo	13.4	24.3	0			WNW	74	10:34	23.0	22		NW	20	1008.1	19.5	23		WSW	35	1013.0	
3	Tu	7.9	18.8	0			WSW	48	02:09	12.8	44		WSW	19	1029.5	17.6	32		ESE	13	1028.3	
4	We	2.3	22.9	0			N	37	11:25	10.5	69		W	9	1029.7	21.9	30		NE	15	1023.3	
5	Th	5.5	27.2	0			N	28	10:46	13.9	66	8	Calm		1024.6	27.0	28	7	N	15	1019.3	
6	Fr	10.7	29.4	0			NW	48	14:37	20.5	53		NNW	9	1022.5	29.0	25		NW	22	1017.3	
7	Sa	14.0	24.7	0			SE	43	13:08	23.9	46	6	ESE	11	1021.5	20.1	70	6	ESE	20	1021.2	
8	Su	14.5	20.8	0			SSW	22	07:01	14.9	54	8	WSW	13	1021.3	18.9	44	7	N	9	1016.3	
9	Mo	8.1	24.3	0			WSW	41	11:19	17.4	45		NW	13	1017.8	23.9	31		WSW	19	1014.8	
10	Tu	8.5	22.1	0			ENE	26	14:15	16.6	58		WNW	9	1025.7	20.6	58		E	15	1023.8	
11	We	6.7	26.1	0			S	33	19:53	16.5	75		Calm		1024.7	25.2	35		NNE	9	1019.6	
12	Th	15.2	20.1	0			S	57	15:21	16.9	70	8	S	22	1021.7	17.8	61	1	S	28	1021.8	
13	Fr	10.2	19.3	0			SW	30	09:33	12.9	58	8	WSW	13	1028.4	17.5	48	8	ESE	13	1025.1	
14	Sa	4.8	24.0	0			S	54	21:08	13.8	70		WNW	7	1023.6	23.0	28		W	13	1017.7	
15	Su	6.4	17.0	0			SSW	61	12:36	12.6	46	1	SSW	20	1026.8	15.7	37	7	S	30	1026.0	
16	Mo	3.5	19.9	0			E	31	13:14	11.3	51		WNW	9	1026.6	17.8	38		ESE	17	1022.6	
17	Tu	5.8	22.2	0			SE	30	15:39	14.5	51		W	11	1026.4	21.3	32		NW	13	1020.6	
18	We	4.2	26.1	0			WNW	44	15:12	16.5	37		W	17	1018.0	25.9	12		WNW	20	1011.9	
19	Th	7.9	26.7	0			W	59	15:34	17.3	37		WNW	6	1009.8	25.2	13		W	33	1005.1	
20	Fr	11.3	24.8	0			W	41	08:37	16.5	38		W	22	1010.9	24.4	18		W	17	1006.5	
21	Sa	8.3	24.2	0			WSW	39	16:26	18.6	41		WSW	11	1010.7	23.1	21		WNW	22	1008.5	
22	Su	8.2	25.7	0			WNW	33	13:50	18.8	41		NNW	11	1016.0	25.2	23		WNW	15	1013.1	
23	Mo	6.6	28.7	0			SW	33	16:37	18.6	51		NNW	9	1019.4	28.4	21		WNW	15	1015.0	
24	Tu	11.6	26.7	0			SSE	28	00:13	17.8	65	1	Calm		1021.6	23.0	53	5	E	17	1016.0	
25	We	13.9	26.8	0			W	31	16:29	18.3	64	8	Calm		1014.7	25.3	37	8	W	9	1009.2	
26	Th	10.5	13.5	8.6			S	54	02:38	10.8	91	8	SW	19	1019.2	10.9	89	8	SSW	19	1020.2	
27	Fr	10.2	17.2	12.2			SSE	41	05:24	13.1	83	8	S	15	1027.9	14.6	77	6	S	17	1026.9	
28	Sa	9.8	19.1	7.8			E	35	12:47	17.0	61	8	ESE	20	1029.4	17.4	63	8	ESE	19	1025.8	
29	Su	10.0	21.4	0.6			ENE	26	15:07	17.1	78	3	WSW	9	1023.7	19.7	74	8	NE	9	1019.0	
30	Mo	14.1	20.3	7.4			S	48	11:20	17.5	74	8	SW	17	1019.7	18.4	61	1	SSE	28	1020.2	
Statistics for September 2024																						
Mean		9.0	23.0							16.3	56	6		11	1021.1	21.5	40	6		18	1017.9	
Lowest		2.3	13.5	0						10.5	22	1	Calm		1008.1	10.9	12	1	#	9	1005.1	
Highest		15.2	29.4	12.2			WNW	74		23.9	91	8	#	22	1029.7	29.0	89	8	WSW	35	1028.3	
Total				36.6																		

IDCJDW2161.202409 Prepared at 13:00 UTC on Monday 14 October 2024

Figure 2. Bureau of Meteorology Daily Weather Observation Holsworthy October 2024

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9 am				3 pm								
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa				
1	Tu	7.6	23.0	0.2			E	37	15:50	17.0	65		Calm		1023.5	19.9	59		E	20	1020.9	
2	We	12.9	19.2	5.2			SSE	37	11:23	14.4	94	8	SSE	11	1030.8	18.5	62	6	SSE	19	1029.5	
3	Th	11.6	20.9	0.4			E	31	15:08	18.3	60	8	ENE	9	1031.0	18.9	54	1	E	20	1026.6	
4	Fr	6.3	24.7	0.2			ENE	24	14:37	16.1	68		NNW	9	1020.8	23.6	46	7	ENE	13	1013.3	
5	Sa	13.3	25.9	2.0			WNW	43	10:00	21.8	66	2	WNW	13	1007.6	24.8	30	5	W	19	1005.2	
6	Su	10.3	27.4	0			W	46	15:01	18.6	56		NNW	9	1011.1	27.1	27		W	17	1009.9	
7	Mo	10.2	29.1	0			SSE	50	22:52	18.5	61	1	NNW	7	1017.9	28.4	28		WNW	19	1014.3	
8	Tu	13.9	15.4	0			SSE	54	23:16	14.2	80	8	SSE	19	1023.2	14.3	62	8	SSE	26	1023.0	
9	We	11.9	16.8	0			SSE	31	11:14	15.3	60	8	S	17	1026.8	16.6	53	8	SSE	19	1025.4	
10	Th	10.4	24.9	0			N	33	11:23	15.9	74		NW	9	1023.8	23.9	45		NNW	11	1018.9	
11	Fr	12.5	24.9	0			SSE	31	22:37	18.6	74		WSW	6	1024.3	23.3	59	3	ESE	17	1019.9	
12	Sa	14.4	18.8	5.0			SSE	57	00:35	16.0	66	8	SSE	17	1026.6	17.1	49	7	SSE	22	1026.8	
13	Su	8.7	21.4	0			E	30	16:00	13.3	76	8	WSW	7	1027.6	20.6	48	8	ENE	15	1022.8	
14	Mo	9.0		0						16.2	71	8	W	9	1019.4	15.6	87	8	S	28	1017.4	
Statistics for the first 14 days of October 2024																						
Mean		10.9	22.5							16.7	69	6		10	1022.5	20.9	50	6		18	1019.6	
Lowest		6.3	15.4	0						13.3	56	1	Calm		1007.6	14.3	27	1	NNW	11	1005.2	
Highest		14.4	29.1	5.2			SSE	57		21.8	94	8	SSE	19	1031.0	28.4	87	8	S	28	1029.5	
Total				13.0																		

3. Results

Data results captured by our water quality sampling are presented herein and are representative of baseline water quality results for Moorebank Precinct West Basin 5. Threshold guideline quantitative values for the water quality parameter themes are compared and correlated to ANZECC/ARMCANZ (2000) guidelines under the categorisation thresholds – Waterway benchmark group: ‘The protection of slightly disturbed lowland river ecosystems in southeast Australia’.

As these are the first samples results collected under our scope for the SIOMP-MPW sites, the sampling results presented in this report will be considered for future analysis against subsequent results for use as baseline data for the drainage network SIOMP function.

Triggers Exceedances from both the In-Situ Data and the Laboratory Samples October 2024

Location Basin 6 Outflow 5.2

Dissolved Oxygen (DO %) is at 113.21% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

Total phosphorous was at 160 µg/L which is above the threshold of 25 50 µg/L for rivers flowing to the coast.

Total nitrogen was at 1,100 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This reading for nitrogen is considered high against the benchmark, function of the bioretention basins is not at optimal design given that the filtration profiling and vegetation design to absorb and process nitrogen and nitrates is not at a complete stage, the expectation that readings for nitrogen will improve in future as the basins are completed and function in accordance with final design which is current not the case for the site.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

All other tested attributes are considered to meet the ANZECC guidelines for natural low land rivers – which is applied within the report as a general benchmarking standard.

Literature Review

Peak Nitrogen Values

Nitrogen

Nitrogen has spiked to a level approximately 3 times the ANZECC trigger value for rivers flowing to the coast at this collection point.

<https://www.dcceew.gov.au/environment/protection/npi/resource/student/total-nitrogen-0>

Literature:

In a 1996 paper reported in the Journal of Hydrology B. Arheimer a, L. Andersson a, A. Lepistö b suggest that; Intensively drained catchments showed the quantitatively largest difference between growing and dormant seasons for NH₄ • N concentrations retained within the creek – stream system.

In general, links between nitrogen concentrations and flow/seasons could be related to annual mean temperature, annual mean concentrations and the water regime of the catchments. The geographical heterogeneity of detected links and the still rather low explanation level for the concentration variation, show the importance of a more dynamic approach to nitrogen monitoring and inclusion of reportable weather and flow conditions within the monitoring process.

It is advised that nitrogen levels recorded within the nearby Anzac Creek and potentially extend to nearby River WQ test results be quantified / evaluated and cross referenced with this data, to identify the existence of broader trends in the associated drainage network and recipient natural creek and river systems. Any longer-term trends and general pattern for increased nitrogen will continue to be assessed across future reporting periods. Testing at increased water depth at the source and after activation of the network after rainfall events will help calibrate this result against previous trends of much lower values.

observations suggest that nitrogen and phosphorus loads were driven primarily by surface runoff rather than groundwater discharge to natural streams.

Praktan D. Wadnerkar a, Luke Andrews a, Wei Wen Wong b, Xiaogang Chen a c, Rogger E. Correa a, Shane White a, Perran L.M. Cook b, Christian J. Sanders a d, Isaac R. Santos a e
Paper reported in Science of the Total Environment March 2021 suggest

‘Overall, intensive agricultural land use and episodic rainfall events were the major spatial and temporal drivers of nitrogen loads within a natural water body.’

J. S. Baron, E. K. Hall, B. T. Nolan, J. C. Finlay, E. S. Bernhardt, J. A. Harrison, F. Chan & E. W. Boyer; 2012
Article The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States, suggest

‘Alterations in precipitation amount and dynamics will alter runoff quality, thereby influencing both rates of Nr inputs to aquatic ecosystems and groundwater and the water residence times that affect Nr removal within aquatic systems.

Both infrastructure within the catchment and climate change alter the landscape connectivity and hydrologic residence time that are essential to denitrification process within a drainage system.

While Nr inputs to and removal rates from aquatic systems are influenced by climate and management, reduction of N inputs from their source will be the most effective means to prevent or to minimize environmental and economic impacts of excess Nr.

Of relevance to the subject site could be the accumulation of nitrates from oxides distributed by exhaust fumes from trucks and heavy combustion equipment as Oxides of nitrogen are contained in the exhaust fumes emitted

into the atmosphere by cars, aeroplanes, trains and boats. These emissions are dissolved by rain and then enter streams, lakes and other water bodies.

https://www.dcceew.gov.au/sites/default/files/documents/factsheet-totalnitrogen_0.pdf

What effect does total nitrogen have on the environment?

Total nitrogen can have damaging effects on the environment and particularly on aquatic life (the fish, shellfish and other creatures in our rivers, lakes and oceans) because most nitrogen is leaked into waterways. Total nitrogen can also lead to toxic blue-green algal blooms. Blue-green algae can harm humans and can make both humans and animals very sick. Do you see how important it is to help keep our waterways clean?

<https://nitrogen-generators.com/what-is-the-main-industrial-use-of-nitrogen/#:~:text=Food%20Packaging%3A%20It%20is%20common,snack%20foods%20can%20be%20extended.>

Five (5) Industrial Applications of Nitrogen

While the main industrial use of nitrogen is to create ammonia that is required for fertilizer, explosives, and other materials, it uses go far beyond these applications. From food packaging to pharmaceuticals, nitrogen gas can be found in more places and used for more purposes than you may have realized.

Food Packaging: It is common practice for food processing companies to use compressed nitrogen to displace oxygen in the packaging of perishable foods. Without oxygen, the shelf life of foods such as meats, fruits, vegetables, and various snack foods can be extended. Nitrogen can also add a cushion around food to keep it safe during transport.

Chemical Blanketing: Nitrogen is typically used to prevent fires and explosions in dangerous atmospheres like chemical plants or manufacturing facilities, by lowering the oxygen level below explosive limits.

Electronics: In the process of assembling electronics, nitrogen gas is used when two electronic components are forming a permanent connection, also known as soldering. The gas is used to reduce surface tension so there is a cleaner break away from the site of the electrical bond. Nitrogen gas is also used in a computer's main processing system to prevent it from overheating.

Laboratory: Laboratories require a very specific environment to ensure that tests and results are carried out accurately. Nitrogen gas is used to control oxygen levels, humidity and temperature, and maintain an appropriate atmosphere for highly sensitive procedures and equipment. Additionally, there are various pieces of laboratory equipment that require nitrogen for purging.

Laser Cutting: The application of nitrogen as a purging gas in the steel industry is extremely important. It is used as an assist gas to blow away molten material and achieve a stronger stainless or aluminized steel product that is also more resistant to corrosion.

<https://nigen.com/industries-that-benefit-from-on-site-nitrogen-systems/>

Industries That Benefit from On-Site Nitrogen Systems

Gaseous nitrogen is very useful in large-scale manufacturing and industrial applications. The large volumes of nitrogen gas required for these operations are either sourced from vendors in gas cylinders or generated on-site. In this article, we will highlight critical industrial processes that benefit from on-site nitrogen systems.

Elevation pH values recorded from location Discharge point 6

pH – Acidity, Alkalinity

https://www.umass.edu/mwwp/protocols/rivers/ph_alkalinity_river.html

Alkalinity is a measure of a river's "buffering capacity," or its ability to neutralize acids. Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H⁺ ions and lower the acidity of the water (which means increased pH). They do this usually by combining with the H⁺ ions to make new compounds. Without this acid neutralizing capacity, any acid added to a river would cause an immediate change in the pH.

Measuring alkalinity is important to determining a river's ability to neutralize acidic pollution (as measured by pH) from rainfall or snowmelt. It's one of the best measures of the sensitivity of the river to acid inputs.

Alkalinity comes from rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges. Total alkalinity is measured by collecting a water sample, and measuring the amount of acid needed to bring the sample to a pH of 4.2. At this pH all the alkaline compounds in the sample are "used up." The result is reported as milligrams per liter (mg/l) of calcium carbonate.

3.2 Interpreting Results

Dissolved Oxygen – Measures:

Dissolved oxygen (DO) is oxygen held (dissolved) in the water and available to aquatic organisms.

The amount of dissolved oxygen in a river or stream can tell us a lot about its water quality.

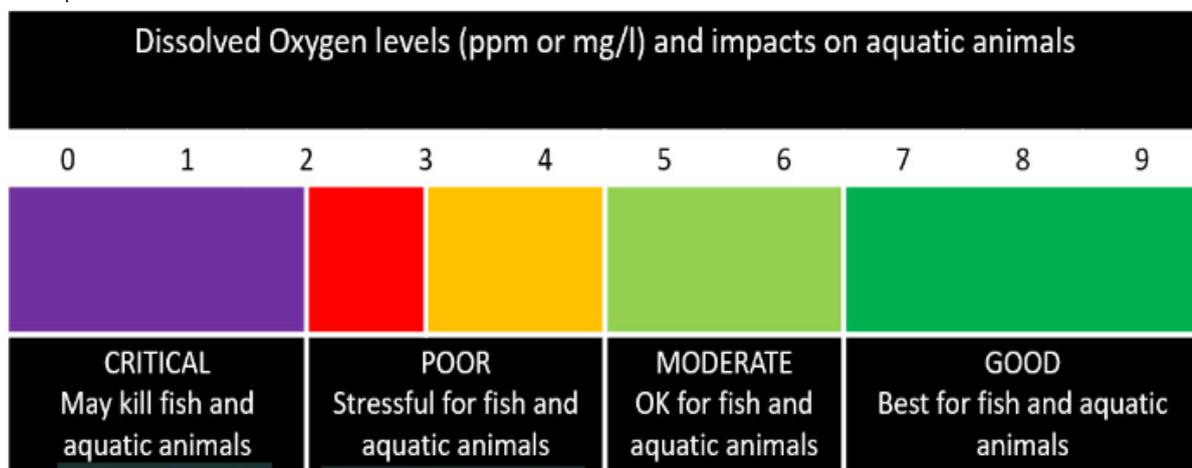
Water will naturally contain a certain amount of dissolved oxygen that is absorbed from the air and produced by plants and algae living in the water.

Temperature has a large effect on the amount of oxygen dissolved in water; cold water can hold higher levels of oxygen than warmer water. Higher water temperatures over summer will cause oxygen levels to drop.

Other factors such as river flow, wind, nutrients and bacterial activity can also affect the amount of dissolved oxygen in waterways.

Dissolved oxygen levels typically range between 5 and 14 mg/L (or ppm).

Example:



Salinity – Measures:

Electrical conductivity is a measure of the saltiness of the water and is measured on a scale from 0 to 50,000 uS/cm. Electrical conductivity is measured in microsiemens per centimeter (uS/cm). Freshwater is usually between 0 and 1,500 uS/cm and typical sea water has a conductivity value of about 50,000 uS/cm. Examples:

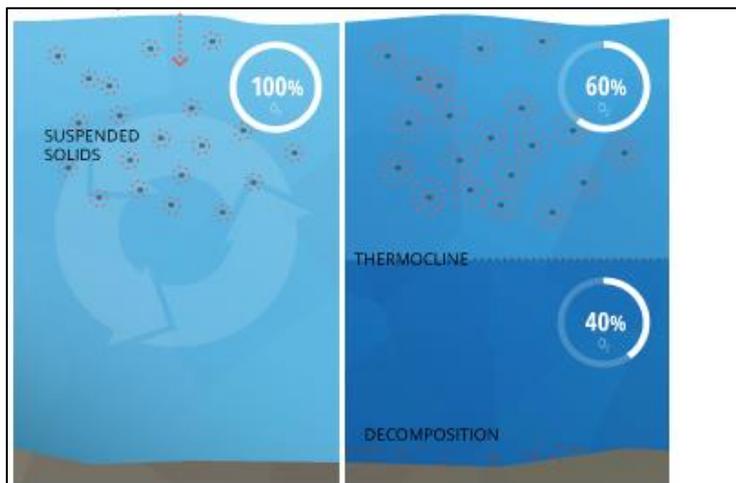
μS/cm	Use
0 - 800	<ul style="list-style-type: none">• Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material)• Generally good for irrigation, though above 300μS/cm some care must be, particularly with overhead sprinklers, which may cause leaf, scorch on some salt sensitive plants.• Suitable for all livestock
800 - 2500	<ul style="list-style-type: none">• Can be consumed by humans, although most would prefer water in the lower half of this range if available• When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants• Suitable for all livestock
2500 -10,000	<ul style="list-style-type: none">• Not recommended for human consumption, although water up to 3000 μS/cm can be consumed• Not normally suitable for irrigation, although water up to 6000 μS/cm can be used on very salt tolerant crops with very special management techniques. Over 6000 μS/cm, occasional emergency may be possible with care• When used for drinking water by poultry and pigs, the salinity should be limited to about 6000 μS/cm. Most other livestock can use water up to 10000 μS/cm

Total Dissolve Solids (TDS) – Measures

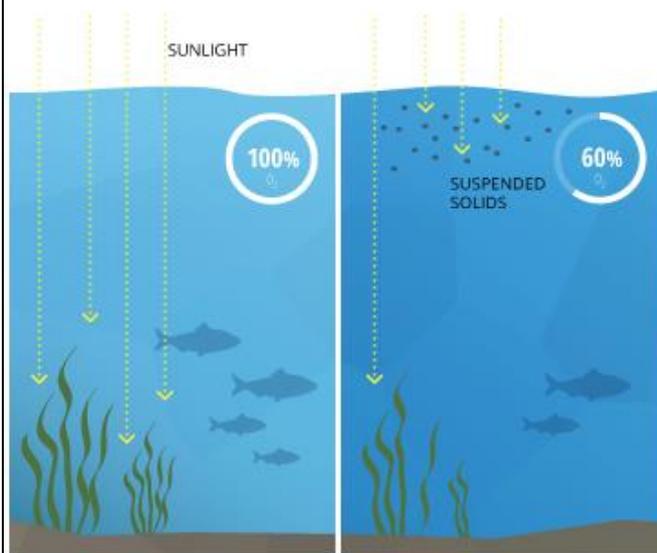
Dissolved solids, smaller than 2 microns, refer to any minerals, salts, metals, in the form of molecules, atoms, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that dissolve in water.

The TDS concentration is the sum of all filterable substances in water that can be determined gravimetrically. However, in most cases, TDS is primarily comprised of ions.

High levels of total suspended solids can affect turbidity, increase water temperatures and decrease dissolved oxygen (DO) levels. This can cause the water to heat up more rapidly because the suspended particles absorb more heat and deplete oxygen, which can adversely affect aquatic life.



Suspended solids can increase the temperature of water as they absorb additional heat from the sun. This can also cause dissolved oxygen levels to drop below the thermocline, creating hypoxic conditions.



