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Dunmore Hard Rock Quarry Annual Review

1 July 2023 – 30 June 2024

Document Control Sheet

Document Control				
Ref	Prepared by	Approved by	Date	Distribution
V1.0	Matt Bray	Lauren Sibigtroth	29/09/2024	• Department of Planning, Housing and Infrastructure • Environmental Protection Authority • Shellharbour City Council • Dunmore Quarry CCC • Online at https://www.boral.com.au/locations/boral-dunmore-operations

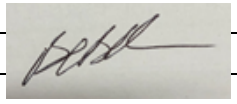
Dunmore Hard Rock Quarry Annual Review Title Block

Name of operation	Boral Dunmore Hard Rock Quarry
Name of operator	Boral Resources (NSW) Pty Ltd
Development consent	DA-470-11-2003
Name of holder of development consent	Boral Resources (NSW) Pty Ltd
Water licence number	WAL#25152 Ref# 10AL103610
Name of holder of water licence	Boral Resources (NSW) Pty Ltd
Name of holder of EPL	Boral Resources (NSW) Pty Ltd
Annual Review start date	1 July 2023
Annual Review end date	30 June 2024

I, Brodie Bolton, certify that this audit is a true and accurate record of the compliance statues of the Dunmore Hard Rock Quarry for the period of the 2024 Financial Year and that I am authorised to make this statement on behalf of Boral Resources (NSW) Pty Ltd.

Note

The annual review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual $250,000.

Name of authorised reporting officer	Brodie Bolton
Title of authorised reporting officer	Quarry Manager
Signature	
Date	30/09/2024

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List of Abbreviations

ACHMP	Aboriginal and Cultural Heritage Management Plan
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
AR	Annual review
AS	Australian Standard
BFMP	Bushfire Management Plan
BMP	Blast Management Plan
BOS	Biodiversity Offset Strategy
CCC	Community Consultative Committee
DA 470-11-2003	The development application for the Dunmore Hard Rock Quarry operated by Boral Resources (NSW) Pty Ltd
DO	Dissolved Oxygen
DPHI	Department of Planning, Housing and Infrastructure
DRG	NSW Division of Resources and Geoscience
EPA	Environmental Protection Authority
EPA&A Act	Environmental Planning and Assessment Act 1979
EPL 77	Environmental Protection Licence 77 for the Dunmore Hard Rock Quarry operated by Boral Resource (NSW) Pty Ltd
FFMP	Flora and Fauna Management Plan
FY24	Financial Year 2024 (1 July 2023 – 30 June 2024)
HVAS	High Volume Air Sampler
IEA	Independent Environmental Audit
LOR	Limit of Reporting
ML	Megalitres
MSDS	Material Safety Data Sheet
NATA	National Association of Testing Authorities
NMP	Noise Management Plan
NRAR	Natural Resource Access Regulator
NTU	Nephelometric Turbidity Units
OEH	Office of Environment and Heritage
PIRMP	Pollution Incident Response Management Plan

PM10	Particulate Matter (10 microns in diameter)
PM2.5	Particulate Matter (2.5 microns in diameter)
POEO Act	*Protection of the Environment Operations Act 1997*
RIC	Rail Infrastructure Corporation
S5.C9	Used to refer to a particular condition in DA-470-11-2003 (in this case Schedule 5, Condition 9).
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
WMP	Water Management Plan
WQO	Water Quality Objectives
µg/m^3	Micrograms per cubic metre

1. Purpose and Scope

In addition to determining compliance of the operation, DA 470-11-2003 Schedule 5 Condition 9 (S5.C9) requires that the AR reports on specific components of the operation.

S5.C9 and all other relevant conditions required to be addressed as part of the AR are outlined in Table 1 with reference to the section of this report where each has been addressed. The timeframe for the annual review is the 2023 Financial Year which is 1 July 2023 –30 June 2024.

Table 1 Annual Review Consent Requirements

Condition	Condition Requirements	Location within this report
S4.C29	In each Annual Review, the Applicant must:	
	(a) recalculate the site water balance for the development; and	Section 5.5.4
	(b) provide information on evaporative losses, dust suppression, dam storage levels and implications of obtaining any water supplies from off-site; and	Section 5.5.4
	(c) evaluate water take against licensing requirements	Section 5.5.4
S4.C50	The Applicant must include a progress report on the implementation of the Flora and Fauna Management Plan in the Annual Review.	Section 5.7, Appendix F
S4.C67	The Applicant must include a progress report on the implementation of the Rehabilitation Management Plan in the Annual Review.	Section 5.7, Appendix F
S4.C81	The Applicant must describe what measures have been implemented to minimise the amount of waste generated by the development in the Annual Review	Section 5.9
S4.C87	The Applicant must:	
	a. provide annual production data to the DRG using the standard form for that purpose; and	Section 3
	b. include a copy of this data in the Annual Review.	Section 3

Condition	Condition Requirements	Location within this report
S5.C9	By the end of September each year, or other timing as may be agreed by the Planning Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Planning Secretary. The review must: a) Describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year; b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against the: • Relevant statutory requirements, limits or performance measures/criteria; • Requirements of any plan or program required under this consent; • Monitor results of previous years; and • Relevant predictions in the document listed in condition 2 of schedule 3; c) Identify any non-compliance over the last financial year, and describe what actions were (or are being) taken to ensure compliance; d) Identify any trends in the monitoring data over the life of the development; e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development. The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.	Section 5.7, Appendix F Section 5, Section 6.1 Section 1.1 Section 5 Section 5 Section 5

1.1. Statement of Compliance

The statement of compliance for the FY24 reporting period (1 July 2023 – 30 June 2024) is contained in Table 2 below.

Table 2 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA-470-11-2003	No

The non-compliances identified in the reporting period are detailed in Table 3. Each non-compliance has been risk assessed as per the DPHI Annual Review Guidelines Compliance Status key outlined in Table 3.

Table 3 Non-Compliances Risk Assessment

Condition #	Condition Description	Compliance Status	Comments	Section addressed
DA 470-11-2003 S4.C70 C	Within three years of the determination of Modification 11, and every five years thereafter (if directed to do so by the Planning Secretary), the Applicant must commission and pay the full costs of a Transport Options Review for the development. This review must: a) be conducted by a suitably qualified, experienced and independent expert/s whose appointment has been endorsed by the Planning Secretary; b) be prepared in consultation with TfNSW and Council; c) review the economic, social and environmental costs and benefits of all reasonable and feasible options for the	Non-compliant Administrative	Transport Options Review was due in March 2022 but was not submitted to the Department until July 2023.	3.1.1

Condition #	Condition Description	Compliance Status	Comments	Section addressed
	transport of quarry products from the site (including by rail and road); d) review and report on available rail terminal capacity; e) recommend any appropriate measures or actions to: i. reduce the economic, social and environmental costs associated with transport of quarry products by road from the site; and ii. maximise the use of rail deliveries from the site; and f) be conducted and reported to the satisfaction of the Planning Secretary. Within three months of commencing this review, or within another timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the review report to the Planning Secretary and any other NSW agency that requests it, together with its response to any recommendations contained in the review report.			
DA 470-11-2003 S5.C10	Prior to 1 April 2017, and every three years thereafter, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an	Non-compliant administrative	IEA was undertaken in November 2023, however was required to be undertaken in April 2023 in order to be completed on time.	5.12

Condition #	Condition Description	Compliance Status	Comments	Section addressed
	Independent Environmental Audit of the development. This audit must: (a) be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Planning Secretary; (b) include consultation with the relevant agencies and the CCC; (c) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent and any relevant EPL and/or Water Licences (including any assessment, plan or program required under these approvals); CONSOLIDATED CONSENT 30 (d) review the adequacy of any approved strategies, plans or programs required under the abovementioned approvals; (e) recommend appropriate measures or actions to improve			

Condition #	Condition Description	Compliance Status	Comments	Section addressed
	the environmental performance of the development, and/or any assessment, plan or program required under the abovementioned approvals; and (f) be conducted and reported to the satisfaction of the Planning Secretary			

Risk Assessment of Non-Compliances

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: • potential for serious environmental consequences, but is unlikely to occur; • potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • potential for moderate environmental consequences, but is unlikely to occur; or • potential for low environmental consequences, but is likely to occur
Administrative	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (eg submitting a report to government later than required under approval conditions)

Copies of the AR will be submitted to the DPHI and made available to the public at on the Dunmore Quarry website.

https://www.boral.com.au/locations/boral-dunmore-operations

1.2. Contacts Relevant to Dunmore Quarry Operations

Key contacts associated with the management of the Quarry operations, environment, safety and stakeholder relationships are provided in Table 4.