Suspended solids, particularly algae, can block sunlight from reaching submerged plants. This can cause dissolved oxygen levels to drop, as the plants rely on respiration (consuming oxygen) instead of photosynthesis.

Turbidity – Total Suspended Solids (TSS)

Turbidity data are reported in Nephelometric Turbidity Units (NTU). To provide a sense of scale, water with a turbidity of 1 NTU is crystal clear, water at 5 NTU has a tiny trace of discoloration, and water at 100 NTU is brown and opaque. The standard is less than 10 NTU for rural streams and rivers and less than 30 NTU for urban lakes and ponds.

Total suspended solids (TSS) are particles that are larger than 2 microns found in the water column. Anything smaller than 2 microns (average filter size) is considered a dissolved solid. Most suspended solids are made up of inorganic materials, though bacteria and algae can also contribute to the total solids concentration.



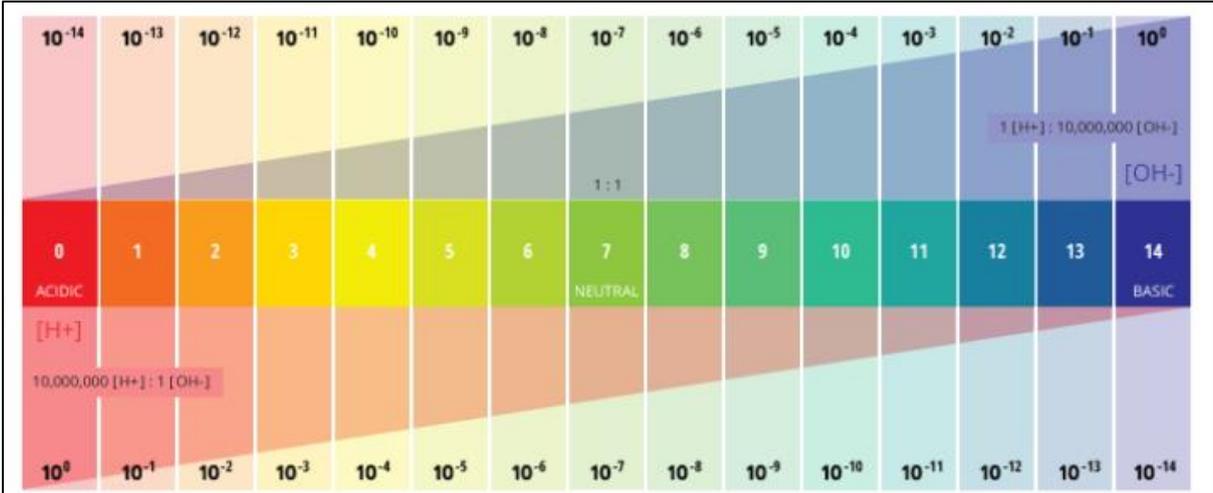
pH – Acidity / Alkalinity – Measures

The pH refers to the degree of acidity or alkalinity of a substance. A pH of 7 is neutral. A value above 7 indicates that the water is more alkaline and a pH below 7 indicates acidic conditions.

A pH of 7 is considered neutral. The logarithmic scale means that each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number. pH stands for the “power of hydrogen”³. The numerical value of pH is determined by the molar concentration of hydrogen ions (H⁺)³. This is done by taking the negative logarithm of the H⁺ concentration (-log(H⁺)).

Standard values for pH readings are expected, pH 6.5–9 for rural streams and rivers and pH 6–9 for urban lakes and ponds.

In freshwater systems pH sets up the conditions for how easy it is for nutrients to be available and how easily things like heavy metals (toxicity for aquatic life) can dissolve in the water. Rivers and lakes generally range between 5 (acidic) and 9 (basic) on the pH scale.



The logarithmic scale of pH means that as pH increases, the H⁺ concentration will decrease by a power of 10. Thus at a pH of 0, H⁺ has a concentration of 1 M. At a pH of 7, this decreases to 0.0000001 M. At a pH of 14, there is only 0.000000000000001 M

Summary of results

Aquatic ecosystems	
Indicator	Numerical criteria (trigger values)
Total phosphorus	<ul style="list-style-type: none"> Upland rivers: 20 µg/L Lowland rivers: 25 µg/L for rivers flowing to the coast; Lakes & reservoirs: 10 µg/L Estuaries: 30 µg/L
Total nitrogen	<ul style="list-style-type: none"> Upland rivers: 250 µg/L Lowland rivers: 350 µg/L for rivers flowing to the coast; Lakes & reservoirs: 350 µg/L Estuaries: 300µg/L
Chlorophyll-a	<ul style="list-style-type: none"> Upland rivers: not applicable Lowland rivers: 5 µg/L Lakes & reservoirs: 5 µg/L. Estuaries: 4 µg/L.
Turbidity	<ul style="list-style-type: none"> Upland rivers: 2–25 NTU (see supporting information) Lowland rivers: 6–50 NTU (see supporting information) Lakes & reservoirs: 1–20 NTU Estuaries: 0.5–10 NTU
Salinity (electrical conductivity)	<ul style="list-style-type: none"> Upland rivers: 30–350 µS/cm Lowland rivers: 125–2200 µS/cm supporting information
Dissolved oxygen	<ul style="list-style-type: none"> Upland rivers: 90–110% Lowland rivers: 85–110% Freshwater lakes & reservoirs: 90–110% Estuaries: 80–110% <p>Note: Dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability.</p>
pH	<ul style="list-style-type: none"> Upland rivers: 6.5–8.0 Lowland rivers: 6.5–8.5 Freshwater lakes & reservoirs: 6.5–8.0 Estuaries: 7.0–8.5 <p>Changes of more than 0.5 pH units from the natural seasonal maximum or minimum should be investigated.</p>

3.1 Key Summary of Results Spring (October) 2024

Dissolved Oxygen (DO %) is at 114.29% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Zinc is at 0.008mg/L which is at the threshold for lowland rivers, however marginally higher in value than the other basin records for this period.

Continue to monitor for trends under future readings.

All other tested attributes are considered to meet the ANZECC guidelines for natural low land rivers – which is applied within the report as a general benchmarking standard.

3.2 Recommendations

There are no water quality management recommendations provided under this reporting period.

STORMWATER DISCHARGE TESTING SITE

Site image 1. Testing site Basin 6 - Outflow



Table. In-situ data and observations Retention Basin 6 outflow

Moorebank West Precinct - Retention Basin 6 Outflow (MPW 5.2 outflow)			
Date: 09/10/2024	Time: 11:25am	Temp: 15.3°C	Humidity: 60%
Operator: Marco Perry		Coordinates: -33.947085, 150.917653	
Equipment used: Aquatroll 500			
Parameter	Recording	ANZECC ANZECC 2000 Guidelines *Lowland rivers	Triggered? Y/N
Temperature (Celcius)	20.1	Abnormal to seasonal variation	N
Dissolved Oxygen (DO %)	113.21%	*Lowland rivers Lower limit: 85% Upper Limit: 110%	Y
Dissolved Oxygen (DO ppm)	10.4 ppm	*Lowland rivers Lower limit: 85% Upper Limit: 110%	
Electrical Conductivity (C- um/cm)	7.3 C- um/cm	125–2200 µS/cm	N
pH	6.51	Min 6.5 Max 8.5	N
NTU	6.73	6-50	N

(a) Total phosphorus

Basin 6.1 inflow - Total phosphorous – Qube Logistics, Moorebank, NSW		Trigger Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results - Total phosphorous:	160 µg/L	25 µg/L - 50 µg/L	Y
Notes: <ul style="list-style-type: none">• Channel Culvert• Trigger value 50 µg/L for lowland rivers, trigger value 25 µg/L for rivers flowing to the coast Anzecc Guidelines 2000.			

(b) Total Nitrogen as N (TKN + NOx) by Discrete Analyser

Basin 6.1 inflow - Total nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results -Total nitrogen:	1,100 µg/L	350 µg/L for rivers flowing to the coast	Y
Notes: <ul style="list-style-type: none">• Total Nitrogen as N (TKN + NOx) by Discrete Analyser• Trigger values are based on a low-lying river			

(c) Kjeldahl nitrogen Total Kjeldahl Nitrogen as N

Basin 6.1 inflow - Kjeldahl nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results – kjeldahl nitrogen:	1,000 µg/L	-	-
Notes: <ul style="list-style-type: none">• Total Kjeldahl Nitrogen as N			

(d) Dissolved metals;

Basin 6.1 inflow - Dissolved metals – Qube Logistics, Moorebank, NSW			
Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			
Lab results – Dissolved metals:	Measures mg/L	Trigger value ANZECC Guidelines 2000 95% protection criteria	Triggered
Arsenic	<0.001	0.013 mg/L	N
Cadmium	<0.0001	0.0002 mg/L	N
Chromium	<0.001	0.001 mg/L	N
Copper	0.001	0.0014mg/L	N
Nickel	0.002	0.011 mg/L	N
Lead	<0.001	0.0034 mg/L	N
Zinc	<0.005	0.008 mg/L	N
Mercury	<0.0001	0.0006 mg/L	N
Notes: - ANZECC Guidelines (2000) suggest 0.002 mg/L is considered appropriate for slightly-moderately disturbed systems. - Copper and Zinc exceed ANZECC Guidelines			

(e) PFAS;

Basin 6.1 inflow - PFAS – Qube Logistics, Moorebank, NSW			
PFAS Surrogate	Measure µg/L	95% species protection (DEE 2016)	Triggered
Perfluorooctane sulfonic acid (PFOS) µg/L	101%	.13 (µg/L)	
Perfluorooctanoic acid (PFOA)	101%	220 (µg/L)	
Notes: This Guidance focuses on PFOS and PFOA as potential indicators of wider contamination by related PFASs. The reasons for this approach include: <ul style="list-style-type: none">• Most research undertaken on PFASs internationally and in Australia has focused on PFOS and PFOA due to their frequent occurrence in the environment, persistence, and bioaccumulation.• PFOS and PFOA can also be the breakdown endpoint of other precursor products.• PFOS and PFOA are the most commonly encountered PFAS in the environment and wildlife.• Information on other PFASs, of which there are several hundred known, is more limited.• Effective management of PFOS and PFOA may help address potential contamination where other PFASs may also be present. * DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.			

(f) Total suspended solids.

Basin 6.1 inflow - Total suspended solids – Qube Logistics, Moorebank, NSW		EPA exceedance value	Trigger
Lab results – Total suspended solids: mg/L	24 mg/L	50 mg/L	N
Notes: <ul style="list-style-type: none"> Total Suspended Solids dried at 104 ± 2°C 			

(g) Total hydrocarbons

Basin 6.1 inflow - Total hydrocarbons – Qube Logistics, Moorebank, NSW							
Lab results -Total hydrocarbons:	Trigger value ANZECC Guidelines 2000 – slightly disturbed lowland river ecosystem	Triggered	Baseline monitoring May 2024 (Apical)	Monitoring discharge points October 2024 (Apical)	Monitoring discharge points Month Year (Apical)	Monitoring discharge points Month Year (Apical)	Trend
Benzene µg/L	1300 µg/L	N	<1	<1			
Toluene µg/L	-	N	<2	<2			
Ethylbenzene µg/L	-	N	<2	<2			
meta-& para-Xylene µg/L	200 µg/L	N	<2	<2			
Ortho-Xylene µg/L	470 µg/L	N	<2	<2			
Total Xylenes µg/L	-	-	<2	<2			
Sum of BTEX µg/L	-	-	<1	<1			
Naphthalene µg/L	85 µg/L	N	<5	<5			
Notes: <ul style="list-style-type: none"> The data were compared to the default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000) for the protection of slightly disturbed lowland river ecosystems in southeast Australia. A commonly encountered example of additive toxicity of mixtures is the simple aromatic hydrocarbons commonly associated with contaminated petroleum sites, benzene, toluene, ethyl benzene and xylenes, collectively known as BTEX 							

Water Quality Monitoring Comparative Table (Temporal)

Retention Basin 6 MPW. Testing Site MPW 6 outflo

Testing Site 6 MPW Inflow	May 2024	Oct 2024	
pH	8.54	6.51	
Dissolved Oxygen - %/L	5.5 DO mg/L	10.4mg/L	
Actual Electronic Conductivity - ms/cm	0.627 SPC - ms/cm	7.3 <0.0001 (C _{um/cm})	
Temperature - °C	14.4	20.1	
Turbidity	6.13 NTU	6.73 NTU	
Total phosphorous - mg/L	0.42 mg/L	0.16 mg/L	
Total nitrogen - mg/L	3.7 mg/L	1.1 mg/L	
Kjeldahl nitrogen mg/L	1.8 mg/L	1.0 mg/L	
Dissolved metals			
Arsenic	0.003	<0.001	
Cadmium	<0.0001	<0.0001	
Chromium	0.001	<0.001	
Copper	0.005	0.001	
Nickel	0.002	0.002	
Lead	<0.001	<0.001	
Zinc	0.021	<0.005	
Mercury	<0.0001	<0.0001	
PFAS			
Lab results – SUM of PFAS Micrograms/L	0.10	1.55	
SUM of PFHxS & PFOS Microgrms/L	0.03	1.08	
Total suspended solids mg/L	<5	24	
Total hydrocarbons			
Benzene	<1	<1	
Toluene	<2	<2	
Ethylbenzene	<2	<2	
meta-& para-Xylene	<2	<2	
Ortho-Xylene	<2	<2	
Total Xylenes	<2	<2	
Sum of BTEX	<1	<1	
Naphthalene	<5	<5	-

Appendix A. Raw data tables; source - Australian Laboratory Services

Basin 6: Outflow

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time					09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00
Compound	CAS Number	LOR	Unit		EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFO\$AA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFO\$AA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FT\$)	757124-72-4	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FT\$)	27619-97-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FT\$)	39108-34-4	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FT\$)	120226-60-0	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS\$	---	0.01	µg/L		<0.01	0.69	1.55	0.04	0.08
Sum of PFHx\$ and PFO\$	355-46-4/1763-23-1	0.01	µg/L		<0.01	0.56	1.08	0.04	0.05
Sum of PFAS\$ (WA DER List)	---	0.01	µg/L		<0.01	0.65	1.49	0.04	0.08
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%		99.8	99.2	98.1	102	103
Toluene-D8	2037-26-5	2	%		101	98.3	97.7	102	99.9
4-Bromofluorobenzene	460-00-4	2	%		96.2	94.6	92.3	94.0	93.6
EP231S: PFAS Surrogate									
13C4-PFO\$	---	0.02	%		98.2	96.9	101	103	103
13C8-PFOA	---	0.02	%		98.7	97.9	101	101	101

Chemical	Trigger values for freshwater (μgL^{-1})				Trigger values for marine water (μgL^{-1})			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 ^C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 ^A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin	B	2.6	4.4	6	9 ^A	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 ^C	1000 ^C	ID	ID	ID	ID
Alcohol ethoxylated sulfate (AES)	340	650	850 ^C	1100 ^C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 ^C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons								
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 ^A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH >6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC_{50} data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) — check Section 8.3.7 for spread of data and its significance. 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Sections 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) — check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.

D = Ammonia as TOTAL ammonia as $[\text{NH}_3\text{-N}]$ at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2.

E = Chlorine as total chlorine, as [Cl]; see Section 8.3.7.2.

F = Cyanide as un-ionised HCN, measured as [CN]; see Section 8.3.7.2.

G = Sulfide as un-ionised H_2S , measured as [S]; see Section 8.3.7.2.

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30 mg/L CaCO_3 . These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.

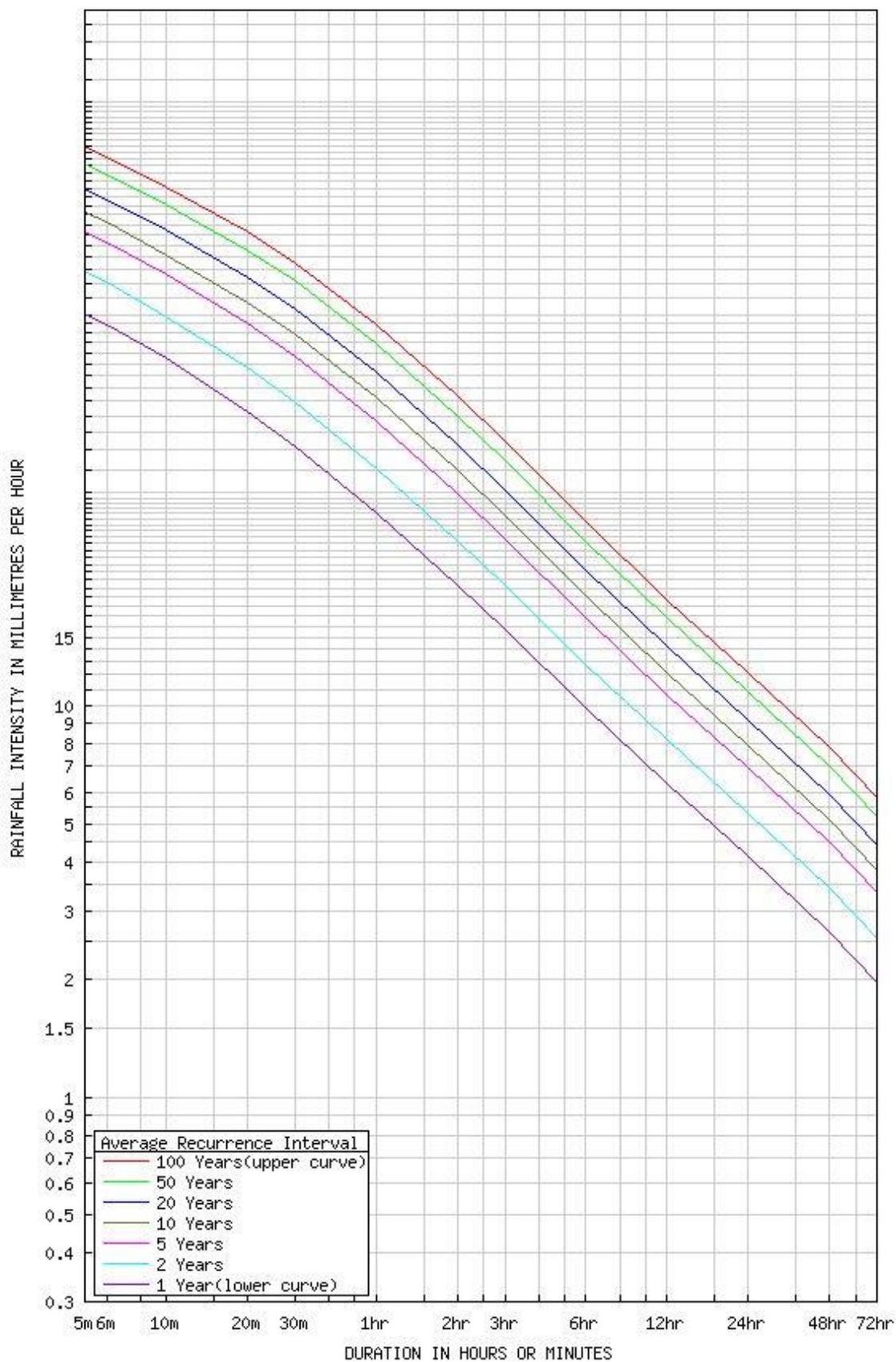
Table 5. Ecological water quality guideline values developed by water regulators

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - technical draft default guideline values for PFOS and PFOA.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The 99% species protection level for PFOS is close to the level of detection. Agencies may wish to apply a 'detect' threshold in such circumstances rather than a quantified measurement.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	Note 3: The WQGs advise ⁴¹ that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Regulators may specify or environmental legislation may prescribe the level of species protection required, rather than allowing for case-by-case assessments.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	As above. Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	

Australian Water Quality Guidelines for Fresh and Marine Waters

Type of indicator	Indicator	Units	Fresh waters	Marine waters
	Dissolved oxygen ²	mg/L	> 6 (> 80–90% saturation)	> 6 (> 80–90% saturation)
	Nutrients/nuisance growths	–	(Section 2.3.3)	(Section 2.3.3)
	pH	–	6.5–9.0	< 0.2 pH unit change
	Salinity	mg/L	< 1000 (about 1,500 µS/cm)	–
	Suspended particulate matter/turbidity	–	< 10% change seasonal mean concentration (see also colour & clarity)	< 10% change seasonal mean concentration (see also colour & clarity)
	Temperature ³	–	< 2°C increase	< 2°C increase
Toxicants				
Inorganic toxicants	Aluminium	µg/L	< 5.0 (if pH ≤ 6.5)	NR
	Aluminium	µg/L	< 100.0 (if pH > 6.5)	–
	Ammonia	µg/L	20.0–30.0 (Table 2.3)	NR
	Antimony	µg/L	30.0	500.0
	Arsenic	µg/L	50.0	50.0
	Beryllium	µg/L	4.0 ⁴	NR
	Cadmium	µg/L	0.2–2.0 ⁵	2.0
	Chromium	µg/L	10.0	50.0
	Copper	µg/L	2.0–5.0 ⁵	5.0
	Cyanide	µg/L	5.0	5.0
	Iron	µg/L	1,000.0 ⁶	NR
	Lead	µg/L	1.0–5.0 ⁵	5.0
	Mercury	µg/L	0.1	0.1
	Nickel	µg/L	15.0–150.0 ⁵	15.0
	Selenium	µg/L	5.0	70.0
	Silver	µg/L	0.1	1.0
	Sulfide	µg/L	2.0	2.0
	Thallium	µg/L	4.0	20.0
	Tin (tributyltin)	µg/L	0.008	0.002
Zinc	µg/L	5.0–50.0 ⁶	50.0	
Organic toxicants	Acrylonitrile	µg/L	NR	NR
	Benzidine	µg/L	NR	NR
	Dichlorobenzidine	µg/L	NR	NR
	Diphenylhydrazine	µg/L	NR	NR
Halogenated aliphatic compounds	Hexachlorobutadiene	µg/L	0.1	0.3
	Halogenated ethers	µg/L	NR	NR
	Isophorone	µg/L	NR	NR
Monocyclic aromatic compounds	Benzene	µg/L	300.0	300.0
	Chlorinated benzenes	µg/L	(Table 2.8)	NR

Appendix C. Intensity Frequency Duration – Average Recurrence Interval Indicator
[Intensity-Frequency-Duration \(bom.gov.au\)](http://Intensity-Frequency-Duration (bom.gov.au))



Moorebank Logistics Park West Precinct

Basin 8

Spring Stormwater Network Water Quality
Monitoring Data & Reporting October 2024



Site image: retention basin 8 MPW (Apical image October 2024)

Prepared for: MID Plumbing P/L

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ABN: 656 420 10 400

Consulted Documents / database.