Table 4 Contacts Relevant to Dunmore Quarry Operations

Contact	Position	Contact Details
Brodie Bolton	Dunmore Quarry Manager	Tel: (02) 4237 2000 Email: brodie.bolton@boral.com.au
Angus Shedden	Metropolitan Operations Manager NSW/ACT	(02) 4237 8414 Email: angus.shedden@boral.com.au
Matt Bray	Environment and Stakeholder Advisor Dunmore	Tel: (02) 4237 8414 Email: matt.bray@boral.com.au
Kate Woodbridge	Stakeholder Relations Manager	Tel: (02) 4237 8414 Email: kate.woodbridge@boral.com.au

2. Dunmore Quarry Operations

The Dunmore Hard Rock Quarry, owned and operated by Boral Resources (NSW) Pty Ltd, is located at Tabbita Road Dunmore, approximately 12 kilometres north-west of Kiama in the Shellharbour Local Government Area. The Quarry produces hard rock from Bumbo Latite Member, a fine-grained intermediate volcanic rock similar to basalt, which is crushed to produce coarse aggregates, road construction materials and fines.

Development Consent (DA 470-11-2003), issued 19 November 2004 by the Minister for Infrastructure and Planning, allows Boral to produce up to 2.5 million tonnes of quarry product a calendar year (Mtpa), and transport it offsite by road and rail to local and regional markets.

Dunmore Hard Rock Quarry (the site) covers approximately 248 hectares and is surrounded by private property, predominantly agricultural grazing land and tracts of remnant native vegetation, to the south, north and west (The Boral owned and operated Dunmore Lakes Sand Project adjoins the site to the east).

The extraction method involves drilling and blasting to produce broken rock, that is transported to the primary crusher feed bin. The primary-crushed rock is further reduced in size in a series of crushers, before being conveyed to the tertiary screen house where the crushed rock is sized according to product specifications. The sized products are then stockpiled within the various stockpile areas on site, until they are transported to local and regional markets.

During the reporting period, extraction has occurred in the area known as the Croome West Pit. Approval of the most recent modification, MOD 13, was granted in June 2024. The site layout is shown below in Figure 1.

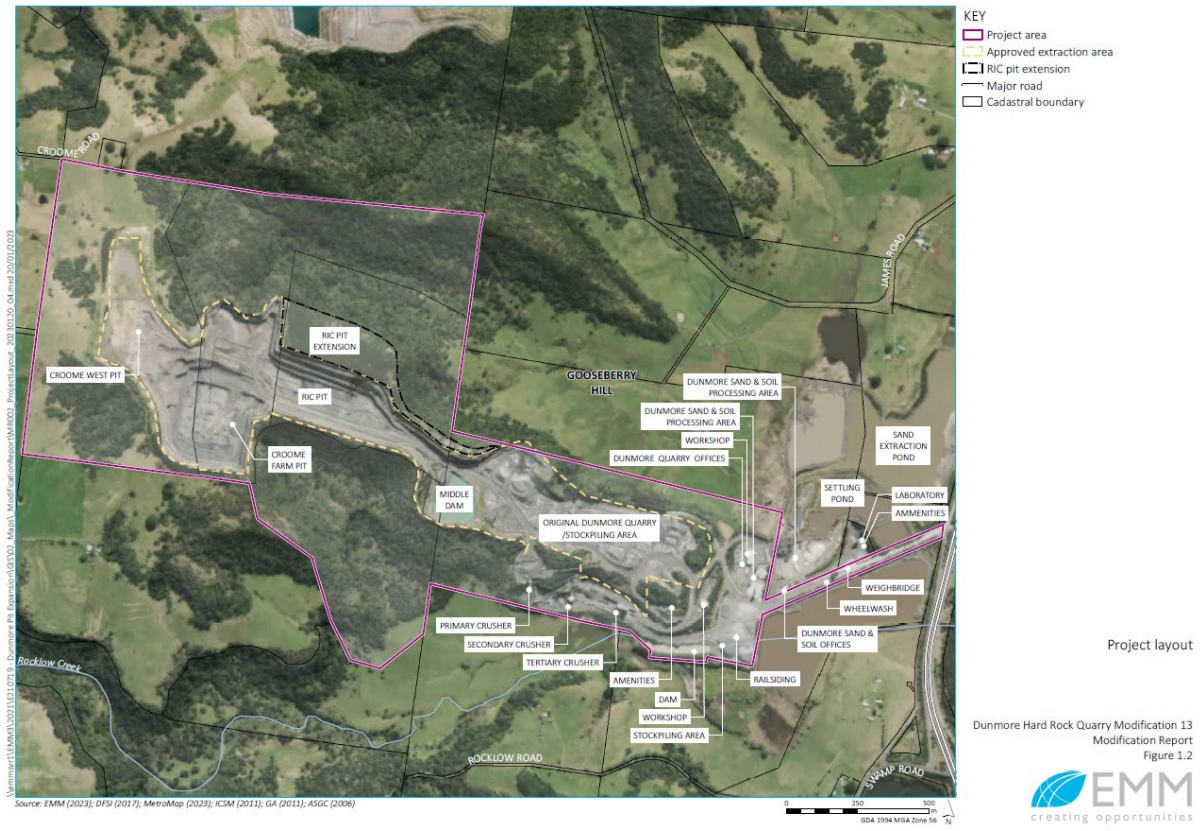


Figure 1 Dunmore Site Layout

2.1. Operations the last 12 months

Operations have continued in the Croome west pit, with no changes.

Product continues to be supplied to a number of large infrastructure projects including the Western Sydney Airport (WSA) project and HMAS Albatross.

2.2. Operations the next 12 months

Rock will still be sourced from the Croome pit however access to the RIC reserve will commence around November 24. This will include the translocation of vegetation and removal of overburden from the site.

Water management upgrades as well as extensive rehabilitation will be commenced in line with the Mod 13 approval.

Licences and Approvals

Dunmore Quarry operates under a number of regulatory approvals and licences which are summarised in Table 5 below.