Australia and New Zealand Guidelines for fresh and Marine Water Quality (2000)

[NATIONAL WATER QUALITY MANAGEMENT STRATEGY - Australian and New Zealand Guidelines for Fresh and Marine Water Quality \(2000\) - Volume 2 - Aquatic ecosystems](#)

Bureau of Meteorology – Australian Government [Australia's official weather forecasts & weather radar - Bureau of Meteorology \(bom.gov.au\)](#)

Moorebank Intermodal Precinct West – Stage 3 (SSD 10431) | Assessment Report March 2021

<https://moorebankintermodalprecinct.com.au/wp-content/uploads/2023/04/MPW-S3-DPIE-assessment-report-to-IPC.pdf>

WQM Report Western Precinct _Basin 8_Autumn 2024 – Apical Bushfire and Planning - April 2024

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Lot 2 DP 1197707 Part Lot 3 DP 1197707 Part Anzac Road and Moorebank Avenue public road reserves Development: Moorebank Precinct West Stage 2 (MPW Stage 2)

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 10431 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot 100 DP 1049508 Lot 101 DP 1049508 Moorebank Precinct West Stage 3 (MPW Stage 3)

Australian Laboratory Services (ALS) Work Order EW2402561 Certificate of Analysis Water Sample Data 31st May 2024.

Liverpool DCP

[Liverpool's Development Control Plans | Liverpool City Council \(nsw.gov.au\)](#)

DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.

<https://environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgt-guidance-pfos-pfoa.pdf>

Development Consent SSD 7709 - Section 4.38 of the Environmental Planning and Assessment Act 1979

<https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2019/05/moorebank-intermodal-precinct-west-stage-2/referral-from-department-of-planning-and-environment/revised-recommended-conditions/mpw-stage-2-recommended-conditions-inclusive-of-edits-191105.pdf>

Glossary

The following definitions apply to terms used in this report. Many of these definitions are consistent with relevant national literature and cited where appropriate.

Current status trigger value

Concentrations of water quality indicators that reflect existing ecosystem condition, and therefore provide a target for ecosystem maintenance and a benchmark against which future water quality trends may be monitored.

Environmental value

Particular values or uses of the environment important for a healthy ecosystem or for public benefit, welfare, safety or health and requiring protection from the effects of pollution or degradation (Environment Australia 2002).

Indicator

A parameter (biological, physical or chemical) used to provide a measure of the quality of water or the condition of an ecosystem (Environment Australia 2002).

Low-risk trigger value

Concentrations (or loads) of key performance indicators [of water quality] at which if not exceeded, there is a low risk that adverse biological effects will occur (ANZECC 2000a).

Median

The middle reading, or 50th percentile, of all readings taken. i.e. of the readings 10, 13, 9, 16 and 11 (re-ordering these to read 9, 10, 11, 13 and 16), the median is 11. The mean (or average), is the sum of all values divided by the total number of readings (which in this case equals 11.8).

Reference condition

Refers to a site which is unmodified or minimally modified from 'natural' condition. Most commonly, reference sites are subject to limited disturbance from human activity. The reference condition then serves as a standard or target against which environmental change in other similar sites can be assessed.

Trigger value

A concentration that, if exceeded, would indicate a potential environmental problem, and so 'trigger' a management response, such as further investigation and/or remedial actions (ANZECC 2000a).

Water quality guideline

A numerical concentration level (e.g. of a contaminant) or narrative statement (e.g. visual appearance of a water body) recommended to support and maintain a designated water use (ANZECC 2000a)

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 3 (the Project) of Moorebank Precinct West (MPW), which comprises the third stage of development within the Moorebank Precinct West under Development Approval SSD-10431.

The proposal is SSD under clause 19 of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, as it is development for the purpose of rail and related transport facilities.

The MPW site is located on the western side of Moorebank Avenue and forms the western section of the Moorebank Intermodal Precinct (Map image 1 & 2). The MPW site is approximately 2.5 kilometres (km) from the Liverpool city centre, 27 km south-west of the Sydney Central Business District (CBD) and 26 km west of Port Botany.

The MPW site is irregular in shape, approximately 3 km from north to south and 960 m from east to west at its widest point and covers an area of approximately 220 ha. It is situated between the Georges River to the west (with the SSFL running north-south to the west of the river); and Moorebank Avenue to the east.

Works on the MPW site to date have commenced under two current and active development consents:

- MPW Stage 1 early works, which provides demolition, rehabilitation, remediation of contaminated land, and the establishment of construction facilities and access including site security (as part of the SSD 5066 consent)
- MPW Stage 2, which provides for the construction and 24/7 operation of an intermodal facility and associated warehousing (SSD 7709).

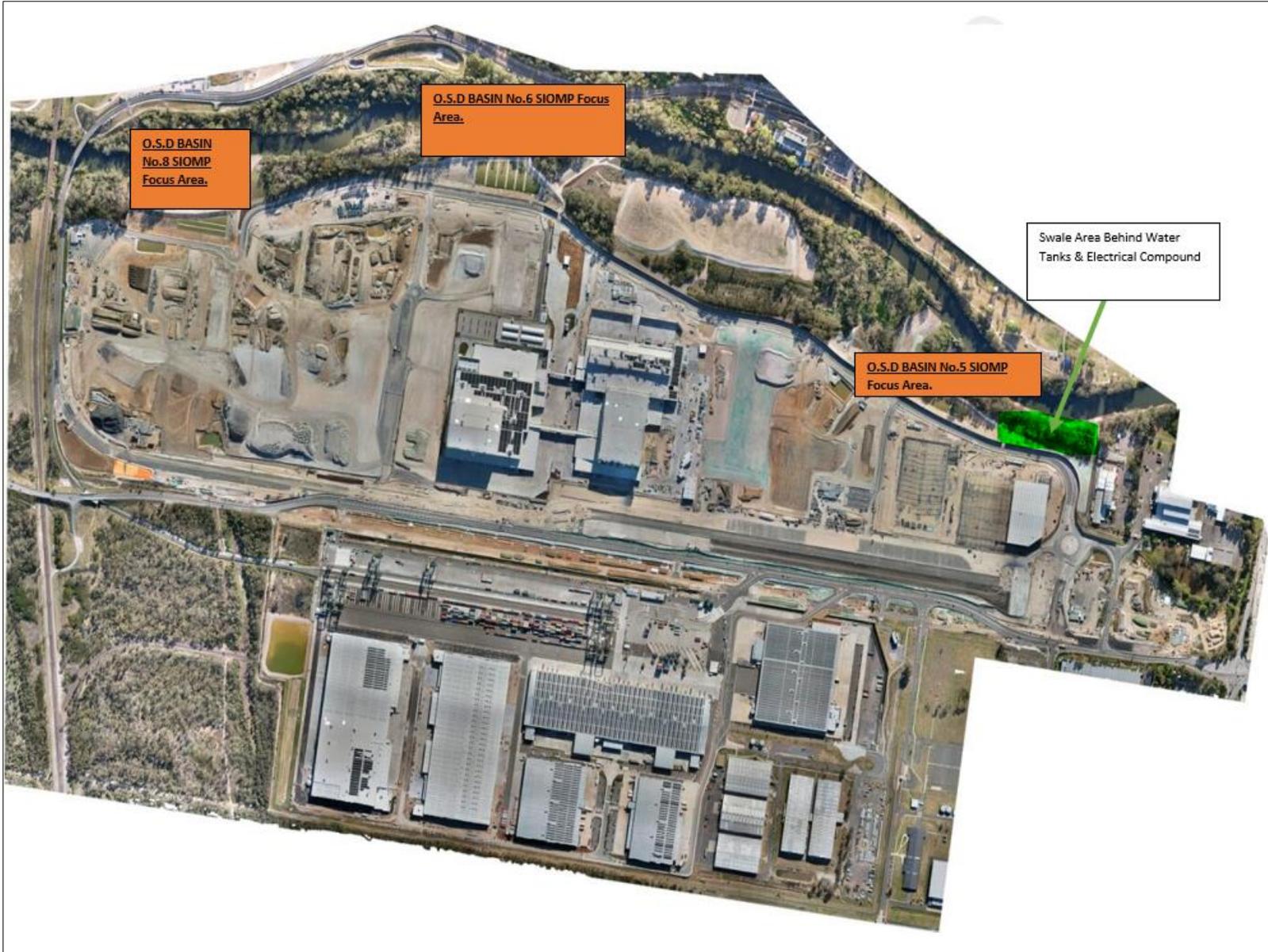
Across the entire precinct there are six onsite detention basins. Bioretention/biofiltration systems also make up the stormwater management infrastructure within the site.

This water quality monitoring program is guided by the Stormwater Infrastructure Operation and Maintenance Plan (SIOPM) and is provided to Qube Holdings Limited (the Applicant) on behalf of MID Plumbing. Three onsite bio-retention basins are present within Moorebank Precinct West. This report is in reference to Basin 8 (MPW – south).

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Moorebank Precinct West Stage 2 (MPW Stage 2)

CoC	Requirement
Stormwater Quality Monitoring	
B38.	Stormwater Quality Monitoring Program - Prior to commencement of operation Part of the Operational Environmental Management Plan

Map Image 2. Moorebank Precinct West Detention Basins (provided by MID Plumbing)



2. Monitoring Program Methodology

2.1 Monitoring Sites

To support stormwater and drainage management of the facility the MLP West precinct has established a vast stormwater infrastructure system consisting of several Water Sensitive Urban Design (WSUD) functions including raingardens detention basins and bio-swales. These networks are designed to minimise the velocity and peak discharge of stormwater draining from the site and act as onsite detention basins to harvest and sequester potential pollutants generated at the site through designed biological processes.

The stormwater infrastructure system discharges water into the natural drainage system via three outlets:

- Basin 5 detains water from the northern section of MPW before discharging into Georges River
- Basin 6 detains water from the mid-section of MPW before discharging into Georges River
- Basin 8 detains water from the southern section of MPW before discharging into Georges River

Monitoring of the discharge points has been established via our ongoing program with MID Plumbing under the SIOMP program to collect qualitative data and analyse the performance of the WSUD provisions and to establish any potential trends in water quality readings from the stormwater network discharge points prior to release of water into the natural hydrological systems of Anzac Creek and the Georges River.

Table 1. Type of outlet MPW

Discharge Point (see figure 2)	Associated Outlet (see figure 1)	Type of outlet/detention basin
Basin 5	Inlet	Bio retention
	Outlet	Outlet point
	Georges River	River
Basin 6	Inlet	Bio retention
	Outlet	Outlet point
Basin 8	Inlet	Bio retention
	Outlet	Outlet structure

2.2 Water Quality Assessment

Surface water quality data collected at the discharge points is assessed with reference to ANZECC Guidelines (2000) and correlated with baseline Water Quality monitoring results provided by previous condition assessment reports.

By comparing water test data under the program across the testing timeline we can identify and report upon trends, identify exceedances and exclude potential anomalies for datasets.

Table. ANZECC Low Risk Trigger Values

Ecosystem type	Turbidity NTU	EC µS/cm	pH*	DO	TN mg/L	NO _x -N mg/L	NH ₄ ⁺ -N mg/L	TP mg/L	DRP - P mg/L
Upland river	2-25	30-350	6.5-7.5	90-110	0.480	0.190	0.013	0.013	0.005
Lowland river	6-50	125-2200	6.5-8.0	85-110	0.500	0.190	0.020	0.050	0.020

Values for Low Land River Systems as insert above are used as the reference guide to water quality parameter values and overall health and safety statements regarding the quality of discharged water from the SIOMP drainage network.

Annual spring and autumn water quality data presented from Anzac Creek and Georges River testing programs by other scientific consultants may also be cross referenced to the data prepared by Apical under the SIOMP program to establish potential trends in results and identify increases in accumulated pollutants from the site under operational condition, which may appear present within adjacent natural waterways.

Site data was collected in the form of water samples and in field data recordings at the prescribed monitoring points, water samples and water probe readings are undertaken following Australia and New Zealand guidelines for fresh and marine water quality – 2000 (ANZECC Guidelines), In situ water quality parameters relevant to stream health and aquatic assessment profiling were collected in field with a multiparameter hand-held water quality monitoring probe (Aquatroll 600).

Water data is collected, analysed and collated under the same methodologies and process under each testing period, the ensure consistency in the process.

Measures tested and samples taken:

- pH
- Dissolved Oxygen
- Electrical Conductivity
- Water Temperature and
- Turbidity

Water samples are collected at inlet and discharge points (Basin 5, Basin 6 & Basin 8) then sent to Australian Laboratory Services (ALS) for quality testing analysis [Surface water \(alsglobal.com\)](http://www.alsglobal.com).

Water analytical suites / testing parameters are provided to obtain overall water condition results and chemical sampling of collected water is undertaken for a range of nutrients, metals, and hydrocarbons relevant to stream health and aquatic assessment protocol, key nutrients, metals, and pollutants included in the assessment to reflect an overall suite of water quality condition guides which are listed below:

- Total phosphorous
- Total Nitrogen
- Kjeldahl Nitrogen
- Dissolved Metals
- PFAS
- Total Suspended Solids
- Total Hydrocarbons

The raw data results from the lab analysis provided to us by ALS Laboratory Services are presented within this report (see Appendix A).

Key water quality data attributes are recorded, tables and compared against; previous condition baseline data, Liverpool Development Control Plan (DCP) water quality targets, Conditions of Consent B40 and ANZECC Guideline (2000) trigger limits under the condition category -(90% protection criteria for freshwater natural systems).

The water quality guidelines are applied to ensure adjacent natural waterways George River and Anzac creek are not adversely affected by poor water quality discharge from the Moorebank logistics park site and operations.

Trends observed in our datasets are analysed on a temporal scale with any trigger values for specific water quality measures highlighted and presented within the results chapter of each seasonal report. This report provides baseline data for Basin 5 (MPW) from which trend analysis will compound over future reporting periods.

2.3 Data Analysis

The water quality measurements collected are used to assess water quality at each site in terms of health of aquatic ecosystems by comparison with guideline values recommended by the ANZECC and ARM CANZ (2000) guidelines for the protection of lowland streams (i.e. systems at < 150 m altitude) in south-east Australia. This categorisation for stream health is deemed relevant for the description of Anzac Creek, the recipient natural way due to the location in the geomorphic landscape and correlations of expected biophysical health and habitat profiles for similar stream environments.

2.4 Survey dates and personnel

On the 9th October 2024, ecologists from Apical Bushfire and Planning attended Moorebank Precinct West (MPW) to collect water quality data across the testing sites which are located within selected inlet points and discharge points within the stormwater drainage and management system (SIOMP) located within the Moorebank Logistics Park site West (See map image 2).

Inlet and outlet points within the network are representative of variant sites where stormwater will enter a node of the system (as a point source) and then release from the that node of the system at a discharge point. By recording inlet and discharge data water quality can be tracked along the continuum within the system to determine condition changes and overall trends in measured quality at given sites.

This data was collected on behalf of MID plumbing in accordance with 'The Stormwater Infrastructure Operation and Maintenance Plan Moorebank Logistics Park – West Precinct 2020' and in compliance with Condition of Consent B40 (Liverpool City) for the subject site. The results of such monitoring data collection are presented within this report.

2.5 Rainfall

Between the 1st of September and the 30th of September 2024 Moorebank received approximately 36.6mm of rainfall (<http://www.bom.gov.au/climate/dwo/202409/html/IDCJDW2161.202409.shtml>). Between the 1st of October and the 8th of October 2024 Moorebank received approximately 8mm of rainfall.

Figure 1. Bureau of Meteorology Daily Weather Observation Holsworthy September 2024

Date	Day	Temps		Rain mm	Evap mm	Sun hours	Max wind gust			9 am				3 pm								
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa				
1	Su	7.3	26.5	0			NW	37	14:12	18.2	41		N	6	1012.6	26.2	18		NW	20	1008.3	
2	Mo	13.4	24.3	0			WNW	74	10:34	23.0	22		NW	20	1008.1	19.5	23		WSW	35	1013.0	
3	Tu	7.9	18.8	0			WSW	48	02:09	12.8	44		WSW	19	1029.5	17.6	32		ESE	13	1028.3	
4	We	2.3	22.9	0			N	37	11:25	10.5	69		W	9	1029.7	21.9	30		NE	15	1023.3	
5	Th	5.5	27.2	0			N	28	10:46	13.9	66	8	Calm	1024.6	27.0	28	7	N	15	1019.3		
6	Fr	10.7	29.4	0			NW	48	14:37	20.5	53		NNW	9	1022.5	29.0	25		NW	22	1017.3	
7	Sa	14.0	24.7	0			SE	43	13:08	23.9	46	6	ESE	11	1021.5	20.1	70	6	ESE	20	1021.2	
8	Su	14.5	20.8	0			SSW	22	07:01	14.9	54	8	WSW	13	1021.3	18.9	44	7	N	9	1016.3	
9	Mo	8.1	24.3	0			WSW	41	11:19	17.4	45		NW	13	1017.8	23.9	31		WSW	19	1014.8	
10	Tu	8.5	22.1	0			ENE	26	14:15	16.6	58		WNW	9	1025.7	20.6	58		E	15	1023.8	
11	We	6.7	26.1	0			S	33	19:53	16.5	75		Calm	1024.7	25.2	35		NNE	9	1019.6		
12	Th	15.2	20.1	0			S	57	15:21	16.9	70	8	S	22	1021.7	17.8	61	1	S	28	1021.8	
13	Fr	10.2	19.3	0			SW	30	09:33	12.9	58	8	WSW	13	1028.4	17.5	48	8	ESE	13	1025.1	
14	Sa	4.8	24.0	0			S	54	21:08	13.8	70		WNW	7	1023.6	23.0	28		W	13	1017.7	
15	Su	6.4	17.0	0			SSW	61	12:36	12.6	46	1	SSW	20	1026.8	15.7	37	7	S	30	1026.0	
16	Mo	3.5	19.9	0			E	31	13:14	11.3	51		WNW	9	1026.6	17.8	38		ESE	17	1022.6	
17	Tu	5.8	22.2	0			SE	30	15:39	14.5	51		W	11	1026.4	21.3	32		NW	13	1020.6	
18	We	4.2	26.1	0			WNW	44	15:12	16.5	37		W	17	1018.0	25.9	12		WNW	20	1011.9	
19	Th	7.9	26.7	0			W	59	15:34	17.3	37		WNW	6	1009.8	25.2	13		W	33	1005.1	
20	Fr	11.3	24.8	0			W	41	08:37	16.5	38		W	22	1010.9	24.4	18		W	17	1006.5	
21	Sa	8.3	24.2	0			WSW	39	16:26	18.6	41		WSW	11	1010.7	23.1	21		WNW	22	1008.5	
22	Su	8.2	25.7	0			WNW	33	13:50	18.8	41		NNW	11	1016.0	25.2	23		WNW	15	1013.1	
23	Mo	6.6	28.7	0			SW	33	16:37	18.6	51		NNW	9	1019.4	28.4	21		WNW	15	1015.0	
24	Tu	11.6	26.7	0			SSE	28	00:13	17.8	65	1	Calm	1021.6	23.0	53	5	E	17	1016.0		
25	We	13.9	26.8	0			W	31	16:29	18.3	64	8	Calm	1014.7	25.3	37	8	W	9	1009.2		
26	Th	10.5	13.5	8.6			S	54	02:38	10.8	91	8	SW	19	1019.2	10.9	89	8	SSW	19	1020.2	
27	Fr	10.2	17.2	12.2			SSE	41	05:24	13.1	83	8	S	15	1027.9	14.6	77	6	S	17	1026.9	
28	Sa	9.8	19.1	7.8			E	35	12:47	17.0	61	8	ESE	20	1029.4	17.4	63	8	ESE	19	1025.8	
29	Su	10.0	21.4	0.6			ENE	26	15:07	17.1	78	3	WSW	9	1023.7	19.7	74	8	NE	9	1019.0	
30	Mo	14.1	20.3	7.4			S	48	11:20	17.5	74	8	SW	17	1019.7	18.4	61	1	SSE	28	1020.2	
Statistics for September 2024																						
Mean		9.0	23.0							16.3	56	6		11	1021.1	21.5	40	6		18	1017.9	
Lowest		2.3	13.5	0						10.5	22	1		Calm	1008.1	10.9	12	1	#	9	1005.1	
Highest		15.2	29.4	12.2						23.9	91	8		#	22	1029.7	29.0	89	8	WSW	35	1028.3
Total				36.6																		

IDCJDW2161.202409 Prepared at 13:00 UTC on Monday 14 October 2024

Figure 2. Bureau of Meteorology Daily Weather Observation Holsworthy October 2024

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am				3 pm								
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				mm	mm	hours	km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa	
1	Tu	7.6	23.0	0.2			E	37	15:50		17.0	65		Calm	1023.5	19.9	59		E	20	1020.9	
2	We	12.9	19.2	5.2			SSE	37	11:23		14.4	94	8	SSE	11	1030.8	18.5	62	6	SSE	19	1029.5
3	Th	11.6	20.9	0.4			E	31	15:08		18.3	60	8	ENE	9	1031.0	18.9	54	1	E	20	1026.6
4	Fr	6.3	24.7	0.2			ENE	24	14:37		16.1	68		NNW	9	1020.8	23.6	46	7	ENE	13	1013.3
5	Sa	13.3	25.9	2.0			WNW	43	10:00		21.8	66	2	WNW	13	1007.6	24.8	30	5	W	19	1005.2
6	Su	10.3	27.4	0			W	46	15:01		18.6	56		NNW	9	1011.1	27.1	27		W	17	1009.9
7	Mo	10.2	29.1	0			SSE	50	22:52		18.5	61	1	NNW	7	1017.9	28.4	28		WNW	19	1014.3
8	Tu	13.9	15.4	0			SSE	54	23:16		14.2	80	8	SSE	19	1023.2	14.3	62	8	SSE	26	1023.0
9	We	11.9	16.8	0			SSE	31	11:14		15.3	60	8	S	17	1026.8	16.6	53	8	SSE	19	1025.4
10	Th	10.4	24.9	0			N	33	11:23		15.9	74		NW	9	1023.8	23.9	45		NNW	11	1018.9
11	Fr	12.5	24.9	0			SSE	31	22:37		18.6	74		WSW	6	1024.3	23.3	59	3	ESE	17	1019.9
12	Sa	14.4	18.8	5.0			SSE	57	00:35		16.0	66	8	SSE	17	1026.6	17.1	49	7	SSE	22	1026.8
13	Su	8.7	21.4	0			E	30	16:00		13.3	76	8	WSW	7	1027.6	20.6	48	8	ENE	15	1022.8
14	Mo	9.0		0							16.2	71	8	W	9	1019.4	15.6	87	8	S	28	1017.4
Statistics for the first 14 days of October 2024																						
Mean		10.9	22.5								16.7	69	6	10	1022.5	20.9	50	6		18	1019.6	
Lowest		6.3	15.4	0							13.3	56	1	Calm	1007.6	14.3	27	1	NNW	11	1005.2	
Highest		14.4	29.1	5.2			SSE	57			21.8	94	8	SSE	19	1031.0	28.4	87	8	S	28	1029.5
Total				13.0																		

3. Results

Data results captured by our water quality sampling are presented herein and are representative of baseline water quality results for Moorebank Precinct West Basin 8. Threshold guideline quantitative values for the water quality parameter themes are compared and correlated to ANZECC/ARMCANZ (2000) guidelines under the categorisation thresholds – Waterway benchmark group: ‘The protection of slightly disturbed lowland river ecosystems in southeast Australia’.