Table 5 Relevant Licences and Approvals

Approval	Detail	Regulatory Authority
DA 470-11-2003 Modification 13	Approved in June 2024, MOD13 covered a 8ha extension of the RIC pit to allow for further extraction until 2043.	NSW Department of Planning, Housing and Infrastructure
EPL 77	The EPL is issued for the scheduled activity of: Crushing, Grinding, Separation and Extractive activities for tonnages up to 2 million tonnes per annum as defined by the EPA anniversary date 01 July.	NSW Environmental Protection Authority
Water Access Licence WAL#25152 WSW# 10AL103610	Extraction of water from the Lower Dam. This allows for 227 ML per annum to be extracted from Rocklow Creek. Since 2008 the Lower Dam has been taken offline from Rocklow Creek as part of MOD 2	Water NSW
Water Access Licence WAL#44509	Extraction of water from the Greater Sydney Basin. This allows for 250 ML per annum to be extracted.	Water NSW

A copy of DA 470-11-2003 and EPL 77 is available on request or can be accessed through the Boral Dunmore website:

https://www.boral.com.au/locations/boral-dunmore-operations

3. Production, Sales and Transport

Production was forecast to be lower than expected but delivered a strong result due to the buoyant Greater Sydney market with an increase in infrastructure works in both the Sydney and Illawarra.

Table 6 and Table 7 detail the production data in both a monthly breakdown and the format submitted to DRG as required by S4.C77.

Table 6 Production data

Month	Production (t)	Sales (t)	
		Road	Transfers
Jul-2023	124,880	115,840	
Aug-2023	159,960	114,648	6,444
Sep-2023	122,187	96,164	1,758
Oct-2023	106,552	106,683	5,510
Nov-2023	118,864	93,481	
Dec-2023	71,221	68,850	8,743
Jan-2024	96,097	60,344	4,406
Feb-2024	115,473	94,610	8,840
Mar-2024	88,015	90,258	6,611
Apr-2024	101,219	66,271	8,816
May-2024	96,286	60,930	8,806
Jun-2024	97,904	61,210	4,399
FY 24 Total	1,298,658	1,029,289	64,333
		1,093,622	

Table 7 Sales data for FY23 period

Total Sales/Disposals			
Product	**Type of Material**	**Quantity (Tonnes)**	**$ Value of Sale***
Virgin Materials			
Crushed Coarse Aggregates			
Over 75mm	Latite	152,300	*
Over 30mm to 75mm	Latite	223,301	*
5mm to 30mm	Latite	425,620	*
Under 5mm	Latite	228,068	*
Natural sand		64,333	*
Manufactured Sand	Latite	0	*
Construction Sand		0	*
Prepared Road Base & Sub Base	Latite	0	*
Other Unprocessed Materials	Latite	0	*
Total		1,093,622	*

Note: This data is an approximation of FY24 production data and is subject to change.

*This information is commercially sensitive and has been omitted.

** This product is not part of the total sales

3.1. Transport Dispatch Data

Transport numbers are extracted from the transport monitoring system, which uses a docket tracking system to calculate the dispatch number, which is then automatically migrated over to the transport dispatch monitoring sheet.

No exceedances occurred with respect to the limit of 400 laden trucks from the site per day during the reporting period. The highest number of trucks leaving site on any given day was 181.

3.1.1. Transport Options Review

A transport options review is required within three years of determination of Modification 11 and every five years after as per SC.C60C. The review was completed in 2023, and the conclusion and recommended measures are as follows:

The TMP includes this transport option review for Dunmore Hard Rock Quarry. The quarry is approved to transport 2.5 Mtpa of quarry products either by road or rail. There is no current maximum cap for rail transport. Peppertree Quarry is approved to produce up to 3.5 Mtpa with the majority of the product transported by rail. Up to 100,000 tonnes of material is able to be transported by road per annum, where needed.

60 C Modification 11 consolidated consent for Dunmore quarry requires a transport option review for this quarry in every five years.

A weekly rail schedule indicates that collectively Enfield and St Peters terminal can accommodate a maximum of five trains per day effectively, where the trains that unload at both terminals count as two trains.

Currently most of the rail deliveries occur from Peppertree quarry. The modern rail infrastructure of Peppertree quarry allows longer trains and the loading of products more quickly and efficiently. Furthermore, the travel distance to Sydney from Peppertree quarry is almost double that of Dunmore quarry. The longer distance rail travel is more cost effective and economically viable. At Peppertree quarry, the majority of the quarry products are required to be transported by rail.

Currently one train per week carries quarry material between Dunmore quarry to St Peters terminal. Given the train capacity is approximately 2,600 tonnes, the per annum rail transport is now restricted to 135,200 tonnes which is approximately 5% of the total transport per annum. However, this is acceptable as the Mod 11 TIA found that the transport of 2.5 Mtpa of product by road would not result in any significant adverse impacts on road network capacity, traffic delays or intersection performance on the road transport route.

The relevant technical assessments also indicated that there are no adverse noise or air quality impacts associated the maximum of 2.5 Mtpa of quarry products transported by road. The quarry generates many social and economic benefits in the Illawarra region, as such its operation should continue as it is in relation to its transportation of materials to external customers. Additionally, the Albion Park Rail bypass has been now constructed and opened. It has eased the traffic congestion at Albion Park, which was previously a primary traffic congestion pinch point along the transport route to Sydney.

Located directly adjacent to the Princes Highway with access via the grade separated intersection at Tabbita Road, the Dunmore Quarry operations are ideally positioned to access the arterial road network.

4. Actions Required from Previous Annual Review

Table 8 details the actions required from the FY23 Annual review and where each item is discussed.

Table 8 FY23 Annual review actions

Reference	Description of Action	Actions Completed	Section Addressed
AR1	Update Water Management Plan as part of MOD 12 post approval documentation.	Water Management Plan has been submitted	Section 5.5
AR2	Real time weather system to be investigated.	Real time monitoring system currently under trial.	Section 5.2
AR3	Real time dust monitoring system transition phase to be completed with alert system and HVAS assessment undertaken.	Real time monitoring system currently under trial.	Section 5.2
AR4	Transport Options Review complete and submitted to DPE.	Transport Options Review approved	Section 3.1.1
AR5	Independent Environmental Audit completed for 2023.	IEA completed in November 2023 / February 2024.	
AR6	Rehabilitation Management Plan to be continued.	New due date for Rehabilitation Management Plan in light of Modification 13.	
AR7	Rehabilitation Bond to be completed based on approval of calculation report by DPHI.	Rehabilitation Bond recalculated and approved by DPHI.	
AR8	Complete re-fencing of rehabilitation areas to limit intrusion of cattle when the RVCA area is accessible.	Complete	Section 5.7.3

5. Environmental Performance

Dunmore Quarry has comprehensive management and monitoring programs which collect information and data for the assessment of environmental impacts, regulatory compliance and performance against continual improvement objectives. Specific Management Plans define the framework for measuring environmental performance and compliance with statutory requirements for each relevant aspect of environmental performance.

5.1. Meteorological Monitoring

An onsite weather station is located at Dunmore, which collects a range of meteorological parameters. This system was upgraded as part of the transition to real time air quality monitoring. The location of the weather station is shown in Appendix A.

There is no prescribed impact assessment criteria and meteorological monitoring is used to provide background information for management of the site. A detailed summary of the FY24 and historical rainfall data can be found in Appendix A.

5.1.1. Meteorological Monitoring Long Term Analysis and Trends

The FY24 period was wetter than average with 1,616 mm falling over the reporting period. There were six notable rain events during the reporting period, all of which exceeded the design capacity of the lower dam (90.7 mm over 5 days):

- 28-30 November 2023: 109 mm.
- 24-28 December 2023: 120 mm.
- 3-7 April 2024: 253 mm.
- 3-7 May 2024: 122 mm.
- 9-13 May 2024: 172 mm.
- 6-8 June 2024: 192 mm.

Typically winds during the reporting period originated from the west and west-south-west for the majority of the year. In summer, prevailing winds were also from the north-east. These results are mostly consistent with historic trends and generally had a greater concentration of winds from the west and north-east.