As these are the first samples results collected under our scope for the SIOMP-MPW sites, the sampling results presented in this report will be considered for future analysis against subsequent results for use as baseline data for the drainage network SIOMP function.

Triggers Exceedances from both the In-Situ Data and the Laboratory Samples October 2024

Location Basin 8 Outflow 5.2

Dissolved Oxygen (DO %) is at 114.29% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

Total phosphorous was at 50 µg/L which is above the threshold of 25- 50 µg/L for rivers flowing to the coast.

Total nitrogen was at 800 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This reading for nitrogen is considered high against the benchmark, function of the bioretention basins is not at optimal design given that the filtration profiling and vegetation design to absorb and process nitrogen and nitrates is not at a complete stage, the expectation that readings for nitrogen will improve in future as the basins are completed and function in accordance with final design which is current not the case for the site.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

All other tested attributes are considered to meet the ANZECC guidelines for natural low land rivers – which is applied within the report as a general benchmarking standard.

Literature Review

Peak Nitrogen Values

Nitrogen

Nitrogen has spiked to a level approximately 3 times the ANZECC trigger value for rivers flowing to the coast at this collection point.

<https://www.dcceew.gov.au/environment/protection/npi/resource/student/total-nitrogen-0>

Literature:

In a 1996 paper reported in the Journal of Hydrology B. Arheimer a, L. Andersson a, A. Lepistö b suggest that; Intensively drained catchments showed the quantitatively largest difference between growing and dormant seasons for NH₄ • N concentrations retained within the creek – stream system.

In general, links between nitrogen concentrations and flow/seasons could be related to annual mean temperature, annual mean concentrations and the water regime of the catchments. The geographical heterogeneity of detected links and the still rather low explanation level for the concentration variation, show the importance of a more dynamic approach to nitrogen monitoring and inclusion of reportable weather and flow conditions within the monitoring process.

It is advised that nitrogen levels recorded within the nearby Anzac Creek and potentially extend to nearby River WQ test results be quantified / evaluated and cross referenced with this data, to identify the existence of broader trends in the associated drainage network and recipient natural creek and river systems. Any longer-term trends and general pattern for increased nitrogen will continue to be assessed across future reporting periods. Testing at increased water depth at the source and after activation of the network after rainfall events will help calibrate this result against previous trends of much lower values.

observations suggest that nitrogen and phosphorus loads were driven primarily by surface runoff rather than groundwater discharge to natural streams.

Praktan D. Wadnerkar a, Luke Andrews a, Wei Wen Wong b, Xiaogang Chen a c, Rogger E. Correa a, Shane White a, Perran L.M. Cook b, Christian J. Sanders a d, Isaac R. Santos a e
Paper reported in Science of the Total Environment March 2021 suggest

‘Overall, intensive agricultural land use and episodic rainfall events were the major spatial and temporal drivers of nitrogen loads within a natural water body.’

J. S. Baron, E. K. Hall, B. T. Nolan, J. C. Finlay, E. S. Bernhardt, J. A. Harrison, F. Chan & E. W. Boyer; 2012
Article The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States, suggest

‘Alterations in precipitation amount and dynamics will alter runoff quality, thereby influencing both rates of Nr inputs to aquatic ecosystems and groundwater and the water residence times that affect Nr removal within aquatic systems.

Both infrastructure within the catchment and climate change alter the landscape connectivity and hydrologic residence time that are essential to denitrification process within a drainage system.

While Nr inputs to and removal rates from aquatic systems are influenced by climate and management, reduction of N inputs from their source will be the most effective means to prevent or to minimize environmental and economic impacts of excess Nr.

Of relevance to the subject site could be the accumulation of nitrates from oxides distributed by exhaust fumes from trucks and heavy combustion equipment as Oxides of nitrogen are contained in the exhaust fumes emitted into the atmosphere by cars, aeroplanes, trains and boats. These emissions are dissolved by rain and then enter

streams, lakes and other water bodies.

https://www.dcceew.gov.au/sites/default/files/documents/factsheet-totalnitrogen_0.pdf

What effect does total nitrogen have on the environment?

Total nitrogen can have damaging effects on the environment and particularly on aquatic life (the fish, shellfish and other creatures in our rivers, lakes and oceans) because most nitrogen is leaked into waterways. Total nitrogen can also lead to toxic blue-green algal blooms. Blue-green algae can harm humans and can make both humans and animals very sick. Do you see how important it is to help keep our waterways clean?

<https://nitrogen-generators.com/what-is-the-main-industrial-use-of-nitrogen/#:~:text=Food%20Packaging%3A%20It%20is%20common,snack%20foods%20can%20be%20extended.>

Five (5) Industrial Applications of Nitrogen

While the main industrial use of nitrogen is to create ammonia that is required for fertilizer, explosives, and other materials, it uses go far beyond these applications. From food packaging to pharmaceuticals, nitrogen gas can be found in more places and used for more purposes than you may have realized.

Food Packaging: It is common practice for food processing companies to use compressed nitrogen to displace oxygen in the packaging of perishable foods. Without oxygen, the shelf life of foods such as meats, fruits, vegetables, and various snack foods can be extended. Nitrogen can also add a cushion around food to keep it safe during transport.

Chemical Blanketing: Nitrogen is typically used to prevent fires and explosions in dangerous atmospheres like chemical plants or manufacturing facilities, by lowering the oxygen level below explosive limits.

Electronics: In the process of assembling electronics, nitrogen gas is used when two electronic components are forming a permanent connection, also known as soldering. The gas is used to reduce surface tension so there is a cleaner break away from the site of the electrical bond. Nitrogen gas is also used in a computer's main processing system to prevent it from overheating.

Laboratory: Laboratories require a very specific environment to ensure that tests and results are carried out accurately. Nitrogen gas is used to control oxygen levels, humidity and temperature, and maintain an appropriate atmosphere for highly sensitive procedures and equipment. Additionally, there are various pieces of laboratory equipment that require nitrogen for purging.

Laser Cutting: The application of nitrogen as a purging gas in the steel industry is extremely important. It is used as an assist gas to blow away molten material and achieve a stronger stainless or aluminized steel product that is also more resistant to corrosion.

<https://nigen.com/industries-that-benefit-from-on-site-nitrogen-systems/>

Industries That Benefit from On-Site Nitrogen Systems

Gaseous nitrogen is very useful in large-scale manufacturing and industrial applications. The large volumes of nitrogen gas required for these operations are either sourced from vendors in gas cylinders or generated on-site. In this article, we will highlight critical industrial processes that benefit from on-site nitrogen systems.

Elevation pH values recorded from location Discharge point 6

pH – Acidity, Alkalinity

https://www.umass.edu/mwwp/protocols/rivers/ph_alkalinity_river.html

Alkalinity is a measure of a river's "buffering capacity," or its ability to neutralize acids. Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H⁺ ions and lower the acidity of the water (which means increased pH). They do this usually by combining with the H⁺ ions to make new compounds. Without this acid neutralizing capacity, any acid added to a river would cause an immediate change in the pH.

Measuring alkalinity is important to determining a river's ability to neutralize acidic pollution (as measured by pH) from rainfall or snowmelt. It's one of the best measures of the sensitivity of the river to acid inputs.

Alkalinity comes from rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges. Total alkalinity is measured by collecting a water sample, and measuring the amount of acid needed to bring the sample to a pH of 4.2. At this pH all the alkaline compounds in the sample are "used up." The result is reported as milligrams per liter (mg/l) of calcium carbonate.

3.2 Interpreting Results

Dissolved Oxygen – Measures:

Dissolved oxygen (DO) is oxygen held (dissolved) in the water and available to aquatic organisms.

The amount of dissolved oxygen in a river or stream can tell us a lot about its water quality.

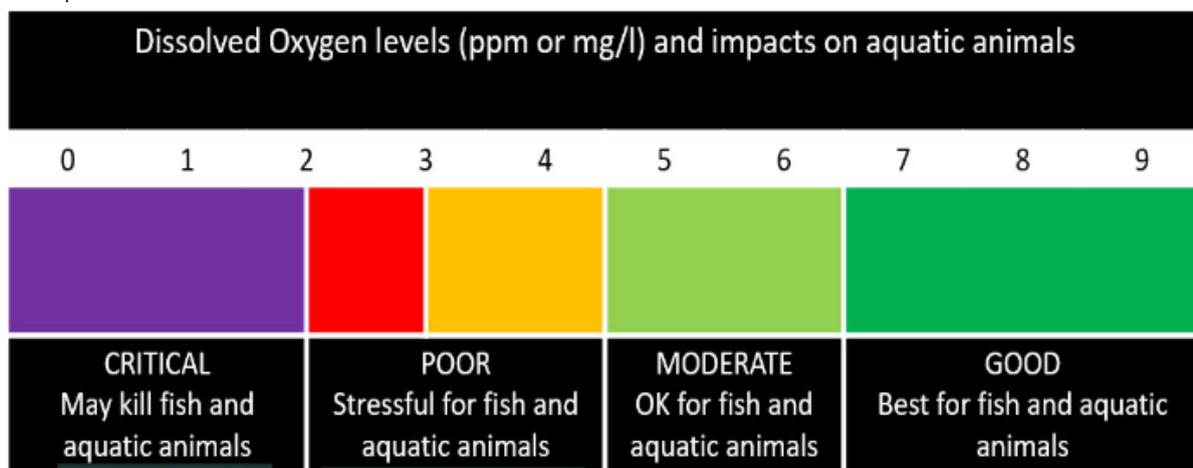
Water will naturally contain a certain amount of dissolved oxygen that is absorbed from the air and produced by plants and algae living in the water.

Temperature has a large effect on the amount of oxygen dissolved in water; cold water can hold higher levels of oxygen than warmer water. Higher water temperatures over summer will cause oxygen levels to drop.

Other factors such as river flow, wind, nutrients and bacterial activity can also affect the amount of dissolved oxygen in waterways.

Dissolved oxygen levels typically range between 5 and 14 mg/L (or ppm).

Example:



Salinity – Measures:

Electrical conductivity is a measure of the saltiness of the water and is measured on a scale from 0 to 50,000 uS/cm. Electrical conductivity is measured in microsiemens per centimeter (uS/cm). Freshwater is usually between 0 and 1,500 uS/cm and typical sea water has a conductivity value of about 50,000 uS/cm. Examples:

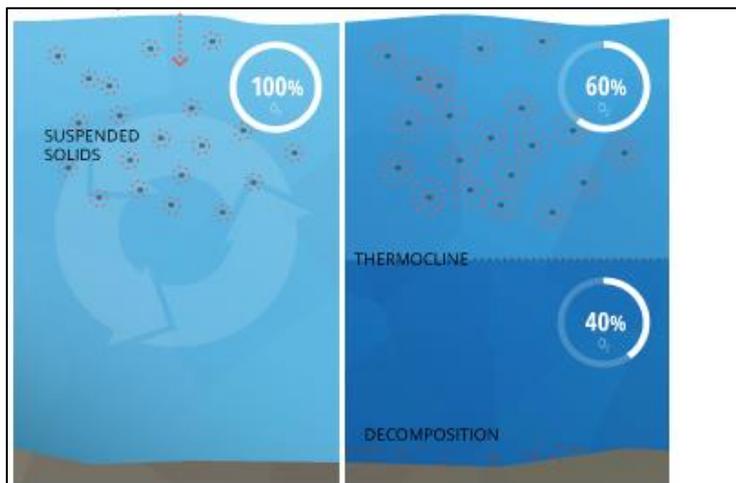
μS/cm	Use
0 - 800	<ul style="list-style-type: none">• Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material)• Generally good for irrigation, though above 300μS/cm some care must be, particularly with overhead sprinklers, which may cause leaf, scorch on some salt sensitive plants.• Suitable for all livestock
800 - 2500	<ul style="list-style-type: none">• Can be consumed by humans, although most would prefer water in the lower half of this range if available• When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants• Suitable for all livestock
2500 -10,000	<ul style="list-style-type: none">• Not recommended for human consumption, although water up to 3000 μS/cm can be consumed• Not normally suitable for irrigation, although water up to 6000 μS/cm can be used on very salt tolerant crops with very special management techniques. Over 6000 μS/cm, occasional emergency may be possible with care• When used for drinking water by poultry and pigs, the salinity should be limited to about 6000 μS/cm. Most other livestock can use water up to 10000 μS/cm

Total Dissolve Solids (TDS) – Measures

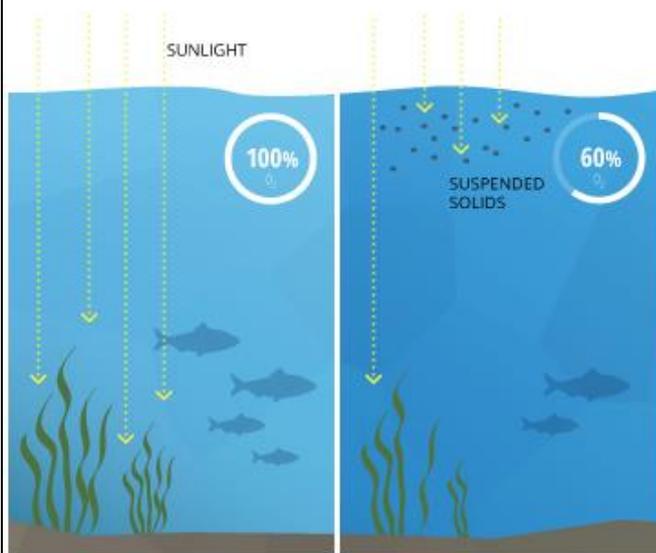
Dissolved solids, smaller than 2 microns, refer to any minerals, salts, metals, in the form of molecules, atoms, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that dissolve in water.

The TDS concentration is the sum of all filterable substances in water that can be determined gravimetrically. However, in most cases, TDS is primarily comprised of ions.

High levels of total suspended solids can affect turbidity, increase water temperatures and decrease dissolved oxygen (DO) levels. This can cause the water to heat up more rapidly because the suspended particles absorb more heat and deplete oxygen, which can adversely affect aquatic life.



Suspended solids can increase the temperature of water as they absorb additional heat from the sun. This can also cause dissolved oxygen levels to drop below the thermocline, creating hypoxic conditions.

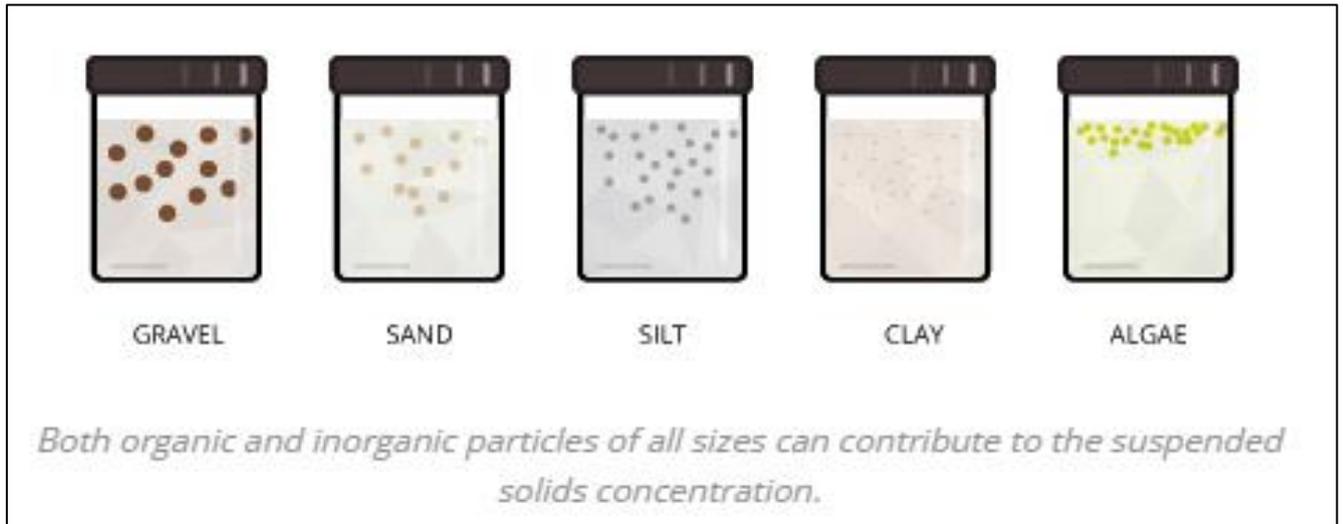


Suspended solids, particularly algae, can block sunlight from reaching submerged plants. This can cause dissolved oxygen levels to drop, as the plants rely on respiration (consuming oxygen) instead of photosynthesis.

Turbidity – Total Suspended Solids (TSS)

Turbidity data are reported in Nephelometric Turbidity Units (NTU). To provide a sense of scale, water with a turbidity of 1 NTU is crystal clear, water at 5 NTU has a tiny trace of discoloration, and water at 100 NTU is brown and opaque. The standard is less than 10 NTU for rural streams and rivers and less than 30 NTU for urban lakes and ponds.

Total suspended solids (TSS) are particles that are larger than 2 microns found in the water column. Anything smaller than 2 microns (average filter size) is considered a dissolved solid. Most suspended solids are made up of inorganic materials, though bacteria and algae can also contribute to the total solids concentration.



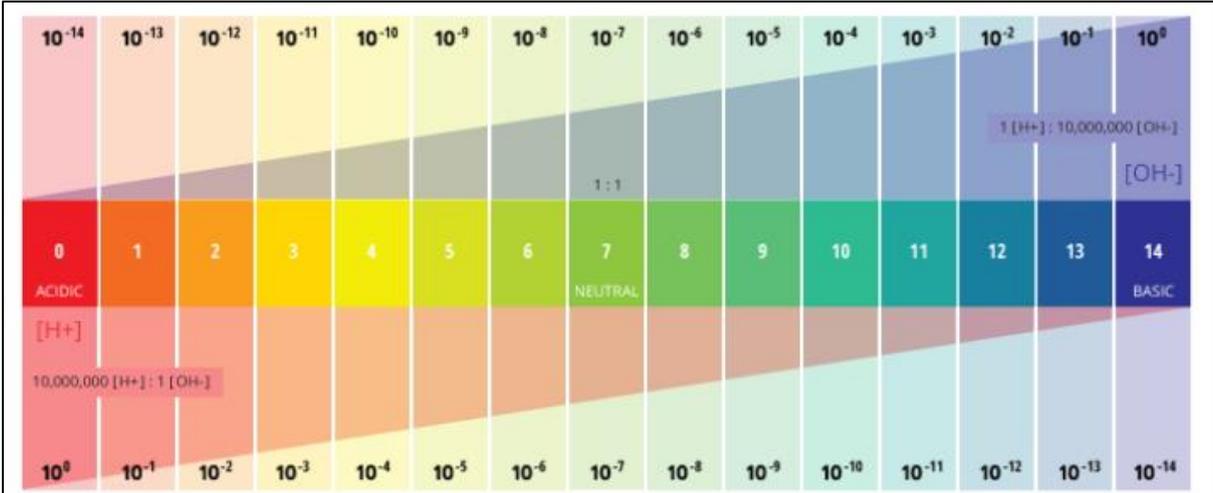
pH – Acidity / Alkalinity – Measures

The pH refers to the degree of acidity or alkalinity of a substance. A pH of 7 is neutral. A value above 7 indicates that the water is more alkaline and a pH below 7 indicates acidic conditions.

A pH of 7 is considered neutral. The logarithmic scale means that each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number pH stands for the “power of hydrogen”³. The numerical value of pH is determined by the molar concentration of hydrogen ions (H⁺)³. This is done by taking the negative logarithm of the H⁺ concentration (-log(H⁺)).

Standard values for pH readings are expected, pH 6.5–9 for rural streams and rivers and pH 6–9 for urban lakes and ponds.