5.1.2. Meteorological Monitoring Summaries and Opportunity for Improvement

The weather station is capable of providing real time data via download which is an upgrade from the previous station. The next reporting period will focus on continuing the processes established during the current reporting period.

5.2. Air Quality Monitoring

Two methods of monitoring air quality are used at Dunmore Quarry. Deposited dust gauges are used to measure deposited dust every 30 days (+/- 2 days). A High Volume Air Sampler (HVAS) is used to measure the fine particulate matter under 10 microns (PM_{10}) every 6 days.

A real time monitoring system has been installed which is used to guide day to day management and response to air quality monitoring. This system is currently in a transitional phase. Under the currently approved AQMP, the real-time monitoring network is proposed to eventually replace the deposited dust and HVAS monitoring once the transitional phase is complete. During the transition phase, the existing HVAS monitor would continue to be operated and be used to validate real-time monitoring network and assess the compliance of the project. An alert system is to be trialled in the next reporting period, as part of the transitional phase. A determination on the use of both the HVAS monitoring network and real time monitors will be made in the FY25 reporting period.

A proposal has been supplied to the EPA in regard to the operation of the real time air quality network, with an agreed timeframe for implementation by the end of 2025.

The location of air quality monitoring equipment is shown below in Figure 2.

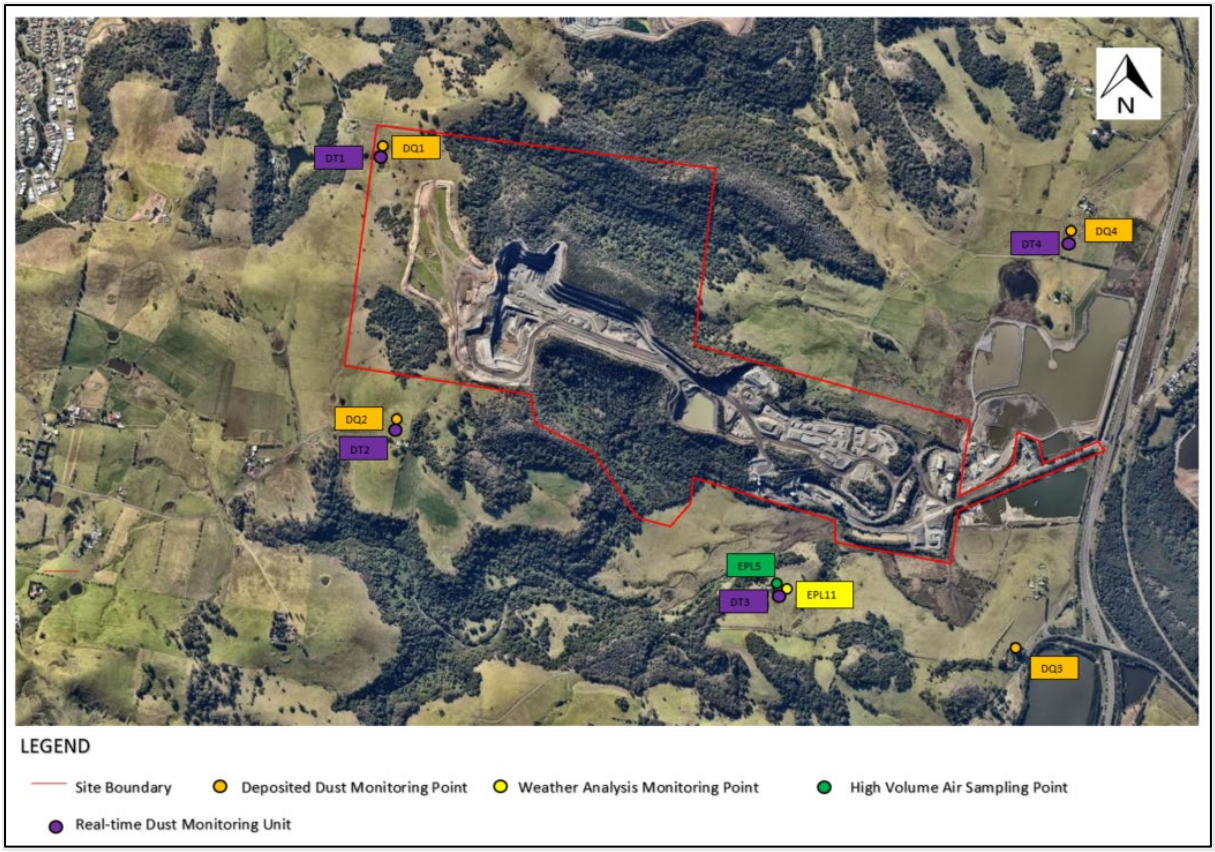


Figure 2 Air Quality Monitoring Locations

5.2.1. Deposited Dust Monitoring Assessment Criteria

The relevant deposited dust impact assessment criteria apply to a residence on privately owned land. Monitoring points 1, 2 and 4 are not located in direct vicinity of residences. It is important to note that the assessment criteria refer to an annual averaging period (i.e. a monthly average over the last 12 months). Impact assessment criteria is shown in Table 9 below.

Table 9 Deposited Dust Impact Assessment Criteria

Pollutant	Averaging Period	Criterion	
Deposited dust[c]	Annual	2g/m2/month[b]	4g/m^2/month[a,d]

[a] Cumulative impacts (ie increases in concentration due to development plus all other sources)

[b] Incremental impact (ie increases in concentration alone, with zero allowable exceedances of criteria over the life of the development.

[c] Deposited dust is defined as insoluble solids

[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Planning Secretary.

5.2.2. Deposited Dust Monitoring FY24 Performance Review

All monitoring points were below the required assessment criteria of rolling annual average of 4g/m^2/month for dust measured as insoluble solids during the reporting period.

All sites also were below 4g/m^2/month for ash fraction which excludes the organic (combustible) component of the sample such as vegetation, bird droppings and insects. These organic contaminants within the sample are typically representative of the surrounding wetlands and farmland which the monitors are located within.

A summary of results for each monitoring location is shown in Table 10 below. A monthly breakdown of each site and summary graphs is located in Figures 3 to 6.

Table 10 Deposited Dust Monitoring Summary

	Site 1 grams/m^2/month		Site 2 grams/m^2/month		Site 3 grams/m^2/month		Site 4 grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	As4h
FY24 Average	1.93	0.91	1.53	0.74	1.87	0.76	1.94	0.73
Criterion	4	-	4	-	4	-	4	-

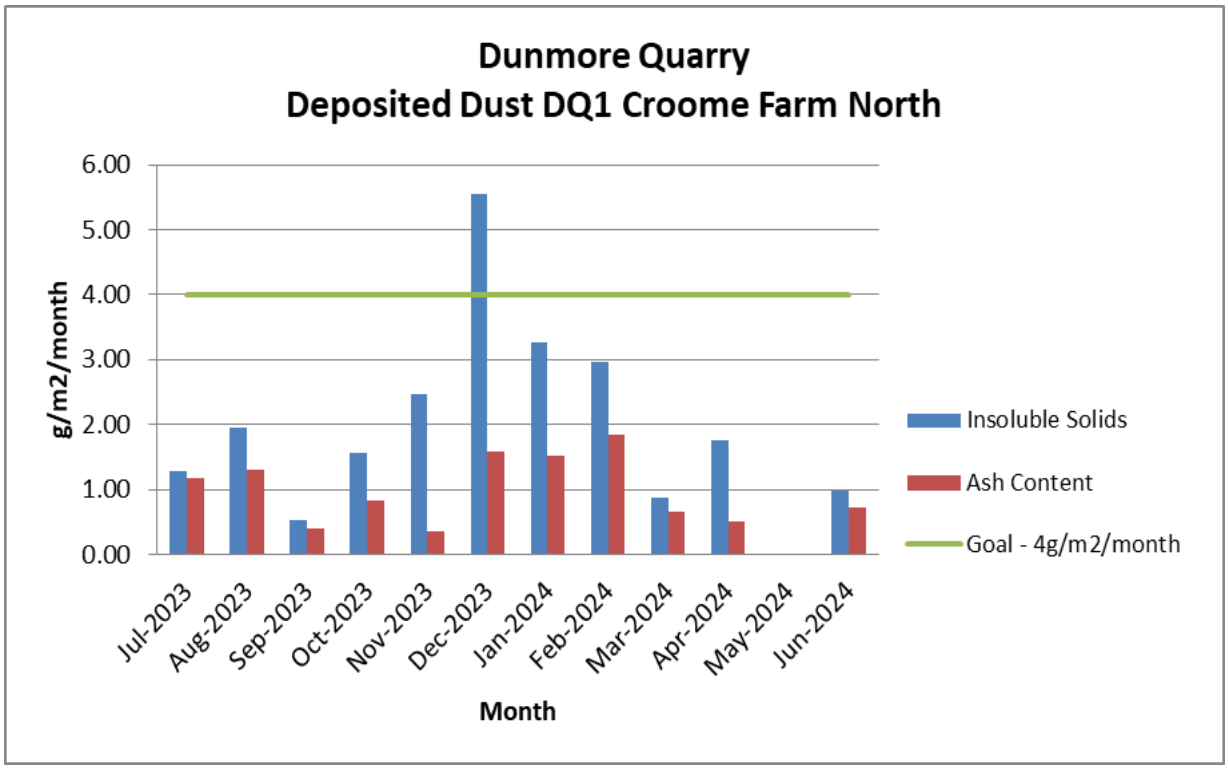


Figure 3 DQ1 Deposited Dust Results

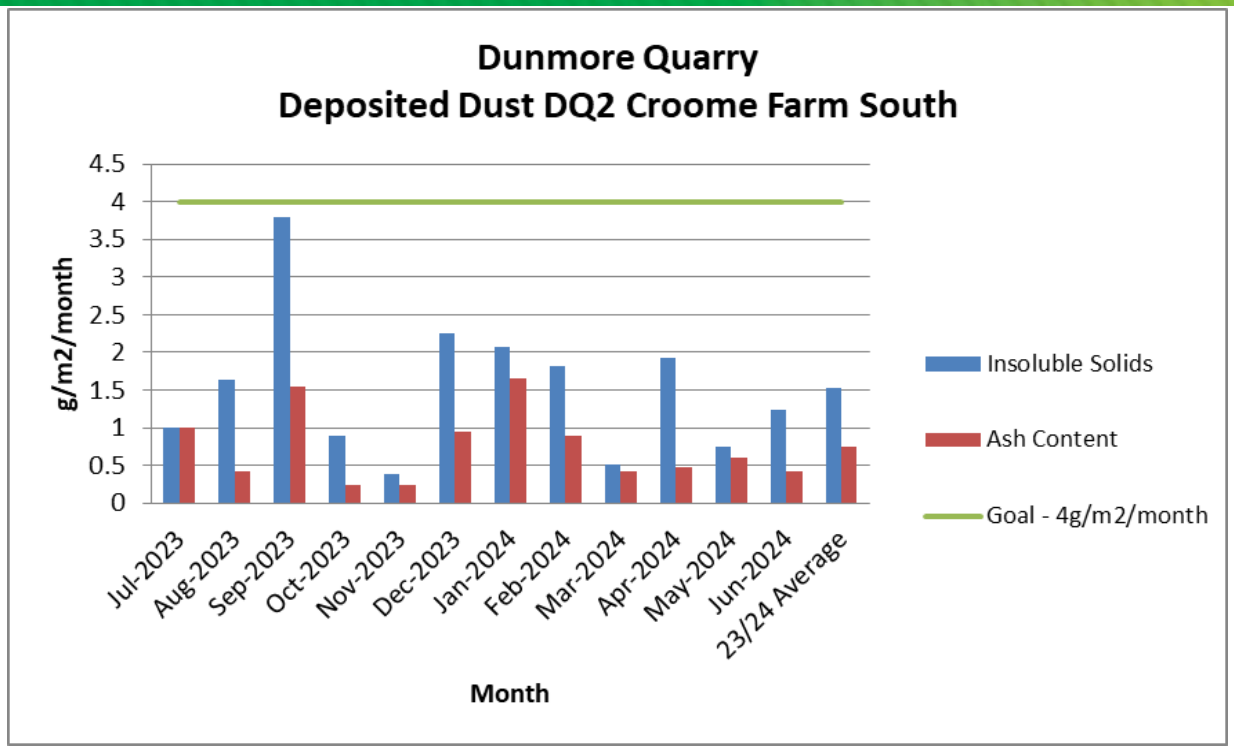


Figure 4 DQ2 Deposited Dust Results

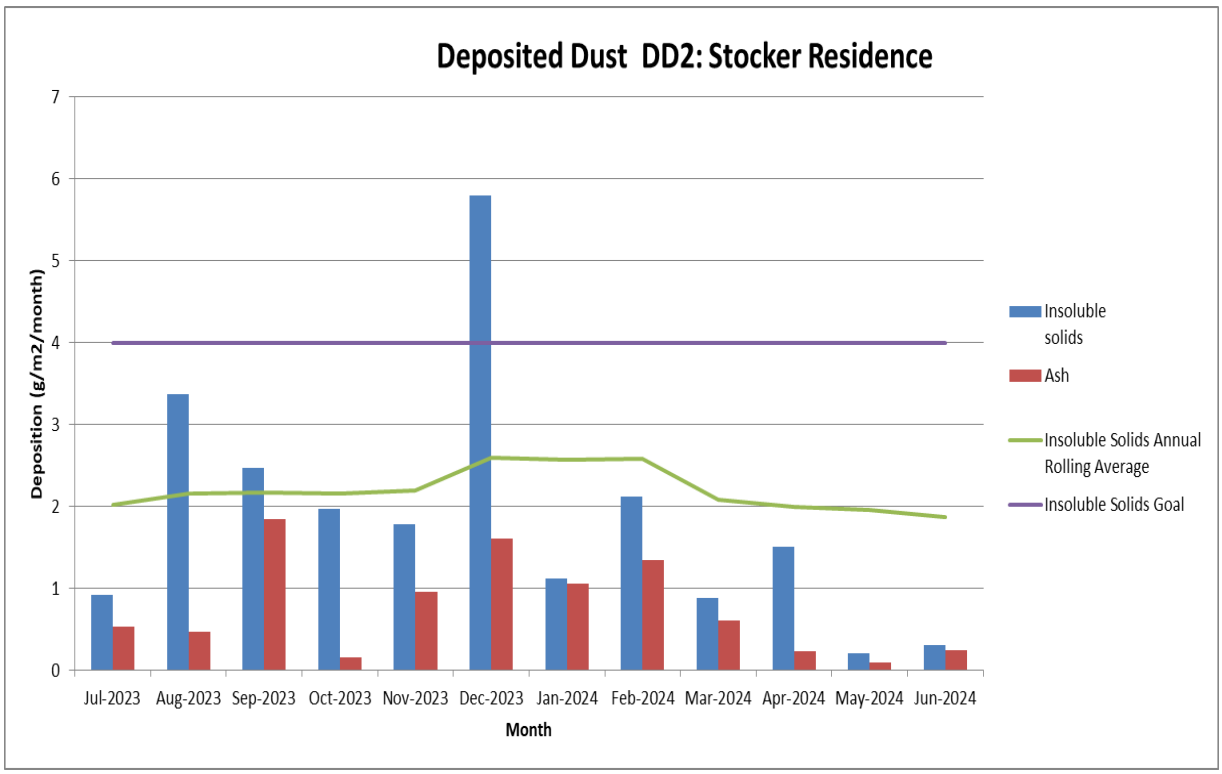


Figure 5 DQ3 Deposited Dust Results

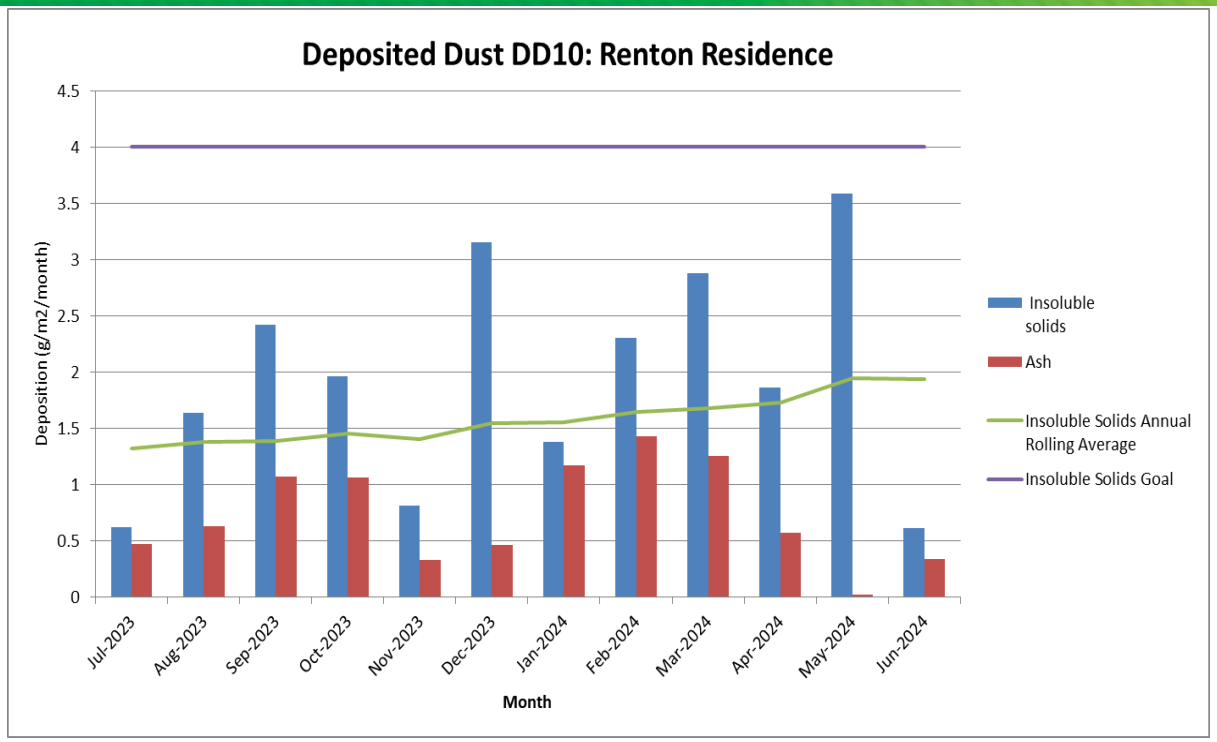


Figure 6 DQ4 Deposited Dust Results

5.2.3. Particulate Monitoring Assessment Criteria

The impact assessment criteria for Particulate Monitoring is provided below in Table 11.

Table 11 Particulate Monitoring Impact Assessment Criteria

Pollutant	Averaging Period	Criterion
PM_{10}	Annual	[a,d] 25 µg/m³