In freshwater systems pH sets up the conditions for how easy it is for nutrients to be available and how easily things like heavy metals (toxicity for aquatic life) can dissolve in the water. Rivers and lakes generally range between 5 (acidic) and 9 (basic) on the pH scale.



The logarithmic scale of pH means that as pH increases, the H⁺ concentration will decrease by a power of 10. Thus at a pH of 0, H⁺ has a concentration of 1 M. At a pH of 7, this decreases to 0.0000001 M. At a pH of 14, there is only 0.000000000000001 M

Summary of Results

Aquatic ecosystems	
Indicator	Numerical criteria (trigger values)
Total phosphorus	<ul style="list-style-type: none"> • Upland rivers: 20 µg/L • Lowland rivers: 25 µg/L for rivers flowing to the coast; • Lakes & reservoirs: 10 µg/L • Estuaries: 30 µg/L
Total nitrogen	<ul style="list-style-type: none"> • Upland rivers: 250 µg/L • Lowland rivers: 350 µg/L for rivers flowing to the coast; • Lakes & reservoirs: 350 µg/L • Estuaries: 300µg/L
Chlorophyll-a	<ul style="list-style-type: none"> • Upland rivers: not applicable • Lowland rivers: 5 µg/L • Lakes & reservoirs: 5 µg/L. • Estuaries: 4 µg/L.
Turbidity	<ul style="list-style-type: none"> • Upland rivers: 2–25 NTU (see supporting information) • Lowland rivers: 6–50 NTU (see supporting information) • Lakes & reservoirs: 1–20 NTU • Estuaries: 0.5–10 NTU
Salinity (electrical conductivity)	<ul style="list-style-type: none"> • Upland rivers: 30–350 µS/cm • Lowland rivers: 125–2200 µS/cm supporting information
Dissolved oxygen	<ul style="list-style-type: none"> • Upland rivers: 90–110% • Lowland rivers: 85–110% • Freshwater lakes & reservoirs: 90–110% • Estuaries: 80–110% <p>Note: Dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability.</p>
pH	<ul style="list-style-type: none"> • Upland rivers: 6.5–8.0 • Lowland rivers: 6.5–8.5 • Freshwater lakes & reservoirs: 6.5–8.0 • Estuaries: 7.0–8.5 <p>Changes of more than 0.5 pH units from the natural seasonal maximum or minimum should be investigated.</p>

3.1 Key Summary of Results Spring (October) 2024

Dissolved Oxygen (DO %) is at 114.29% which is above the threshold of between 85-110% for lowland rivers. This is considered a positive attribute for stream health as increased oxygen levels are a general surrogate for healthy stream conditions for aquatic organisms and biota.

Total phosphorous was at 50 µg/L which is above the threshold of 25- 50 µg/L for rivers flowing to the coast.

Total nitrogen was at 800 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This reading for nitrogen is considered high against the benchmark, function of the bioretention basins is not at optimal design given that the filtration profiling and vegetation design to absorb and process nitrogen and nitrates is not at a complete stage, the expectation that readings for nitrogen will improve in future as the basins are completed and function in accordance with final design which is current not the case for the site.

pH is 6.21 which is below the threshold of 6.5-8.5 % for lowland rivers.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute
This reading is considered only a slight acidic reading below the neutral range.

pH readings at the discharge must be monitored overtime to observe any negative trend for this attribute

Total phosphorous is at 30 µg/L which is above the threshold of 25 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

Total nitrogen is at 400 µg/L which is above the threshold of 350 µg/L for rivers flowing to the coast.

This is considered only a slight exceedance for the value and reflects the general site condition as a non-natural environ, and not a natural low land river – which is the benchmarking for the results.

All other tested attributes are considered to meet the ANZECC guidelines for natural low land rivers – which is applied within the report as a general benchmarking standard.

3.2 Recommendations

There are no recommendations provided for water quality results over this testing period.

STORMWATER DISCHARGE TESTING SITE

BASIN 8 – OUTFLOW

Site image 1. Testing site Basin 8 - Outflow



Table. In-situ data and observations Retention Basin 8 outflow

Moorebank West Precinct - Retention Basin 8 Outflow (MPW 5.2 outflow)			
Date: 09/10/2024	Time: 11:41am	Temp: 15.3°C	Humidity: 60%
Operator: Marco Perry		Coordinates: -33.947085, 150.917653	
Equipment used: Aquatroll 500			
Parameter	Recording	ANZECC ANZECC 2000 Guidelines *Lowland rivers	Triggered? Y/N
Temperature (Celcius)	19.3	Abnormal to seasonal variation	N
Dissolved Oxygen (DO %)	114.29%	*Lowland rivers Lower limit: 85% Upper Limit: 110%	Y
Dissolved Oxygen (DO ppm)	10.5ppm	*Lowland rivers Lower limit: 85% Upper Limit: 110%	N
Electrical Conductivity (C-um/cm)	8.3 (C-um/cm)	125–2200 µS/cm	N
pH	6.44	Min 6.5 Max 8.5	Y
NTU	6.80 NTU	6-50	N

(a) Total phosphorus

Basin 8.1 inflow - Total phosphorous – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results - Total phosphorous:	50 µg/L	25 µg/L - 50 µg/L	Y
Notes: <ul style="list-style-type: none">• Channel Culvert• Trigger value 50 µg/L for lowland rivers, trigger value 25 µg/L for rivers flowing to the coast Anzecc Guidelines 2000.			

(b) Total Nitrogen as N (TKN + NOx) by Discrete Analyser

Basin 8.1 inflow - Total nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results -Total nitrogen:	800 µg/L	350 µg/L for rivers flowing to the coast	Y
Notes: <ul style="list-style-type: none">• Total Nitrogen as N (TKN + NOx) by Discrete Analyser• Trigger values are based on a low-lying river			

(c) Kjeldahl nitrogen Total Kjeldahl Nitrogen as N

Basin 8.1 inflow - Kjeldahl nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results – kjeldahl nitrogen:	700 µg/L	-	-
Notes: <ul style="list-style-type: none">• Total Kjeldahl Nitrogen as N			

(d) Dissolved metals;

Basin 8.1 inflow - Dissolved metals – Qube Logistics, Moorebank, NSW			
Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			
Lab results – Dissolved metals:	Measures mg/L	Trigger value ANZECC Guidelines 2000 95% protection criteria	Triggered
Arsenic	<0.001	0.013 mg/L	N
Cadmium	<0.0001	0.0002 mg/L	N
Chromium	<0.001	0.001 mg/L	N
Copper	<0.001	0.0014mg/L	N
Nickel	0.001	0.011 mg/L	N
Lead	<0.001	0.0034 mg/L	N
Zinc	<0.005	0.008 mg/L	N
Mercury	<0.0001	0.0006 mg/L	N
Notes: - ANZECC Guidelines (2000) suggest 0.002 mg/L is considered appropriate for slightly-moderately disturbed systems. - A spike in cadmium and zinc observed from past WQM has decreased and no longer triggers ANZECC Guidelines 90% protection criteria.			

(e) PFAS;

Basin 8.1 inflow - PFAS – Qube Logistics, Moorebank, NSW			
PFAS Surrogate	Measure µg/L	95% species protection (DEE 2016)	Triggered
Perfluorooctane sulfonic acid (PFOS) µg/L	96.9% µg/L	.13 (µg/L)	
Perfluorooctanoic acid (PFOA)	97.9% µg/L	220 (µg/L)	
Notes: This Guidance focuses on PFOS and PFOA as potential indicators of wider contamination by related PFASs. The reasons for this approach include: <ul style="list-style-type: none"> • Most research undertaken on PFASs internationally and in Australia has focused on PFOS and PFOA due to their frequent occurrence in the environment, persistence, and bioaccumulation. • PFOS and PFOA can also be the breakdown endpoint of other precursor products. • PFOS and PFOA are the most commonly encountered PFAS in the environment and wildlife. • Information on other PFASs, of which there are several hundred known, is more limited. • Effective management of PFOS and PFOA may help address potential contamination where other PFASs may also be present. * DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.			

(f) Total suspended solids.

Basin 8.1 inflow - Total suspended solids – Qube Logistics, Moorebank, NSW		EPA exceedance value	Trigger
Lab results – Total suspended solids: mg/L	<5 mg/L	50 mg/L	N
Notes: <ul style="list-style-type: none"> Total Suspended Solids dried at 104 ± 2°C Total Suspended Solids (TSS) 			

(g) Total hydrocarbons

Basin 8.1 inflow - Total hydrocarbons – Qube Logistics, Moorebank, NSW						
Total Hydrocarbons assessed alongside baseline data (2018) and Autumn monitoring (2019) for Aquatic Monitoring location 11&12 (AQ11 & AQ12 Anzac Creek).						
Lab results -Total hydrocarbons:	Trigger value ANZECC Guidelines 2000 – slightly disturbed lowland river ecosystem	Triggered	Monitoring discharge points May 2024 (Apical)	Monitoring discharge points October 2024 (Apical)		Trend
Benzene µg/L	1300 µg/L	N	<1	<1		No trend
Toluene µg/L	-	N	<2	<2		No trend
Ethylbenzene µg/L	-	N	<2	<2		No trend
meta- & para-Xylene µg/L	200 µg/L	N	<2	<2		No trend
Ortho-Xylene µg/L	470 µg/L	N	<2	<2		No trend
Total Xylenes µg/L	-	-	<2	<2		No trend
Sum of BTEX µg/L	-	-	<1	<1		No trend
Naphthalene µg/L	85 µg/L	N	<5	<5		No trend
Notes: <ul style="list-style-type: none"> The data were compared to the default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000) for the protection of slightly disturbed lowland river ecosystems in southeast Australia. A commonly encountered example of additive toxicity of mixtures is the simple aromatic hydrocarbons commonly associated with contaminated petroleum sites, benzene, toluene, ethyl benzene and xylenes, collectively known as BTEX 						

Water Quality Monitoring Comparative Table (Temporal)

Retention Basin 8 MPW. Testing Site OP-8

Testing Site MPW 8.1 Inflow		May 2024	October 2024	
pH		8.51	6.44	-
Dissolved Oxygen - %/L		13.07 mg/L	10.5mg/L	-
Actual Electronic Conductivity (SPC -ms/cm)		0.558 SPC -ms/cm	8.3 (C-um/cm)	-
Temperature - °C		15.5	19.3	-
Turbidity		5.39 NTU	6.80	-
Total phosphorous - mg/L		0.06 mg/L	0.05 mg/L	-
Total nitrogen - mg/L		0.07 mg/L	0.8 mg/L	-
Kjeldahl nitrogen mg/L		0.07 mg/L	0.7 mg/L	-
Dissolved metals				
Arsenic		<0.001	<0.001	
Cadmium		<0.0001	<0.0001	
Chromium		<0.001	<0.001	
Copper		0.002	<0.001	
Nickel		0.001	0.001	
Lead		<0.001	<0.001	
Zinc		<0.005	<0.005	
Mercury		<0.0001	<0.0001	
PFAS				
Lab results – SUM of PFAS Micrograms/L		0.04	0.69	
SUM of PFHxS & PFOS Microgrms/L		0.04	0.56	
Total suspended solids mg/L		<5	<5	-
Total hydrocarbons				
Benzene	<1	<1	<1	
Toluene	<2	<2	<2	-
Ethylbenzene	<2	<2	<2	-
meta-& para-Xylene	<2	<2	<2	-
Ortho-Xylene	<2	<2	<2	-
Total Xylenes	<2	<2	<2	
Sum of BTEX	<1	<1	<1	
Naphthalene	<5	<5	<5	-

Appendix A. Raw data tables; source - Australian Laboratory Services (MBW 81 is referred to as IP-8 & MBW 80 is referred to as OP-8)

Basin 8: Outflow

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time				09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00	
Compound	CAS Number	LOR	Unit	EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005	
				Result	Result	Result	Result	Result	
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	---	5	mg/L	<5	<5	24	<5	1440	
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.002	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	0.008	<0.005	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	---	0.01	mg/L	0.06	0.05	0.11	0.03	0.90	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	---	0.1	mg/L	0.5	0.7	1.0	0.4	2.1	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	---	0.1	mg/L	0.6	0.8	1.1	0.4	3.0	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	---	0.01	mg/L	0.03	0.05	0.16	0.03	0.25	
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	---	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	---	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	---	50	µg/L	<50	<50	<50	<50	<50	
[^] C10 - C36 Fraction (sum)	---	50	µg/L	<50	<50	<50	<50	<50	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time				09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00	
Compound	CAS Number	LOR	Unit	EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005	
				Result	Result	Result	Result	Result	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^A C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	---	100	µg/L	<100	<100	<100	<100	<100	
^A >C10 - C40 Fraction (sum)	---	100	µg/L	<100	<100	<100	<100	<100	
^A >C10 - C16 Fraction minus Naphthalene (F2)	---	100	µg/L	<100	<100	<100	<100	<100	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1	
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2	
^A Total Xylenes	---	2	µg/L	<2	<2	<2	<2	<2	
^A Sum of BTEX	---	1	µg/L	<1	<1	<1	<1	<1	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.03	0.06	<0.02	<0.02	
Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.04	0.06	<0.02	<0.02	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.32	0.52	0.02	0.03	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.24	0.56	0.02	0.02	

Analytical Results

Sub-Matrix: WATER
(Matrix: WATER)

				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
				Sampling date / time	09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00
Compound	CAS Number	LOR	Unit		EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005
				Result	Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	<0.02	0.10	<0.02	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	0.05	0.20	<0.02	0.03
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	<0.02	0.02	<0.02	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	0.01	0.03	<0.01	<0.01
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FO SA)	754-91-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFO SA)	31506-32-8	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFO SA)	4151-50-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoethanol (MeFO SE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFO SE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GR1	MBW B80	MBW B60	MBW B50 (GR2)	MBE DP1
Sampling date / time					09-Oct-2024 12:30	09-Oct-2024 11:45	09-Oct-2024 11:30	09-Oct-2024 12:00	09-Oct-2024 10:00
Compound	CAS Number	LOR	Unit		EW2404631-001	EW2404631-002	EW2404631-003	EW2404631-004	EW2404631-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFO SAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFO SAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L	<0.01	0.69	1.55	0.04	0.08	
Sum of PFHxS and PFOs	355-46-4/1763-23-1	0.01	µg/L	<0.01	0.56	1.08	0.04	0.05	
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	0.65	1.49	0.04	0.08	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	99.8	99.2	98.1	102	103	
Toluene-D8	2037-26-5	2	%	101	98.3	97.7	102	99.9	
4-Bromofluorobenzene	460-00-4	2	%	96.2	94.6	92.3	94.0	93.6	
EP231S: PFAS Surrogate									
13C4-PFOs	----	0.02	%	98.2	96.9	101	103	103	
13C8-PFOA	----	0.02	%	98.7	97.9	101	101	101	

Chemical	Trigger values for freshwater (μgL^{-1})				Trigger values for marine water (μgL^{-1})			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 ^C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 ^A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin	B	2.6	4.4	6	9 ^A	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 ^C	1000 ^C	ID	ID	ID	ID
Alcohol ethoxylated sulfate (AES)	340	650	850 ^C	1100 ^C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 ^C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons								
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 ^A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH >6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC_{50} data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) — check Section 8.3.7 for spread of data and its significance. 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Sections 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) — check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.

D = Ammonia as TOTAL ammonia as $[\text{NH}_3\text{-N}]$ at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2.

E = Chlorine as total chlorine, as [Cl]; see Section 8.3.7.2.

F = Cyanide as un-ionised HCN, measured as [CN]; see Section 8.3.7.2.

G = Sulfide as un-ionised H_2S , measured as [S]; see Section 8.3.7.2.

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30 mg/L CaCO_3 . These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.

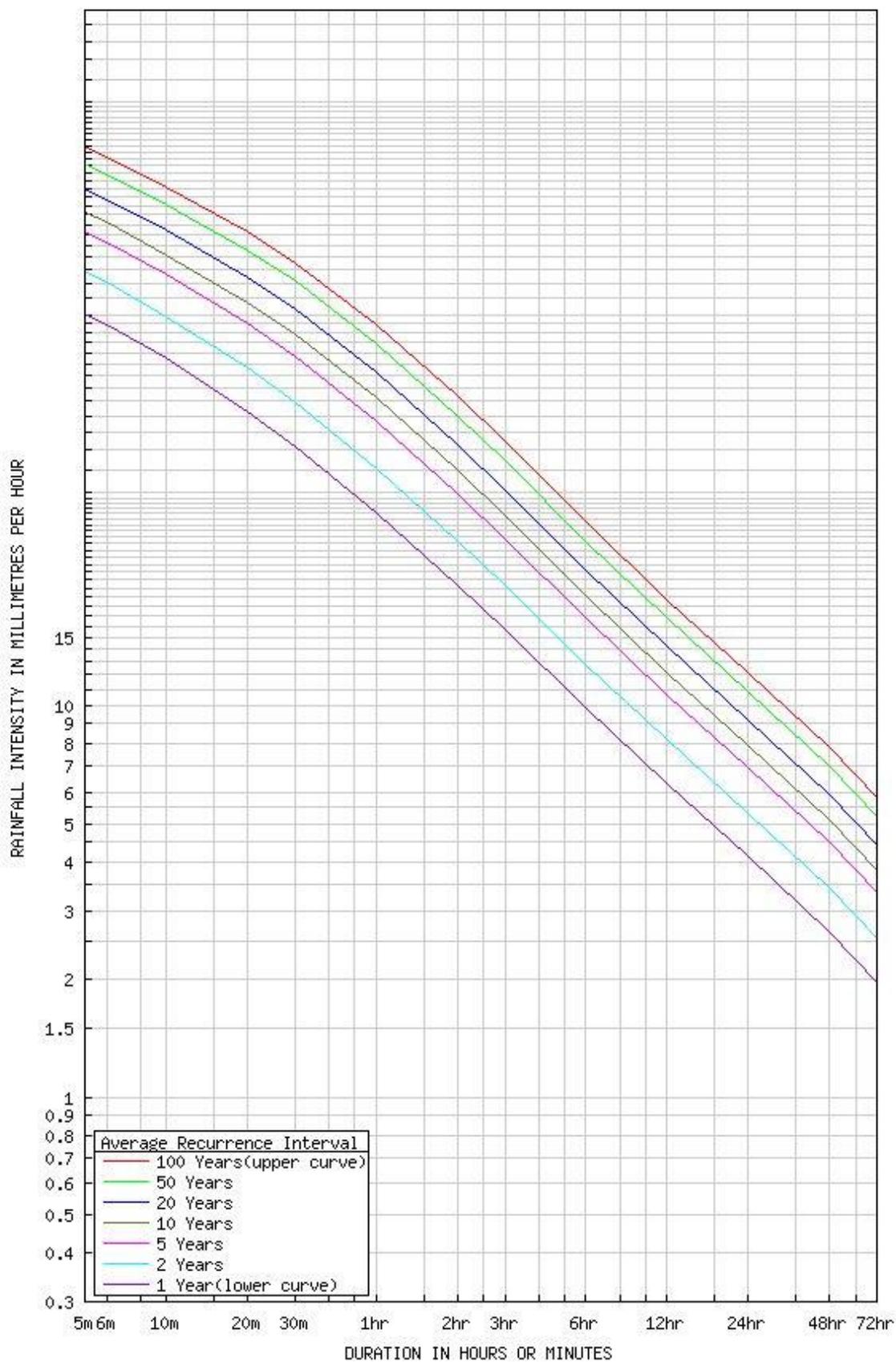
Table 5. Ecological water quality guideline values developed by water regulators

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - technical draft default guideline values for PFOS and PFOA.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The 99% species protection level for PFOS is close to the level of detection. Agencies may wish to apply a 'detect' threshold in such circumstances rather than a quantified measurement.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	Note 3: The WQGs advise ⁴¹ that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Regulators may specify or environmental legislation may prescribe the level of species protection required, rather than allowing for case-by-case assessments.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	As above. Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	

Australian Water Quality Guidelines for Fresh and Marine Waters

Type of indicator	Indicator	Units	Fresh waters	Marine waters
	Dissolved oxygen ²	mg/L	> 6 (> 80–90% saturation)	> 6 (> 80–90% saturation)
	Nutrients/nuisance growths	–	(Section 2.3.3)	(Section 2.3.3)
	pH	–	6.5–9.0	< 0.2 pH unit change
	Salinity	mg/L	< 1000 (about 1,500 µS/cm)	–
	Suspended particulate matter/turbidity	–	< 10% change seasonal mean concentration (see also colour & clarity)	< 10% change seasonal mean concentration (see also colour & clarity)
	Temperature ³	–	< 2°C increase	< 2°C increase
Toxicants				
Inorganic toxicants	Aluminium	µg/L	< 5.0 (if pH ≤ 6.5)	NR
	Aluminium	µg/L	< 100.0 (if pH > 6.5)	–
	Ammonia	µg/L	20.0–30.0 (Table 2.3)	NR
	Antimony	µg/L	30.0	500.0
	Arsenic	µg/L	50.0	50.0
	Beryllium	µg/L	4.0 ⁴	NR
	Cadmium	µg/L	0.2–2.0 ⁵	2.0
	Chromium	µg/L	10.0	50.0
	Copper	µg/L	2.0–5.0 ⁵	5.0
	Cyanide	µg/L	5.0	5.0
	Iron	µg/L	1,000.0 ⁶	NR
	Lead	µg/L	1.0–5.0 ⁵	5.0
	Mercury	µg/L	0.1	0.1
	Nickel	µg/L	15.0–150.0 ⁵	15.0
	Selenium	µg/L	5.0	70.0
	Silver	µg/L	0.1	1.0
	Sulfide	µg/L	2.0	2.0
	Thallium	µg/L	4.0	20.0
Tin (tributyltin)	µg/L	0.008	0.002	
Zinc	µg/L	5.0–50.0 ⁶	50.0	
Organic toxicants	Acrylonitrile	µg/L	NR	NR
	Benzidine	µg/L	NR	NR
	Dichlorobenzidine	µg/L	NR	NR
	Diphenylhydrazine	µg/L	NR	NR
Halogenated aliphatic compounds	Hexachlorobutadiene	µg/L	0.1	0.3
	Halogenated ethers	µg/L	NR	NR
	Isophorone	µg/L	NR	NR
Monocyclic aromatic compounds	Benzene	µg/L	300.0	300.0
	Chlorinated benzenes	µg/L	(Table 2.8)	NR

Appendix C. Intensity Frequency Duration – Average Recurrence Interval Indicator
[Intensity-Frequency-Duration \(bom.gov.au\)](http://Intensity-Frequency-Duration (bom.gov.au))



Moorebank Logistics Park West Precinct

Basin 5 Location

Stormwater Network Water Quality Monitoring
Data & Reporting Autumn 2025



Site image: Outlet retention basin 5 MPW (Apical image 09th April 2025)

Prepared for: MID Plumbing P/L SIOMP Moorebank Precinct West

Prepared by: Daniel Anderson (*BEnvSc, MEnvSc*)

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Phone: 0415617771

PO Box 149 Kiama NSW 2533

ABN: 656 420 10 400

Consulted Documents / database.