PM_{10}	24 hour	[b]50 µg/m³
TSP	Annual	[a,d] 90 µg/m³
$PM_{2.5}$*	Annual	[a,d] 8 µg/m³

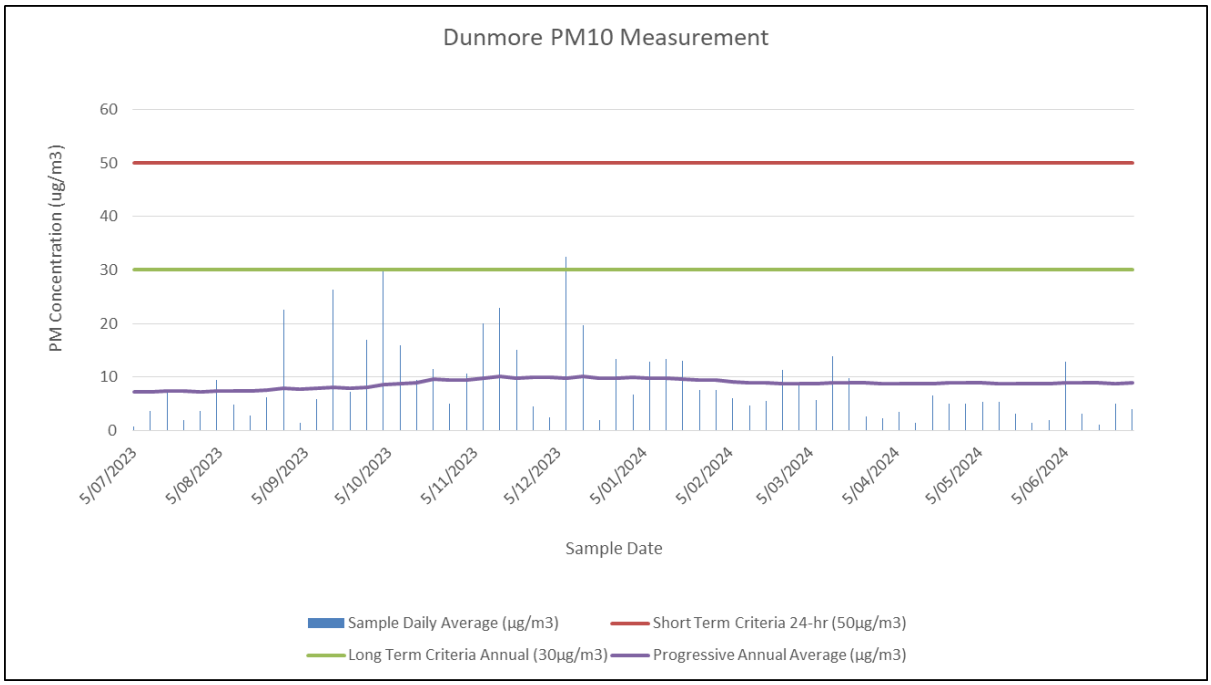
[a] Cumulative impacts (i.e increases in concentration due to development plus all other sources)

[b] Incremental impact (i.e increases in concentration alone, with zero allowable exceedances of criteria over the life of the development.

[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Planning Secretary.

5.2.4. Particulate Monitoring FY24 Performance Review

The PM_{10} readings from FY24 can be seen below in Figure 7.