Australia and New Zealand Guidelines for fresh and Marine Water Quality (2000)

[NATIONAL WATER QUALITY MANAGEMENT STRATEGY - Australian and New Zealand Guidelines for Fresh and Marine Water Quality \(2000\) - Volume 2 - Aquatic ecosystems](#)

Bureau of Meteorology – Australian Government [Australia's official weather forecasts & weather radar - Bureau of Meteorology \(bom.gov.au\)](#)

Moorebank Intermodal Precinct West – Stage 3 (SSD 10431) | Assessment Report March 2021

<https://moorebankintermodalprecinct.com.au/wp-content/uploads/2023/04/MPW-S3-DPIE-assessment-report-to-IPC.pdf>

WQM Report Western Precinct _Basin 5_Autumn 2024 – Apical Bushfire and Planning - April 2024

WQM Report Western Precinct _Basin 8_Spring 2024 – Apical Bushfire and Planning - October 2024

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application

Number: SSD 7709 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent

Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot

100 DP 1049508 Lot 101 DP 1049508 Lot 2 DP 1197707 Part Lot 3 DP 1197707 Part Anzac Road and Moorebank

Avenue public road reserves Development: Moorebank Precinct West Stage 2 (MPW Stage 2)

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application

Number: SSD 10431 Applicant: Sydney Intermodal Terminal Alliance (SIMTA) as Qube Holdings Limited Consent

Authority: The Independent Planning Commission Site: Moorebank Avenue, Moorebank Lot 1 DP 1197707 Lot

100 DP 1049508 Lot 101 DP 1049508 Moorebank Precinct West Stage 3 (MPW Stage 3)

Australian Laboratory Services (ALS) Work Order EW2402561 Certificate of Analysis Water Sample Data 9th April 2025.

Liverpool DCP

[Liverpool's Development Control Plans | Liverpool City Council \(nsw.gov.au\)](#)

DEE 2016. Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy.

<https://environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgt-guidance-pfos-pfoa.pdf>

Development Consent SSD 7709 - Section 4.38 of the Environmental Planning and Assessment Act 1979

<https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2019/05/moorebank-intermodal-precinct-west-stage-2/referral-from-department-of-planning-and-environment/revised-recommended-conditions/mpw-stage-2-recommended-conditions-inclusive-of-edits-191105.pdf>

Glossary

The following definitions apply to terms used in this report. Many of these definitions are consistent with relevant national literature and cited where appropriate.

Current status trigger value

Concentrations of water quality indicators that reflect existing ecosystem condition, and therefore provide a target for ecosystem maintenance and a benchmark against which future water quality trends may be monitored.

Environmental value

Particular values or uses of the environment important for a healthy ecosystem or for public benefit, welfare, safety or health and requiring protection from the effects of pollution or degradation (Environment Australia 2002).

Indicator

A parameter (biological, physical or chemical) used to provide a measure of the quality of water or the condition of an ecosystem (Environment Australia 2002).

Low-risk trigger value

Concentrations (or loads) of key performance indicators [of water quality] at which if not exceeded, there is a low risk that adverse biological effects will occur (ANZECC 2000a).

Median

The middle reading, or 50th percentile, of all readings taken. i.e. of the readings 10, 13, 9, 16 and 11 (re-ordering these to read 9, 10, 11, 13 and 16), the median is 11. The mean (or average), is the sum of all values divided by the total number of readings (which in this case equals 11.8).

Reference condition

Refers to a site which is unmodified or minimally modified from 'natural' condition. Most commonly, reference sites are subject to limited disturbance from human activity. The reference condition then serves as a standard or target against which environmental change in other similar sites can be assessed.

Trigger value

A concentration that, if exceeded, would indicate a potential environmental problem, and so 'trigger' a management response, such as further investigation and/or remedial actions (ANZECC 2000a).

Water quality guideline

A numerical concentration level (e.g. of a contaminant) or narrative statement (e.g. visual appearance of a water body) recommended to support and maintain a designated water use (ANZECC 2000a)

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 3 (the Project) of Moorebank Precinct West (MPW), which comprises the third stage of development within the Moorebank Precinct West under Development Approval SSD-10431.

The proposal is SSD under clause 19 of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, as it is development for the purpose of rail and related transport facilities.

The MPW site is located on the western side of Moorebank Avenue and forms the western section of the Moorebank Intermodal Precinct (Map Image 2).

The MPW site is approximately 2.5 kilometres (km) from the Liverpool city centre, 27 km south-west of the Sydney Central Business District (CBD) and 26 km west of Port Botany.

The MPW site is irregular in shape, approximately 3 km from north to south and 960 m from east to west at its widest point and covers an area of approximately 220 ha. It is situated between the Georges River to the west (with the SSFL running north-south to the west of the river); and Moorebank Avenue to the east.

Works on the MPW site to date have commenced under two current and active development consents:

- MPW Stage 1 early works, which provides demolition, rehabilitation, remediation of contaminated land, and the establishment of construction facilities and access including site security (as part of the SSD 5066 consent)
- MPW Stage 2, which provides for the construction and 24/7 operation of an intermodal facility and associated warehousing (SSD 7709).

This water quality monitoring program is guided by the Stormwater Infrastructure Operation and Maintenance Plan (SIOMP) and is provided to site management on behalf of MID Plumbing.

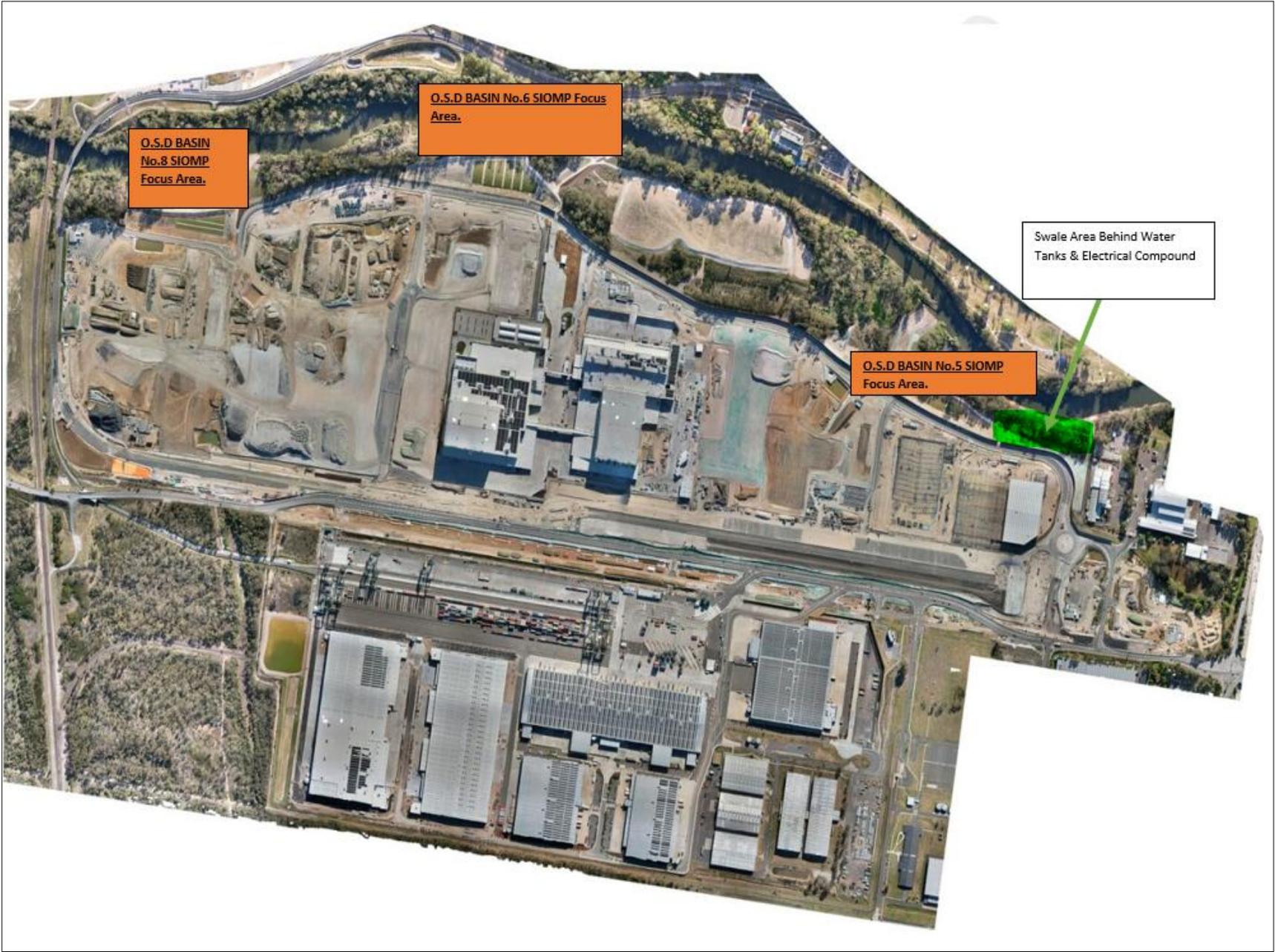
Three onsite bio-retention basins are present within Moorebank Precinct West. This report is in reference to baseline water quality condition reporting for Basin 5 (MPW – north).

Development Consent - Section 4.38 of the Environmental Planning and Assessment Act 1979 - Application Number: SSD 7709 Moorebank Precinct West Stage 2 (MPW Stage 2)

CoC	Requirement
Stormwater Quality Monitoring	
B38.	Stormwater Quality Monitoring Program - Prior to commencement of operation Part of the Operational Environmental Management Plan

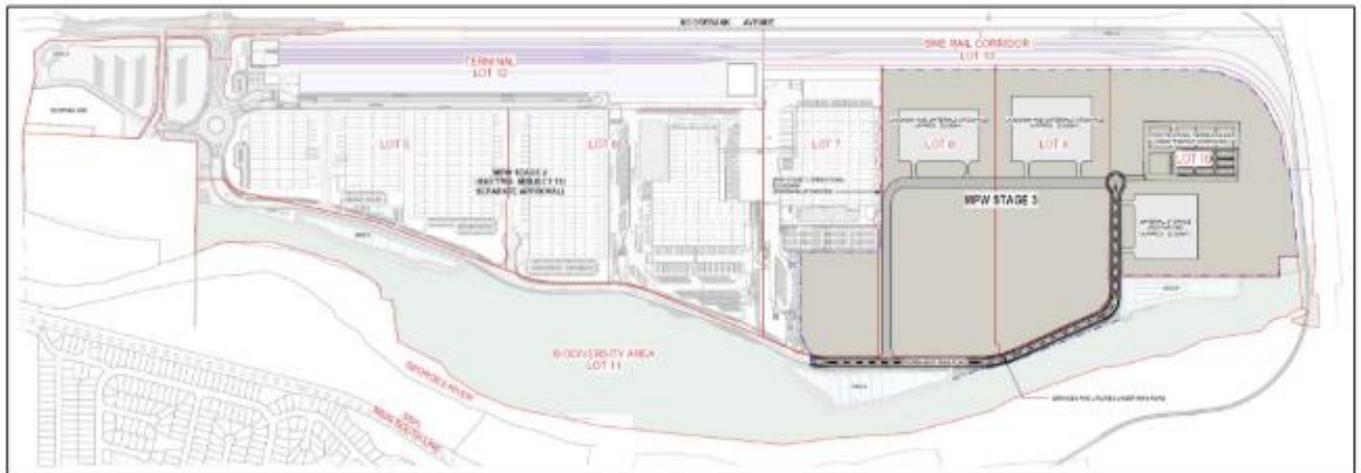
The Stormwater Infrastructure Operation and Maintenance Plan (SIOMP) Moorebank Logistics Park – West Precinct was developed to address the requirements of MPE stage 3 CoCs (SSD 7709). The management plan (SIOMP) identifies the operational drainage and environmental management measures within the stormwater management system that will be applied to activities undertaken across the MLP west Precinct to manage improved water quality objectives and overall functionality of the stormwater detention and drainage network associated with stormwater infrastructure upon the site under the SIOMP.

Map Image 2. Moorebank Precinct West Detention Basins (provided by MID Plumbing)



1.2 Reference information

Map image 4. Moorebank Intermodal Precinct West – Stage 3 State Significant Development Assessment (SSD-10431) March 2021



20. Stormwater Management System or Works

That untreated stormwater is not disposed of into the Georges River or its tributaries.

The likely impact of stormwater disposal on the quality of any receiving waters.

That the levels of nutrients and sediments entering the waterway are not increased by the proposed development.

Whether any proposals to manage stormwater are in accordance with the local council's stormwater management plans and the Managing Urban Stormwater series of documents and meet the local council's stormwater management objectives.

Whether the principles outlined in the *Managing Urban Stormwater Soils and Construction Handbook* (1998) prepared by and available from Landcom and the Department of Housing are followed during each stage of a development (including subdivision).

Detailed stormwater assessments were undertaken as part of MPW Stage 2, and remain applicable to the Stage 3 proposal.

The Department has recommended conditions that would enforce these requirements, by ensuring that appropriate measures are implemented to manage stormwater impacts during construction. In regard to management of stormwater during operation of the MPW site, the MPW Stage 2 proposal incorporates a robust set of conditions to manage the release of stormwater via six onsite detention basins (OSD), a major east-west covered culvert and associated drainage infrastructure.

2. Monitoring Program Methodology

2.1 Monitoring Sites

To support stormwater and drainage management of the facility the MLP West precinct has established a vast stormwater infrastructure system consisting of several Water Sensitive Urban Design (WSUD) functions including raingardens detention basins and bio-swales. These networks are designed to minimise the velocity and peak discharge of stormwater draining from the site and act as onsite detention basins to harvest and sequester potential pollutants generated at the site through designed biological processes.

The stormwater infrastructure system discharges water into the natural drainage system via three outlets:

- **Basin 5 detains water from the northern section of MPW before discharging into Georges River**
- Basin 6 detains water from the mid-section of MPW before discharging into Georges River
- Basin 8 detains water from the southern section of MPW before discharging into Georges River

Monitoring of the discharge points has been established via our ongoing program with MID Plumbing under the SIOMP program (MPE) to collect qualitative data and analyse the performance of the WSUD provisions and to establish any potential trends in water quality readings from the stormwater network discharge points prior to release of water into the natural hydrological systems of Anzac Creek and the Georges River.

This report constitutes the Autumn water quality data alongside baseline data for Basin 5 Moorebank Precinct West (MPW).

Table 1. Type of outlet MPW

Discharge Point (see figure 2)	Associated Outlet (see figure 1)	Type of outlet/detention basin
Basin 5	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp
	Georges River	River – natural drainage conveyance
Basin 6	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp
Basin 8	Inlet	Bio retention basin (holding)
	Outlet	Outlet point – rock ramp

2.2 Water Quality Assessment

Surface water quality data collected at the discharge points is assessed with reference to ANZECC Guidelines (2000) and correlated with baseline & Spring 2025 Water Quality monitoring results provided by previous condition assessment reports.

By comparing water test data under the program across the testing timeline we can identify and report upon trends, identify exceedances and exclude potential anomalies for datasets.

Table 2. ANZECC Low Risk Trigger Values

Ecosystem type	Turbidity NTU	EC µS/cm	pH*	DO	TN mg/L	NO _x - N mg/L	NH ₄ ⁺ - N mg/L	TP mg/L	DRP - P mg/L
Upland river	2-25	30-350	6.5-7.5	90-110	0.480	0.190	0.013	0.013	0.005
Lowland river	6-50	125-2200	6.5-8.0	85-110	0.500	0.190	0.020	0.050	0.020

Values for Low Land River Systems as insert above are used as the reference guide to water quality parameter values and overall health and safety statements regarding the quality of discharged water from the SIOMP drainage network.

Annual spring and autumn water quality data presented from Anzac Creek and Georges River testing programs by other scientific consultants may also be cross referenced to the data prepared by Apical under the SIOMP program to establish potential trends in results and identify increases in accumulated pollutants from the site under operational condition, which may appear present within adjacent natural waterways.

Site data was collected in the form of water samples and in field data recordings at the prescribed monitoring points, water samples and water probe readings are undertaken following Australia and New Zealand guidelines for fresh and marine water quality – 2000 (ANZECC Guidelines), In situ water quality parameters relevant to stream health and aquatic assessment profiling were collected in field with a multiparameter hand-held water quality monitoring probe (Aquatroll 600).

Water data is collected, analysed and collated under the same methodologies and process under each testing period, the ensure consistency in the process.

Measures tested and samples taken:

- pH
- Dissolved Oxygen
- Electrical Conductivity
- Water Temperature and
- Turbidity

Water samples are collected at inlet and discharge points (Basin 5, Basin 6 & Basin 8) then sent to Australian Laboratory Services (ALS) for quality testing analysis [Surface water \(alsglobal.com\)](http://www.alsglobal.com).

Water analytical suites / testing parameters are provided to obtain overall water condition results and chemical sampling of collected water is undertaken for a range of nutrients, metals, and hydrocarbons relevant to stream health and aquatic assessment protocol, key nutrients, metals, and pollutants included in the assessment to reflect an overall suite of water quality condition guides which are listed below:

- Total phosphorous
- Total Nitrogen
- Kjeldahl Nitrogen
- Dissolved Metals
- PFAS
- Total Suspended Solids

- Total Hydrocarbons

The raw data results from the lab analysis provided to us by ALS Laboratory Services are presented within this report (see Appendix A).

Key water quality data attributes are recorded, tables and compared against; previous condition baseline data, Liverpool Development Control Plan (DCP) water quality targets, Conditions of Consent B40 and ANZECC Guideline (2000) trigger limits under the condition category 90% protection criteria for freshwater natural systems.

The water quality guidelines are applied to ensure adjacent natural waterways George River and Anzac creek are not adversely affected by poor water quality discharge from the Moorebank logistics park site and operations.

Trends observed in our datasets are analysed on a temporal scale with any trigger values for specific water quality measures highlighted and presented within the results chapter of each seasonal report. This report provides baseline & Spring 2024 data for Basin 5 (MPW) from which trend analysis will compound over future reporting periods.

2.3 Data Analysis

The water quality measurements collected are used to assess water quality at each site in terms of health of aquatic ecosystems by comparison with guideline values recommended by the ANZECC and ARMCANZ (2000) guidelines for the protection of lowland streams (i.e. systems at < 150 m altitude) in south-east Australia. This categorisation for stream health is deemed relevant for the description of Anzac Creek, the recipient natural way due to the location in the geomorphic landscape and correlations of expected biophysical health and habitat profiles for similar stream environments.

2.4 Survey dates and personnel

On the 9th April 2025, ecologists from Apical Bushfire and Planning attended Moorebank Precinct West (MPW) to collect water quality data across the testing sites which are located within selected inlet points and discharge points within the stormwater drainage and management system (SIOMP) located within the Moorebank Logistics Park site West (See map image 2).

Inlet and outlet points within the network are representative of variant sites where stormwater will enter a node of the system (as a point source) and then release from the that node of the system at a discharge point. By recording inlet and discharge data water quality can be tracked along the continuum within the system to determine condition changes and overall trends in measured quality at given sites.

This data was collected on behalf of MID plumbing in accordance with 'The Stormwater Infrastructure Operation and Maintenance Plan Moorebank Logistics Park – West Precinct 2020' and in compliance with Condition of Consent B40 (Liverpool City) for the subject site. The results of such monitoring data collection are presented within this report.

2.5 Rainfall

Between the 1st of March and the 31st of March 2025 Moorebank received 90.2mm of rainfall (<http://www.bom.gov.au/climate/dwo/202409/html/IDCJDW2161.202409.shtml>). Between the 1st of April and the 15^h of April 2025 Moorebank received 3.4mm of rainfall.