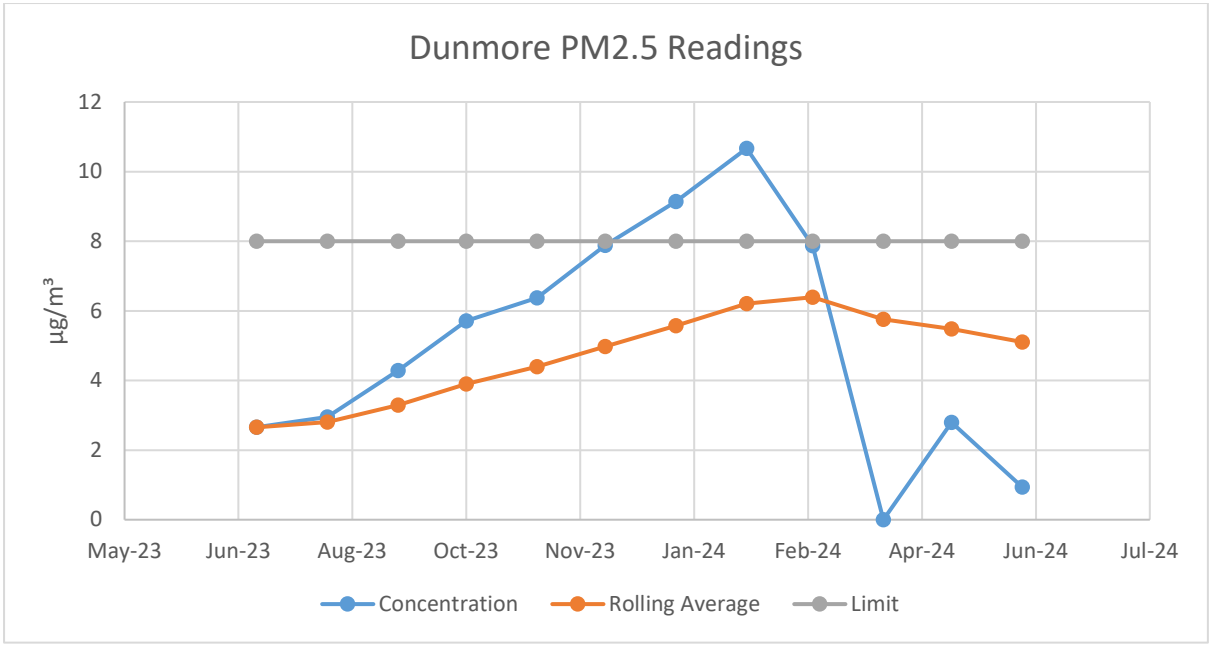


Figure 7 $PM_{2.5}$ and PM_{10} Measurements – FY24

The annual average PM_{10} measurement for the reporting period was below the impact assessment criteria of 30 µg/m³ for PM_{10} and 90 µg/m³ for TSP. The PM_{10} measurements were also similar to the Albion Park South air quality monitoring station's annual averages.

There were no readings recorded as occurring above the long-term criteria for PM_{10} of 50µg/m³ during the reporting period.

TSP concentrations are not measured in the vicinity of the quarry, however annual average TSP concentrations can be derived based on typical ratios of PM_{10}: TSP. Rural areas (such

as DQ), typically experience a PM_{10}:TSP ratio of 0.4. This ratio has been applied to the annual average PM_{10} concentrations to derive a representative TSP background concentration in µg/m³. This methodology is in-line with the method used by Ramboll in the MOD 9 Environmental Assessment for the Dunmore Quarry.

PM2.5 concentrations were extracted from real time monitoring data. The Progressive Annual Average did not exceed the criteria for any months, although a peak in February 2024 was observed, which likely resulted from strong Westerly winds.

Table 12 Summary of Particulate Monitoring Data

Pollutant	Dunmore Quarry FY24 Average (µg/m³)	Albion Park FY24 Average(µg/m³)	Dunmore Quarry Long Term Average (µg/m³)
Measured PM10	8.88	13.4	12.08
Derived TSP	22.2	33.5	30.2
Real time monitor TSP	39.56	-	-
Real time monitor PM10	15.83	-	-
Real time monitor PM2.5	4.56	-	-

5.2.5. Air Quality Monitoring Long Term Analysis and Assessment

The DQ site has been collecting deposited dust data since 2002. A graph of long-term trends can be found in Figure 8 below and shows that deposited dust has typically decreased over time.

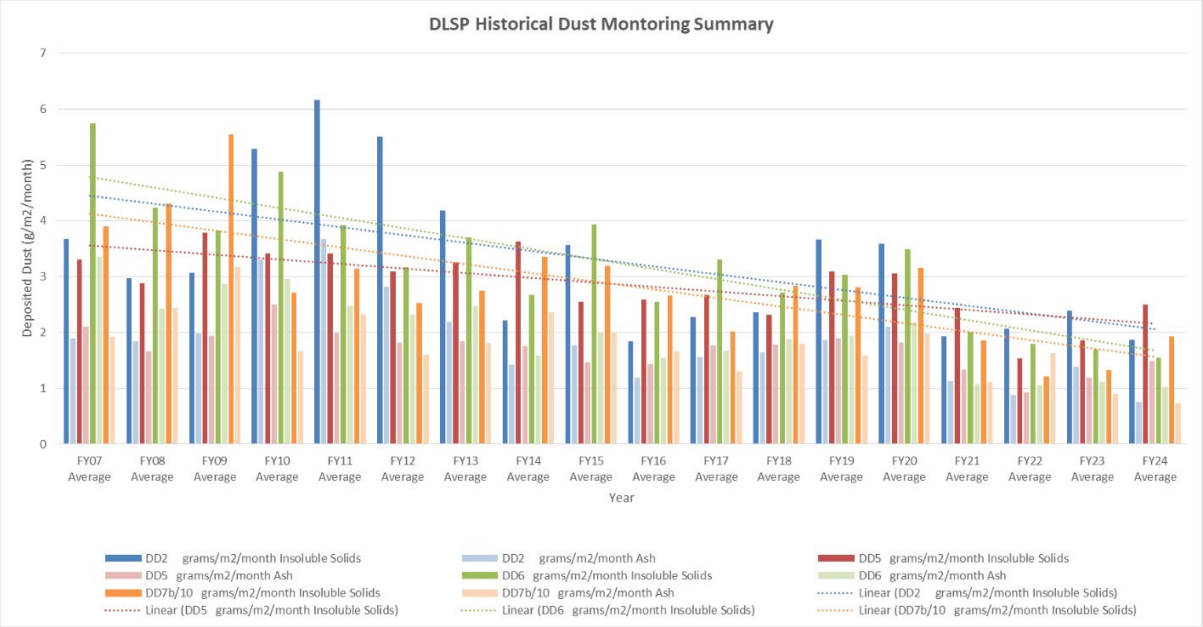


Figure 8 Historical Dust Monitoring Data

A general trend that has been observed is that measured deposited dust is typically higher in dry summer months than winter months, which is to be expected. This trend is also confirmed with the PM_{10} measurements and is generally reflective of regional conditions as a whole.

Figure 9 shows a 90 day average in black, which illustrates a seasonal fluctuation of measured PM_{10} values. A trend can be observed that PM_{10} values are typically higher during summer dry periods and are lower during the winter periods.

This fluctuation is mirrored in the Office of Environment and Heritage's (OEH) Albion Park PM_{10} measurements available on the OEH website (https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility)

These trends indicate the measured PM_{10} and deposited dust values are typically influenced by ambient local conditions rather than development operations at DLSP.