Figure 1. Bureau of Meteorology Daily Weather Observation Holsworthy March 2025

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am			3 pm									
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				mm	mm	hours	km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa	
1	Sa	18.7	32.0	0			S	28	23:13	22.9	78		WSW	13	1016.7	31.2	53		ENE	15	1012.3	
2	Su	19.8	25.7	0			S	52	16:16	23.5	85	8	SSE	19	1013.7	24.8	75	8	SE	30	1013.1	
3	Mo	19.2	25.6	0			S	37	08:09	22.2	71	3	S	22	1018.7	24.3	63	8	S	22	1017.6	
4	Tu	18.5	26.0	6.8			S	46	15:00	21.0	94	8	SE	9	1021.3	24.2	70	8	SSE	26	1021.6	
5	We	18.5	26.7	3.2			SE	35	15:06	22.3	74		SSE	15	1021.8	25.3	55	6	SE	22	1019.5	
6	Th	16.9	26.9	0			SSE	43	15:50	21.9	81	8	SSE	15	1020.4	25.4	62	7	SE	22	1019.9	
7	Fr	17.9	26.5	2.4			ESE	44	12:59	19.9	92	8	SSE	15	1021.6	25.6	55	5	ESE	24	1020.5	
8	Sa	17.4	24.5	2.6			SE	33	12:14	21.1	87	7	SSE	17	1022.8	23.2	70	8	ENE	15	1022.5	
9	Su	19.8	28.5	1.4						21.8	94	8	Calm		1023.7	27.0	55	2	ENE	19	1020.7	
10	Mo	18.5	27.1				NNE	24	13:12	22.9	79	8	NNE	7	1020.8	26.1	60	8	NNE	13	1018.6	
11	Tu	19.4	22.3	9.0			SE	30	06:14	20.2	97	7	SSE	15	1020.5	21.4	93	8	ESE	17	1020.6	
12	We	18.6	27.0	8.0			SE	22	13:50	20.4	94	6	W	9	1022.8	26.8	63	8	ENE	7	1019.8	
13	Th	17.0	31.7	0			N	24	10:29	19.8	97	7	W	7	1020.1	30.5	48		NNW	9	1016.8	
14	Fr	17.8	35.8	0			SSE	30	22:56	23.1	90		Calm		1019.5	34.3	36		NE	9	1016.3	
15	Sa	22.0	34.7	0			SE	30	23:09	23.6	85	8	W	7	1019.9	34.5	45		NE	11	1014.5	
16	Su	21.0	37.0	0			W	39	12:21	25.6	67		W	6	1011.6	36.4	26		WNW	20	1006.7	
17	Mo	15.5	21.5	0			SSE	61	01:54	18.0	51		SSW	20	1018.9	20.5	39		SE	28	1020.8	
18	Tu	10.9	24.4	0			E	28	10:42	16.0	71		Calm		1024.5	23.1	51	8	ESE	17	1022.4	
19	We	15.6	28.6	0			E	31	14:05	19.3	80	1	Calm		1023.3	27.3	54		ESE	20	1019.0	
20	Th	18.2	32.5	0			ENE	31	17:41	22.1	81	1	Calm		1020.3	31.3	47		E	17	1015.6	
21	Fr	17.9	27.5	0			SSE	31	18:36	20.1	90	8	W	7	1014.5	25.9	68	3	N	13	1012.5	
22	Sa	18.9	26.7	1.4			SE	31	16:27	19.8	87	7	W	6	1017.6	25.1	63	8	SE	17	1015.9	
23	Su	19.7	22.1	4.0			S	26	12:46	20.4	92	8	S	13	1021.1	21.0	88	8	S	15	1019.8	
24	Mo	18.8	25.8	3.6						20.3	97	8	S	2	1020.3	24.2	71	7	ESE	9	1018.9	
25	Tu	19.6	26.2				SSE	31	12:01	22.6	82	4	S	13	1023.1	23.4	82	8	SSW	11	1021.2	
26	We	18.4	27.5	1.0			E	33	16:13	19.8	97	1	Calm		1022.6	26.8	54		E	17	1020.5	
27	Th	15.6	25.7	0			S	28	10:22	18.4	94	1	Calm		1023.4	24.6	74	8	SE	17	1022.1	
28	Fr	16.7	24.2	1.4			E	30	13:28	19.9	96	8	Calm		1022.6	23.8	74	8	E	15	1019.7	
29	Sa	18.0	22.0	19.0			SW	37	21:32	18.6	96	7	SSW	7	1012.6	20.0	95	7	WSW	11	1007.3	
30	Su	18.4	24.2	11.8			S	50	14:42	19.4	91	8	WSW	13	1008.1	22.1	79	8	SSW	31	1008.1	
31	Mo	17.4	24.3	14.6			SW	54	13:19	19.5	79	6	SW	17	1011.7	22.6	64	8	SSW	26	1011.7	
Statistics for March 2025																						
Mean		18.1	27.1							20.9	85	6		8	1019.4	25.9	62	7		17	1017.3	
Lowest		10.9	21.5	0						16.0	51	1	Calm		1008.1	20.0	26	2	ENE	7	1006.7	
Highest		22.0	37.0	19.0			SSE	61		25.6	97	8	S	22	1024.5	36.4	95	8	SSW	31	1022.5	
Total				90.2																		

IDCJDW2161.202503 Prepared at 13:00 UTC on Monday 14 April 2025

Figure 2. Bureau of Meteorology Daily Weather Observation Holsworthy April 2025

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9 am			3 pm									
		Min	Max				Dir	Spd	Time	Temp	RH	Cld	Dir	Spd	MSLP	Temp	RH	Cld	Dir	Spd	MSLP	
		°C	°C				mm	mm	hours	km/h	local	°C	%	g th	km/h	hPa	°C	%	g th	km/h	hPa	
1	Tu	15.6	23.2	0			S	37	10:56	19.2	73	5	WSW	9	1015.2	22.1	55	5	SSW	20	1013.3	
2	We	13.0	24.6	0			E	28	16:07	14.3	82	7	WSW	9	1012.4	23.9	41		NE	11	1007.8	
3	Th	10.1	26.7	0			WNW	39	11:44	14.1	94		Calm		1011.3	25.9	26		SW	9	1009.7	
4	Fr	12.3	25.3	0			SE	31	15:50	16.9	86		WSW	7	1016.4	24.6	58	3	SE	15	1014.4	
5	Sa	14.3	26.2	0			SE	39	16:24	18.5	47		WNW	9	1015.0	25.0	31		SE	19	1013.9	
6	Su	9.2	25.3	0			W	26	11:47	17.1	75		NW	9	1018.8	23.6	31	8	S	6	1013.9	
7	Mo	11.5	26.9	0			WSW	43	12:01	19.8	50		NW	11	1018.1	26.7	27		W	11	1015.9	
8	Tu	12.3	22.2	0			SE	28	15:34	18.0	71	7	W	9	1025.2	21.4	60	8	SE	19	1023.1	
9	We	15.5	24.0	1.2			E	28	13:17	19.7	80	5	ENE	7	1025.7	22.1	69	1	ENE	19	1021.4	
10	Th	12.4	24.2	0			NNE	17	14:07	17.7	89	8	Calm		1023.2	23.7	59	8	ENE	7	1020.0	
11	Fr	12.4	30.1	0			SE	37	14:37	20.0	76		WNW	9	1023.9	26.7	48	2	SE	20	1022.8	
12	Sa	15.1	26.4	0			SSE	28	13:10	21.7	74		WNW	6	1030.8	24.9	64	1	E	17	1028.9	
13	Su	13.2	26.8	0			ENE	28	16:05	20.5	85		W	7	1030.2	25.5	51		ENE	17	1025.9	
14	Mo	12.4	28.8	0			S	57	14:47	18.8	86		WSW	9	1025.6	24.4	61		S	26	1023.6	
15	Tu	16.2		2.2						19.4	75	8	SSW	15	1027.7	19.3	72	8	SSE	19	1025.5	
Statistics for the first 15 days of April 2025																						
Mean		13.0	25.8							18.4	76	6		7	1021.3	24.0	50	4		15	1018.7	
Lowest		9.2	22.2	0						14.1	47	5	Calm		1011.3	19.3	26	1	S	6	1007.8	
Highest		16.2	30.1	2.2			S	57		21.7	94	8	SSW	15	1030.8	26.7	72	8	S	26	1028.9	
Total				3.4																		

IDCJDW2161.202504 Prepared at 05:36 UTC on Tuesday 15 April 2025

3. Results

Data results captured by our water quality sampling are presented herein and are representative of baseline water quality results for Moorebank Precinct West Basin 5. Threshold guideline quantitative values for the water quality parameter themes are compared and correlated to ANZECC/ARMCANZ (2000) guidelines under the categorisation thresholds – Waterway benchmark group: ‘The protection of slightly disturbed lowland river ecosystems in southeast Australia’.

As these are the first samples results collected under our scope for the SIOMP-MPW sites, the sampling results presented in this report will be considered for future analysis against subsequent results for use as baseline data for the drainage network SIOMP function.

Triggers Exceedances from both the In-Situ Data and the Laboratory Samples April 2025

Location Basin 5 Outflow

Nitrogen 400 µg/L (Guideline trigger 350)

Copper 0.005 mg/L (Guideline trigger 0.0014mg/L)

Literature Review

Nitrogen Values

Nitrogen

A previous spike in Nitrogen has decreased to almost meet the ANZECC trigger value for rivers flowing to the coast at this collection point. This may be due to increased vegetation within the system allowing for uptake of excess nitrogen being mobilised by the stormwater.

What effect does total nitrogen have on the environment?

Total nitrogen can have damaging effects on the environment and particularly on aquatic life (the fish, shellfish and other creatures in our rivers, lakes and oceans) because most nitrogen is leaked into waterways.

Total nitrogen can also lead to toxic blue-green algal blooms. Blue-green algae can harm humans and can make both humans and animals very sick. Do you see how important it is to help keep our waterways clean?

<https://nitrogen-generators.com/what-is-the-main-industrial-use-of-nitrogen/#:~:text=Food%20Packaging%3A%20It%20is%20common,snack%20foods%20can%20be%20extended.>

Five (5) Industrial Applications of Nitrogen

While the main industrial use of nitrogen is to create ammonia that is required for fertilizer, explosives, and other materials, it uses go far beyond these applications. From food packaging to pharmaceuticals, nitrogen gas can be found in more places and used for more purposes than you may have realized.

Food Packaging: It is common practice for food processing companies to use compressed nitrogen to displace oxygen in the packaging of perishable foods. Without oxygen, the shelf life of foods such as meats, fruits, vegetables, and various snack foods can be extended. Nitrogen can also add a cushion around food to keep it safe during transport.

Chemical Blanketing: Nitrogen is typically used to prevent fires and explosions in dangerous atmospheres like chemical plants or manufacturing facilities, by lowering the oxygen level below explosive limits.

Electronics: In the process of assembling electronics, nitrogen gas is used when two electronic components are forming a permanent connection, also known as soldering. The gas is used to reduce surface tension so there is a cleaner break away from the site of the electrical bond. Nitrogen gas is also used in a computer’s main processing system to prevent it from overheating.

Laboratory: Laboratories require a very specific environment to ensure that tests and results are carried out accurately. Nitrogen gas is used to control oxygen levels, humidity and temperature, and maintain an appropriate atmosphere for highly sensitive procedures and equipment. Additionally, there are various pieces of laboratory equipment that require nitrogen for purging.

Laser Cutting: The application of nitrogen as a purging gas in the steel industry is extremely important. It is used as an assist gas to blow away molten material and achieve a stronger stainless or aluminized steel product that is also more resistant to corrosion.

<https://nigen.com/industries-that-benefit-from-on-site-nitrogen-systems/>

Industries That Benefit from On-Site Nitrogen Systems

Gaseous nitrogen is very useful in large-scale manufacturing and industrial applications. The large volumes of nitrogen gas required for these operations are either sourced from vendors in gas cylinders or generated on-site. In this article, we will highlight critical industrial processes that benefit from on-site nitrogen systems.

Copper Concentration Values

It is well-established that even low concentrations of dissolved copper can be toxic to many aquatic organisms. It is important to understand the variables controlling dissolved copper concentrations in point source stormwater runoff as a means of identifying characteristics of the most problematic sites and designing appropriate treatment strategies.

Studies of copper concentrations in stormwater have also derived that increased dissolved copper concentrations can be highly correlated with both dissolved organic carbon (DOC) and alkalinity; refer ([Jeffrey A. Nason jeff.nason@oregonstate.edu](mailto:jeff.nason@oregonstate.edu), [Don J. Bloomquist](#), and [Matthew S. Sprick](#)). The strong positive relationship between DOC and copper has been observed in other systems (Martinez and McBride, 1999, Romkens and Dolfing, 1998) and highlights the ability of NOM to increase [Cu]_d through complexation.

The sources of copper in stormwater runoff include engine oil, combustion of lubricating oils, roof/gutter runoff, building siding corrosion, fertilizers, pesticides, industrial releases, and wet and dry deposition (Davis, et al., 2001, Kim and Fergusson, 1994, Makepeace, et al., 1995, Rosselot, 2006b). However, the biggest single source of copper to stormwater runoff is use of heavy vehicles and contaminants such as brake pad dust and exhaust particles (Legret and Pagotto, 1999, Rosselot, 2006a).

Recent rainfall totals for the catchment area prior to the testing regimes may also impose a large factor bearing on the results for copper concentration values; Total rainfall volume, rainfall duration, and rainfall intensity have been correlated to decreased copper levels, likely due to dilution (Driscoll, et al., 1990, Kayhanian, et al., 2003). Factors likely to influence the presence of copper in runoff samples include AADT, urban site classification, ADP, the “first flush effect”, total rainfall, and rainfall intensity.

Results of our assessment may confirm other findings that urban (high traffic) catchment areas show the most potential for producing runoff that would expose aquatic species to elevated levels of [Cu]_d (copper), increasing the possibility of copper toxicity. Additionally, first-flush samples displayed consistently higher [Cu]_d than samples collected at later times during a storm. Therefore, best management practices (BMPs) aiming to ameliorate the effect of copper should focus on high traffic, urban areas, the first flush of storms, and point discharges to receiving waters.

3.2 Interpreting Results

Dissolved Oxygen – Measures:

Dissolved oxygen (DO) is oxygen held (dissolved) in the water and available to aquatic organisms.

The amount of dissolved oxygen in a river or stream can tell us a lot about its water quality.

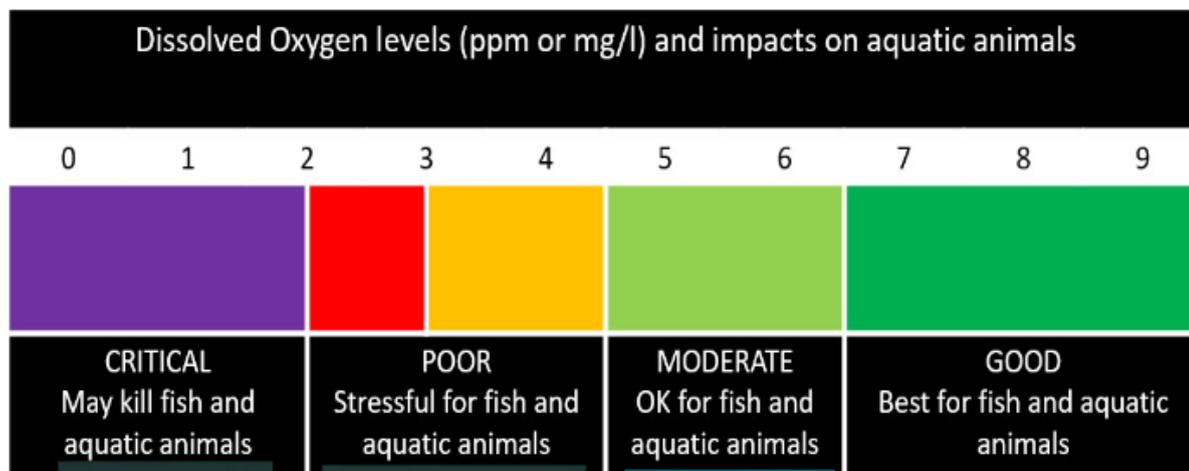
Water will naturally contain a certain amount of dissolved oxygen that is absorbed from the air and produced by plants and algae living in the water.

Temperature has a large effect on the amount of oxygen dissolved in water; cold water can hold higher levels of oxygen than warmer water. Higher water temperatures over summer will cause oxygen levels to drop.

Other factors such as river flow, wind, nutrients and bacterial activity can also affect the amount of dissolved oxygen in waterways.

Dissolved oxygen levels typically range between 5 and 14 mg/L (or ppm).

Example:



Salinity – Measures:

Electrical conductivity is a measure of the saltiness of the water and is measured on a scale from 0 to 50,000 uS/cm. Electrical conductivity is measured in microsiemens per centimeter (uS/cm). Freshwater is usually between 0 and 1,500 uS/cm and typical sea water has a conductivity value of about 50,000 uS/cm.

Examples:

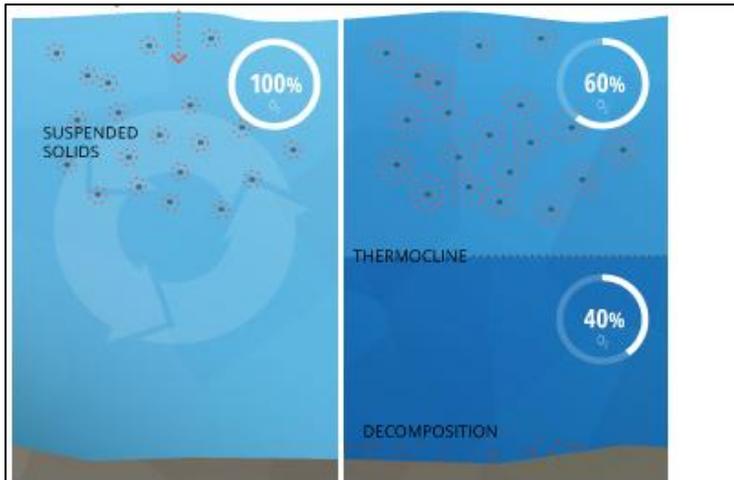
μS/cm	Use
0 - 800	<ul style="list-style-type: none">• Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material)• Generally good for irrigation, though above 300μS/cm some care must be, particularly with overhead sprinklers, which may cause leaf, scorch on some salt sensitive plants.• Suitable for all livestock
800 - 2500	<ul style="list-style-type: none">• Can be consumed by humans, although most would prefer water in the lower half of this range if available• When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants• Suitable for all livestock
2500 -10,000	<ul style="list-style-type: none">• Not recommended for human consumption, although water up to 3000 μS/cm can be consumed• Not normally suitable for irrigation, although water up to 6000 μS/cm can be used on very salt tolerant crops with very special management techniques. Over 6000 μS/cm, occasional emergency may be possible with care• When used for drinking water by poultry and pigs, the salinity should be limited to about 6000 μS/cm. Most other livestock can use water up to 10000 μS/cm

Total Dissolve Solids (TDS) – Measures

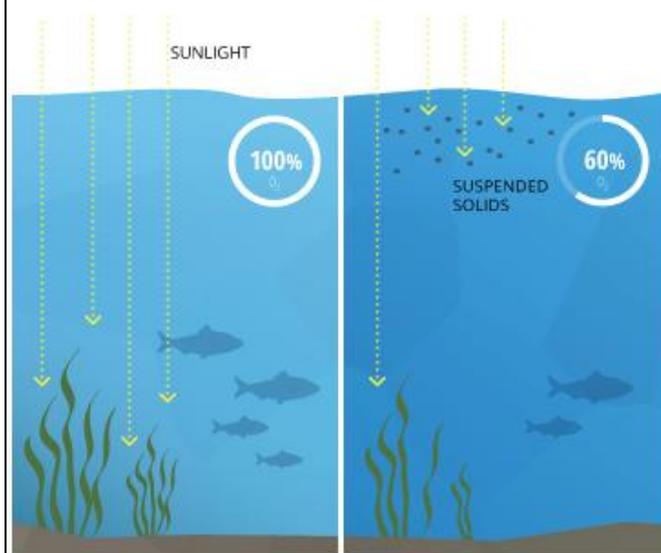
Dissolved solids, smaller than 2 microns, refer to any minerals, salts, metals, in the form of molecules, atoms, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that dissolve in water.

The TDS concentration is the sum of all filterable substances in water that can be determined gravimetrically. However, in most cases, TDS is primarily comprised of ions.

High levels of total suspended solids can affect turbidity, increase water temperatures and decrease dissolved oxygen (DO) levels. This can cause the water to heat up more rapidly because the suspended particles absorb more heat and deplete oxygen, which can adversely affect aquatic life.



Suspended solids can increase the temperature of water as they absorb additional heat from the sun. This can also cause dissolved oxygen levels to drop below the thermocline, creating hypoxic conditions.

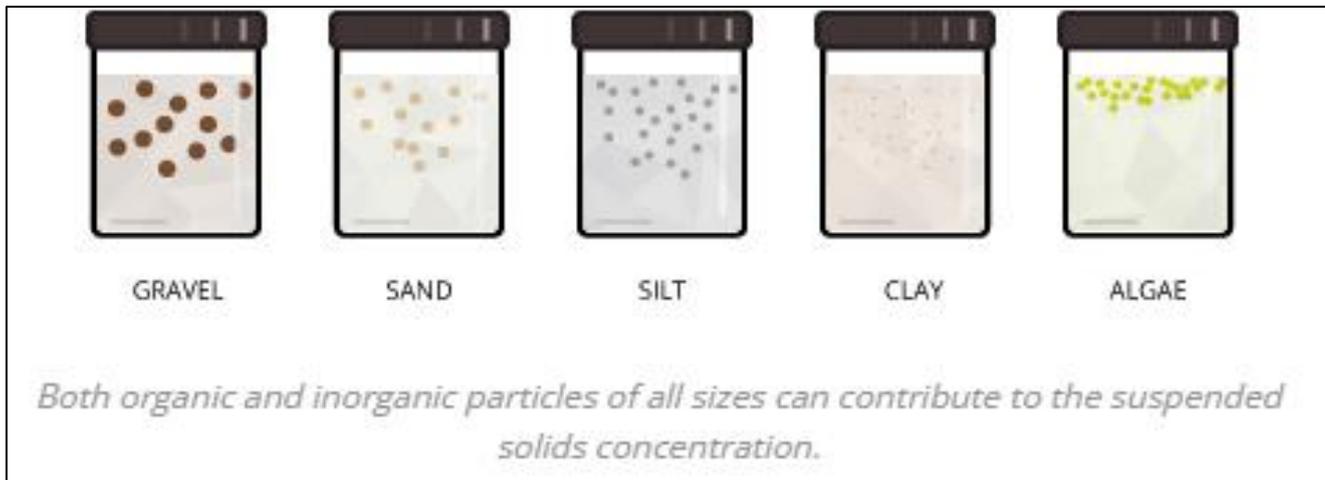


Suspended solids, particularly algae, can block sunlight from reaching submerged plants. This can cause dissolved oxygen levels to drop, as the plants rely on respiration (consuming oxygen) instead of photosynthesis.

Turbidity – Total Suspended Solids (TSS)

Turbidity data are reported in Nephelometric Turbidity Units (NTU). To provide a sense of scale, water with a turbidity of 1 NTU is crystal clear, water at 5 NTU has a tiny trace of discoloration, and water at 100 NTU is brown and opaque. The standard is less than 10 NTU for rural streams and rivers and less than 30 NTU for urban lakes and ponds.

Total suspended solids (TSS) are particles that are larger than 2 microns found in the water column. Anything smaller than 2 microns (average filter size) is considered a dissolved solid. Most suspended solids are made up of inorganic materials, though bacteria and algae can also contribute to the total solids concentration.



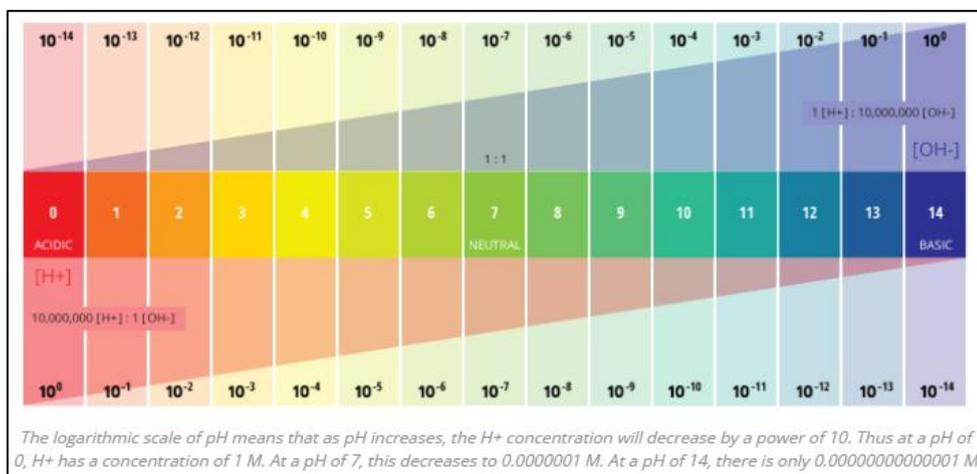
pH – Acidity / Alkalinity – Measures

The pH refers to the degree of acidity or alkalinity of a substance. A pH of 7 is neutral. A value above 7 indicates that the water is more alkaline and a pH below 7 indicates acidic conditions.

A pH of 7 is considered neutral. The logarithmic scale means that each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number. pH stands for the “power of hydrogen”³. The numerical value of pH is determined by the molar concentration of hydrogen ions (H⁺)³. This is done by taking the negative logarithm of the H⁺ concentration (-log(H⁺)).

Standard values for pH readings are expected, pH 6.5–9 for rural streams and rivers and pH 6–9 for urban lakes and ponds.

In freshwater systems pH sets up the conditions for how easy it is for nutrients to be available and how easily things like heavy metals (toxicity for aquatic life) can dissolve in the water. Rivers and lakes generally range between 5 (acidic) and 9 (basic) on the pH scale.



Summary of Results

Aquatic ecosystems	
Indicator	Numerical criteria (trigger values)
Total phosphorus 10 µg/L	<ul style="list-style-type: none"> Upland rivers: 20 µg/L Lowland rivers: 25 µg/L for rivers flowing to the coast; Lakes & reservoirs: 10 µg/L Estuaries: 30 µg/L
Total nitrogen 400 µg/L	<ul style="list-style-type: none"> Upland rivers: 250 µg/L Lowland rivers: 350 µg/L for rivers flowing to the coast; Lakes & reservoirs: 350 µg/L Estuaries: 300µg/L
Chlorophyll-a	<ul style="list-style-type: none"> Upland rivers: not applicable Lowland rivers: 5 µg/L Lakes & reservoirs: 5 µg/L. Estuaries: 4 µg/L.
Turbidity 17.53 NTU	<ul style="list-style-type: none"> Upland rivers: 2–25 NTU (see supporting information) Lowland rivers: 6–50 NTU (see supporting information) Lakes & reservoirs: 1–20 NTU Estuaries: 0.5–10 NTU
Salinity (electrical conductivity) 590 µS/cm	<ul style="list-style-type: none"> Upland rivers: 30–350 µS/cm Lowland rivers: 125–2200 µS/cm supporting information
Dissolved oxygen 10.19 ppm	<ul style="list-style-type: none"> Upland rivers: 90–110% Lowland rivers: 85–110% Freshwater lakes & reservoirs: 90–110% Estuaries: 80–110% <p>Note: Dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability.</p>
pH 8.32	<ul style="list-style-type: none"> Upland rivers: 6.5–8.0 Lowland rivers: 6.5–8.5 Freshwater lakes & reservoirs: 6.5–8.0 Estuaries: 7.0–8.5 <p>Changes of more than 0.5 pH units from the natural seasonal maximum or minimum should be investigated.</p>

Map Image 5. Stormwater Testing Site OP-5 – Basin 5 – MPW



Sample Site Map

0 30 60 120 Meters

Client: M.I.D Plumbing
 Map Issue: Basin 5 Sample Site Map
 Address: BUSHMASTER AVENUE MOOREBANK2170
 Time: 10/07/2024 2:23 PM

LGA: LIVERPOOL CITY COUNCIL
 Lot/DP: 5 to 14/DP 1299137
 Units: Meters

Scale: 1:2,000
 Spatial Reference: WGS 1984 Web Mercator Auxiliary Sphere

Marco Perry
 Environmental/Bushfire Planner
 Bsc EnvSc

Marco@apical-bushfire.com.au

STORMWATER DISCHARGE TESTING SITE

BASIN 5 – OUTFLOW

Site image 1. Testing site Basin 5 - Outflow



Table 3. In-situ data and observations Retention Basin 5 outflow

Moorebank West Precinct - Retention Basin 5 Outflow (MPW outflow)			
Date: 09/04/2025	Time: 12.27pm	Temp: 20.1°C	Humidity: 80%
Operator: Marco Perry		Coordinates: -33.947085, 150.917653	
Equipment used: Aquatroll 500			
Parameter	Recording	ANZECC ANZECC 2000 Guidelines *Lowland rivers	Triggered? Y/N
Temperature (Celcius)	21.9°C	Abnormal to seasonal variation	N
Dissolved Oxygen (DO ppm)	10.19 DO ppm	*Lowland rivers Lower limit: 85% Upper Limit: 110%	N
Electrical Conductivity (SPC -ms/cm)	0.626 SPC -ms/cm	125–2200 µS/cm	N
Electrical Conductivity (ORP mV)	93.5 ORP mV	125–2200 µS/cm	N
pH	8.32	Min 6.5 Max 8.5	N
NTU	17.53	6-50	N

(a) Total phosphorus

MPW outflow - Total phosphorous – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results - Total phosphorous:	<0.01 µg/L	25 µg/L for rivers flowing to the coast	N
Notes: <ul style="list-style-type: none"> • Channel Culvert • µg/L + microseimens per cm • Trigger value 50 µg/L for lowland rivers, trigger value 25 µg/L for rivers flowing to the coast Anzecc Guidelines 2000. Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			

(b) Total nitrogen Total Nitrogen as N (TKN + NOx) by Discrete Analyser

MPW outflow - Total nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results -Total nitrogen:	400 µg/L	350 µg/L for rivers flowing to the coast	Y - marginal
Notes: <ul style="list-style-type: none"> • Total Nitrogen as N (TKN + NOx) by Discrete Analyser • Trigger values are based on a low-lying river • Triiger may be due to concentrated sample 			

(c) Kjeldahl nitrogen Total Kjeldahl Nitrogen as N

MPW outflow - Kjeldahl nitrogen – Qube Logistics, Moorebank, NSW		Trigger Value - ANZECC 2000 Guidelines	Triggered
Lab results – kjeldahl nitrogen:	300 µg/L	-	-
Notes: Total Kjeldahl Nitrogen as N			

d) Dissolved metals;

MPW outflow - Dissolved metals – Qube Logistics, Moorebank, NSW			
Equipment used: - Sample bottles collected from monitoring site ALS Environmental Laboratory Testing Report			
Lab results – Dissolved metals:	Measures mg/L	Trigger value ANZECC Guidelines 2000 95% protection criteria	Triggered
Arsenic	<0.001	0.013 mg/L	N
Cadmium	<0.0001	0.0002 mg/L	N
Chromium	<0.001	0.001 mg/L	N
Copper	0.005	0.0014mg/L	Y
Nickel	0.001	0.011 mg/L	N
Lead	<0.001	0.0034 mg/L	N
Zinc	<0.005	0.008 mg/L	N
Mercury	<0.0001	0.0006 mg/L	N
Notes: - ANZECC Guidelines 90% protection criteria.			

(e) PFAS;

MPW outflow - PFAS – Qube Logistics, Moorebank, NSW			
PFAS Surrogate	Measure %	95% species protection (DEE 2016)	Exceedance?
Perfluorooctane sulfonic acid (PFOS) µg/L	0.01 µg/L	.13 (µg/L)	N
Perfluorooctanoic acid (PFOA)	0.01 µg/L	220 (µg/L)	N
Notes: This Guidance focuses on PFOS and PFOA as potential indicators of wider contamination by related PFASs. The reasons for this approach include: <ul style="list-style-type: none"> • Most research undertaken on PFASs internationally and in Australia has focused on PFOS and PFOA due to their frequent occurrence in the environment, persistence, and bioaccumulation. • PFOS and PFOA can also be the breakdown endpoint of other precursor products. • PFOS and PFOA are the most commonly encountered PFAS in the environment and wildlife. • Information on other PFASs, of which there are several hundred known, is more limited. • Effective management of PFOS and PFOA may help address potential contamination where other PFASs may also be present. 			

(f) Total suspended solids.

MPW outflow - Total suspended solids – Qube Logistics, Moorebank, NSW		EPA exceedance value	Trigger
Lab results – Total suspended solids: mg/L	10 mg/L	50 mg/L	N
Notes: Total Suspended Solids dried at 104 ± 2°C Total Suspended Solids (TSS)			

(g) Total hydrocarbons

Lab results - Total hydrocarbons :	Trigger value ANZECC Guidelines 2000 – slightly disturbed lowland river ecosystem	Triggered	Baseline monitoring May 2024	Monitoring Autumn (April) results
Benzene µg/L	1300 µg/L	N	<1	<1
Toluene µg/L	-	N	<2	<2
Ethylbenzene µg/L	-	N	<2	<2
meta- & para-Xylene µg/L	200 µg/L	N	<2	<2
Ortho-Xylene µg/L	470 µg/L	N	<2	<2
Total Xylenes µg/L	-	-	<2	<2
Sum of BTEX µg/L	-	-	<1	<1
Naphthalene µg/L	85 µg/L	N	<5	<5
Notes: <ul style="list-style-type: none"> The data were compared to the default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000) for the protection of slightly disturbed lowland river ecosystems in southeast Australia. A commonly encountered example of additive toxicity of mixtures is the simple aromatic hydrocarbons commonly associated with contaminated petroleum sites, benzene, toluene, ethyl benzene and xylenes, collectively known as BTEX 				

Water Quality Monitoring Comparative Table (Temporal)

Table 4. Retention Basin 5 MPW. Testing Site MPW 5 Outflow

Testing Site MPW Outflow	May 2024 baseline	October 2024	April 2025
pH	6.39	6.21	8.32
Dissolved Oxygen - %/L	4.11mg/L	10.5	10.19
Actual Electronic Conductivity	0.054945	0.008	93.5 ORP mV
Temperature - °C	18.12	19.5	21.9
Turbidity	0.03 NTU	6.62	17.53
Total phosphorous - mg/L	0.04 mg/L	0.03	<0.01
Total nitrogen - mg/L	1.7 mg/L	0.4	0.4
Kjeldahl nitrogen mg/L	1.0 mg/L	0.4	0.3
Dissolved metals			
Arsenic	<0.001	<0.001	<0.001
Cadmium	<0.0001	<0.0001	<0.0001
Chromium	<0.001	<0.001	<0.001
Copper	0.017	<0.001	0.005
Nickel	0.001	<0.001	0.001
Lead	<0.001	<0.001	<0.001
Zinc	<0.005	0.008	<0.005
Mercury	<0.0001	<0.0001	<0.0001
PFAS			
Lab results – SUM of PFAS Micrograms/L	0.13	0.04	0.08
SUM of PFHxS & PFOS Microgrms/L	0.04	0.04	0.01
Total suspended solids mg/L	6	<5	10
Total hydrocarbons			
Benzene	<1	<1	<1
Toluene	<2	<2	<2
Ethylbenzene	<2	<2	<2
meta-& para-Xylene	<2	<2	<2
Ortho-Xylene	<2	<2	<2
Total Xylenes	<2	<2	<2
Sum of BTEX	<1	<1	<1
Naphthalene	<5	<5	<5

Appendix A. Raw data tables; source - Australian Laboratory Services

Basin 5: Outflow

Page : 8 of 11
 Work Order : EW2501914
 Client : Apical Bushfire and Planning
 Project : Moorebank East + West



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WMP8	WMP7	WMP5	---	---
Sampling date / time				09-Apr-2025 13:10	09-Apr-2025 12:50	09-Apr-2025 12:30	---	---	
Compound	CAS Number	LOR	Unit	EW2501914-006	EW2501914-007	EW2501914-008	-----	-----	
				Result	Result	Result	---	---	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^A C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	---	---	
>C10 - C16 Fraction	---	100	µg/L	<100	<100	<100	---	---	
>C16 - C34 Fraction	---	100	µg/L	<100	<100	<100	---	---	
>C34 - C40 Fraction	---	100	µg/L	<100	<100	<100	---	---	
^A >C10 - C40 Fraction (sum)	---	100	µg/L	<100	<100	<100	---	---	
^A >C10 - C16 Fraction minus Naphthalene (F2)	---	100	µg/L	<100	<100	<100	---	---	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	---	---	
Toluene	108-88-3	2	µg/L	<2	<2	<2	---	---	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	---	---	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	---	---	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	---	---	
^A Total Xylenes	---	2	µg/L	<2	<2	<2	---	---	
^A Sum of BTEX	---	1	µg/L	<1	<1	<1	---	---	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	---	---	
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.11	<0.02	---	---	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.01	0.13	0.01	---	---	



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Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WMP8	WMP7	WMP5	---	---
Sampling date / time				09-Apr-2025 13:10	09-Apr-2025 12:50	09-Apr-2025 12:30	---	---	
Compound	CAS Number	LOR	Unit	EW2501914-006	EW2501914-007	EW2501914-008	-----	-----	
				Result	Result	Result	---	---	
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	<0.1	---	---	
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.04	0.03	---	---	
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.04	0.03	---	---	
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.01	---	---	
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	<0.05	---	---	
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.05	µg/L	<0.05	<0.05	<0.05	---	---	
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	<0.02	---	---	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	<0.05	---	---	
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	<0.05	---	---	
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	---	---	
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	---	---	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WMP8	WMP7	WMP5	----	----
Sampling date / time				09-Apr-2025 13:10	09-Apr-2025 12:50	09-Apr-2025 12:30	----	----	
Compound	CAS Number	LOR	Unit	EW2501914-006	EW2501914-007	EW2501914-008	-----	-----	
				Result	Result	Result	----	----	
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	----	----	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	----	----	
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	----	----	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	----	----	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	----	----	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	----	----	
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L	0.01	0.32	0.08	----	----	
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.01	0.24	0.01	----	----	
Sum of PFAS (WA DER List)	----	0.01	µg/L	0.01	0.32	0.08	----	----	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	98.8	90.8	88.8	----	----	
Toluene-D8	2037-26-5	2	%	93.6	85.2	81.0	----	----	
4-Bromofluorobenzene	460-00-4	2	%	94.7	86.2	81.8	----	----	
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%	102	102	100	----	----	
13C8-PFOA	----	0.02	%	101	105	105	----	----	



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Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	72	143
Toluene-D8	2037-26-5	75	131
4-Bromofluorobenzene	460-00-4	73	137
EP231S: PFAS Surrogate			
13C4-PFOS	---	60	120
13C8-PFOA	---	60	120

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry / Biology).

- (WATER) EK067G: Total Phosphorus as P by Discrete Analyser
- (WATER) EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser
- (WATER) EK061G: Total Kjeldahl Nitrogen By Discrete Analyser
- (WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser
- (WATER) EG035F: Dissolved Mercury by FIMS
- (WATER) EG020F: Dissolved Metals by ICP-MS
- (WATER) EP080/071: Total Petroleum Hydrocarbons
- (WATER) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions
- (WATER) EP080: BTEXN
- (WATER) EP080S: TPH(V)/BTEX Surrogates
- (WATER) EP231A: Perfluoroalkyl Sulfonic Acids
- (WATER) EP231B: Perfluoroalkyl Carboxylic Acids
- (WATER) EP231C: Perfluoroalkyl Sulfonamides
- (WATER) EP231D: (n:2) Fluorotelomer Sulfonic Acids
- (WATER) EP231P: PFAS Sums
- (WATER) EP231S: PFAS Surrogate
- (WATER) EA025: Total Suspended Solids dried at 104 ± 2°C

Chemical	Trigger values for freshwater (μgL^{-1})				Trigger values for marine water (μgL^{-1})			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 ^C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 ^A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin	B	2.6	4.4	6	9 ^A	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 ^C	1000 ^C	ID	ID	ID	ID
Alcohol ethoxylated sulfate (AES)	340	650	850 ^C	1100 ^C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 ^C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons								
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 ^A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH >6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC_{50} data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) — check Section 8.3.7 for spread of data and its significance. 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Sections 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) — check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.

D = Ammonia as TOTAL ammonia as $[\text{NH}_3\text{-N}]$ at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2.

E = Chlorine as total chlorine, as $[\text{Cl}]$; see Section 8.3.7.2.

F = Cyanide as un-ionised HCN, measured as $[\text{CN}]$; see Section 8.3.7.2.

G = Sulfide as un-ionised H_2S , measured as $[\text{S}]$; see Section 8.3.7.2.

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30 mg/L CaCO_3 . These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.

Table 5. Ecological water quality guideline values developed by water regulators

Exposure scenario	PFOS	PFOA	Exposure scenario	Comments and source
Freshwater	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	Australian and New Zealand Guidelines for Fresh and Marine Water Quality - technical draft default guideline values for PFOS and PFOA.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The 99% species protection level for PFOS is close to the level of detection. Agencies may wish to apply a 'detect' threshold in such circumstances rather than a quantified measurement.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: The draft guidelines do not account for effects which result from the biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	Note 3: The WQGs advise ⁴¹ that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Regulators may specify or environmental legislation may prescribe the level of species protection required, rather than allowing for case-by-case assessments.
Interim marine	0.00023 µg/L	19 µg/L	99% species protection - high conservation value systems	As above. Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
	0.13 µg/L	220 µg/L	95% species protection - slightly to moderately disturbed systems	Note 1: The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction.
	2 µg/L	632 µg/L	90% species protection - highly disturbed systems	Note 2: Marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process.
	31 µg/L	1824 µg/L	80% species protection - highly disturbed systems	

Australian Water Quality Guidelines for Fresh and Marine Waters

Type of indicator	Indicator	Units	Fresh waters	Marine waters
	Dissolved oxygen ²	mg/L	> 6 (> 80–90% saturation)	> 6 (> 80–90% saturation)
	Nutrients/nuisance growths	–	(Section 2.3.3)	(Section 2.3.3)
	pH	–	6.5–9.0	< 0.2 pH unit change
	Salinity	mg/L	< 1000 (about 1,500 µS/cm)	–
	Suspended particulate matter/turbidity	–	< 10% change seasonal mean concentration (see also colour & clarity)	< 10% change seasonal mean concentration (see also colour & clarity)
	Temperature ³	–	< 2°C increase	< 2°C increase
Toxicants				
Inorganic toxicants	Aluminium	µg/L	< 5.0 (if pH ≤ 6.5)	NR
	Aluminium	µg/L	< 100.0 (if pH > 6.5)	–
	Ammonia	µg/L	20.0–30.0 (Table 2.3)	NR
	Antimony	µg/L	30.0	500.0
	Arsenic	µg/L	50.0	50.0
	Beryllium	µg/L	4.0 ⁴	NR
	Cadmium	µg/L	0.2–2.0 ⁵	2.0
	Chromium	µg/L	10.0	50.0
	Copper	µg/L	2.0–5.0 ⁵	5.0
	Cyanide	µg/L	5.0	5.0
	Iron	µg/L	1,000.0 ⁶	NR
	Lead	µg/L	1.0–5.0 ⁵	5.0
	Mercury	µg/L	0.1	0.1
	Nickel	µg/L	15.0–150.0 ⁵	15.0
	Selenium	µg/L	5.0	70.0
	Silver	µg/L	0.1	1.0
	Sulfide	µg/L	2.0	2.0
	Thallium	µg/L	4.0	20.0
Tin (tributyltin)	µg/L	0.008	0.002	
Zinc	µg/L	5.0–50.0 ⁶	50.0	
Organic toxicants	Acrylonitrile	µg/L	NR	NR
	Benzidine	µg/L	NR	NR
	Dichlorobenzidine	µg/L	NR	NR
	Diphenylhydrazine	µg/L	NR	NR
Halogenated aliphatic compounds	Hexachlorobutadiene	µg/L	0.1	0.3
	Halogenated ethers	µg/L	NR	NR
	Isophorone	µg/L	NR	NR
Monocyclic aromatic compounds	Benzene	µg/L	300.0	300.0
	Chlorinated benzenes	µg/L	(Table 2.8)	NR

Appendix C. Intensity Frequency Duration – Average Recurrence Interval Indicator
[Intensity-Frequency-Duration \(bom.gov.au\)](http://Intensity-Frequency-Duration (bom.gov.au))