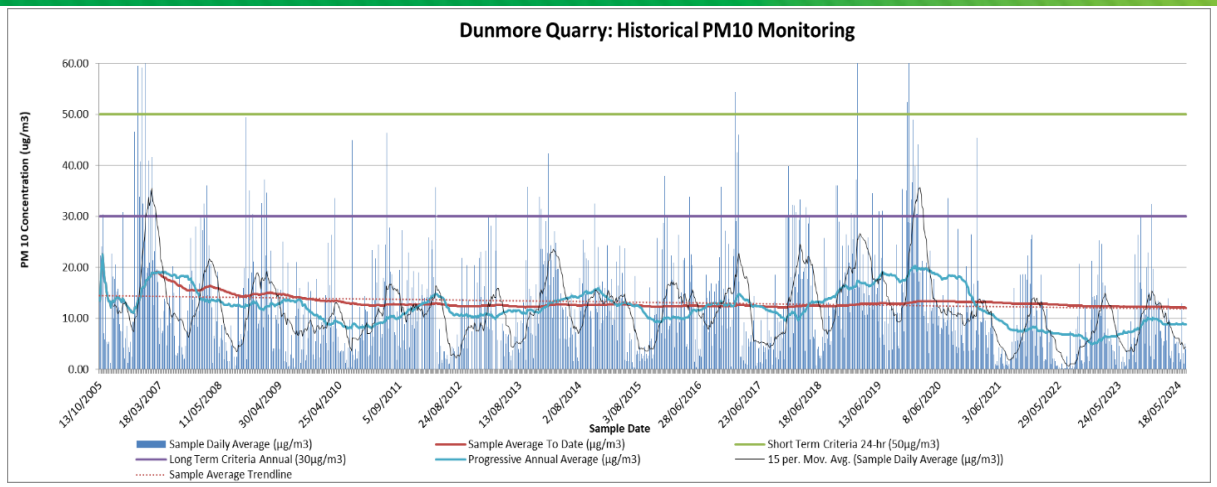


Figure 9 Historical PM_{10} Monitoring Data

5.2.6. Air Quality Monitoring Summary and Opportunities for Improvement

The site is still in the transitional period with a Trigger Action Response Plan and alerting systems being finalised. The alerting system has been redesigned to a web based format to allow greater access to data for operational staff. The next reporting period will focus on fine tuning alerting systems along with continuing the operation of the real time monitoring units. Timings of the implementation of real time dust monitoring are as follows:

- DMP operating system added to control room and main office by December 2024;
- TARP and Alerts put together by August 2024;
- Alert system to be established by September 2024;
- Alert system to be trialled by February 2025;
- TARPS and alerts updated by June 2025; and
- Monitoring network operational by June 2025.

5.3. Blast Monitoring

S4C16 and S4.C17 outline the blast monitoring parameters which are assessed at the nearest receiver, the Benny Residence. Monitoring at the Benny residence indicated compliance with all relevant blast parameters during the reporting period. Monitoring Points are shown in Figure 10.

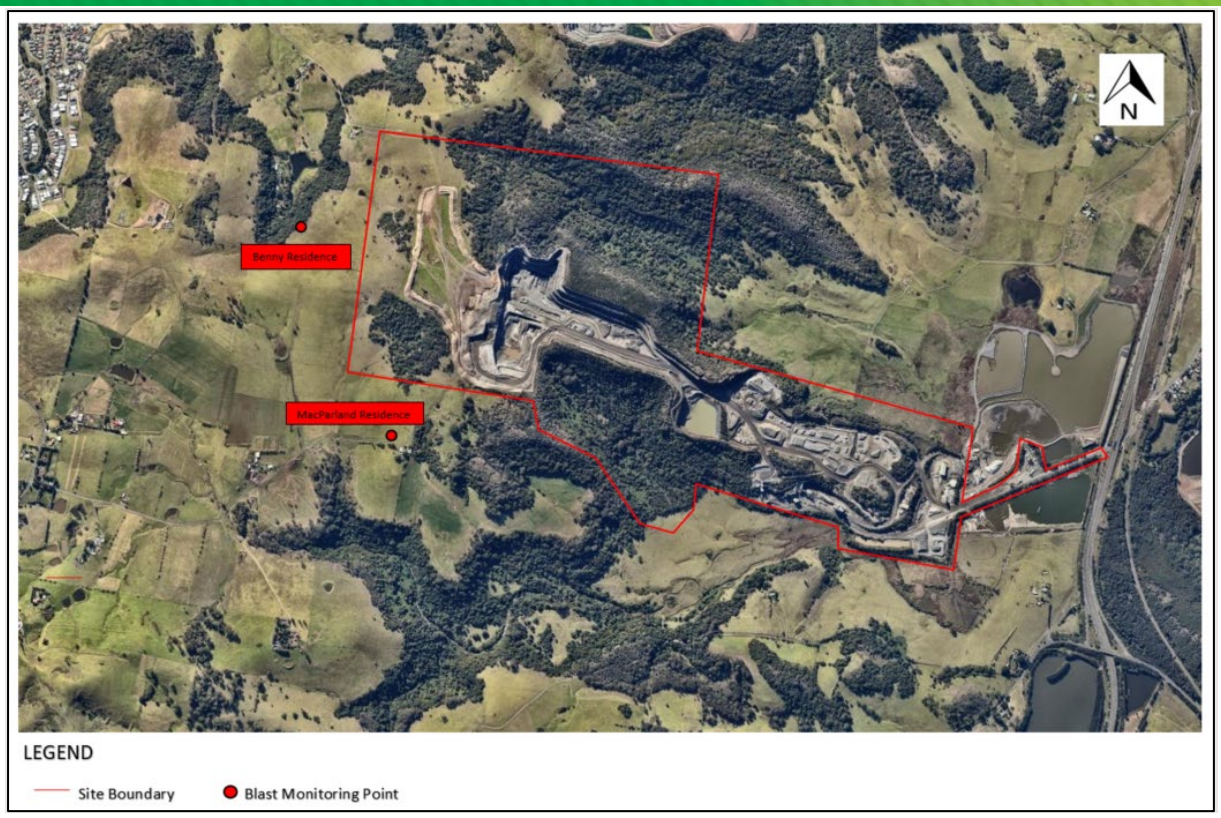


Figure 10 Blast Monitoring Locations

5.3.1. Blast Monitoring Impact Assessment Criteria

S4C16 and S4.C17 outline the blast monitoring parameters which are assessed at the nearest receiver at the Benny Residence. These parameters are reproduced below in Table 13.

Table 13 Blast Monitoring Parameters

Airblast Overpressure	Allowable exceedances
120 ((dB(Lin Peak))	0 (absolute limit)
115 ((dB(Lin Peak))	5% of the total number of blasts over a period of 12 months
Ground Vibration	**Allowable exceedances**
10mm/s	0 (absolute limit)
5mm/s	5% of the total number of blasts over a period of 12 months

In total there were twenty five (25) blasts undertaken during the reporting period, and therefore no more than one (1) blast is allowable over the 95th percentile limits of 115 (dB (Lin Peak)) and 5 mm/s for airblast overpressure and ground vibration respectively at the Benny Residence to ensure compliance with the criteria.

In addition, the approved Blast Management Plan outlines monitoring which will be undertaken to preserve the heritage value of the old flour mill at the MacParlands residence. The following blast parameters were adopted.

Table 14 Blast Monitoring Parameters – MacParlands Residence

Airblast Overpressure	Allowable exceedances
130 ((dB(Lin Peak))	5% of the total number of blasts over a period of 12 months
Ground Vibration	**Allowable exceedances**
30mm/s	5% of the total number of blasts over a period of 12 months

A dilapidation report was commissioned, detailing the condition of the MacParland Residence. Specifically, the condition of the structures of heritage value such as the flour mill, butter mill, hay shed and the primary residence. Baseline monitoring was conducted in FY20. Monitoring during the FY24 period indicated no change to any of the observed structures on the property.

5.3.2. Blast Monitoring FY24 Performance Review

Figure 11 and Figure 12 details a visual representation of the blast monitoring in FY24. A number of blasts did not trigger, and therefore aren't represented in the figures below. The data table associated with these can be found in Appendix D.

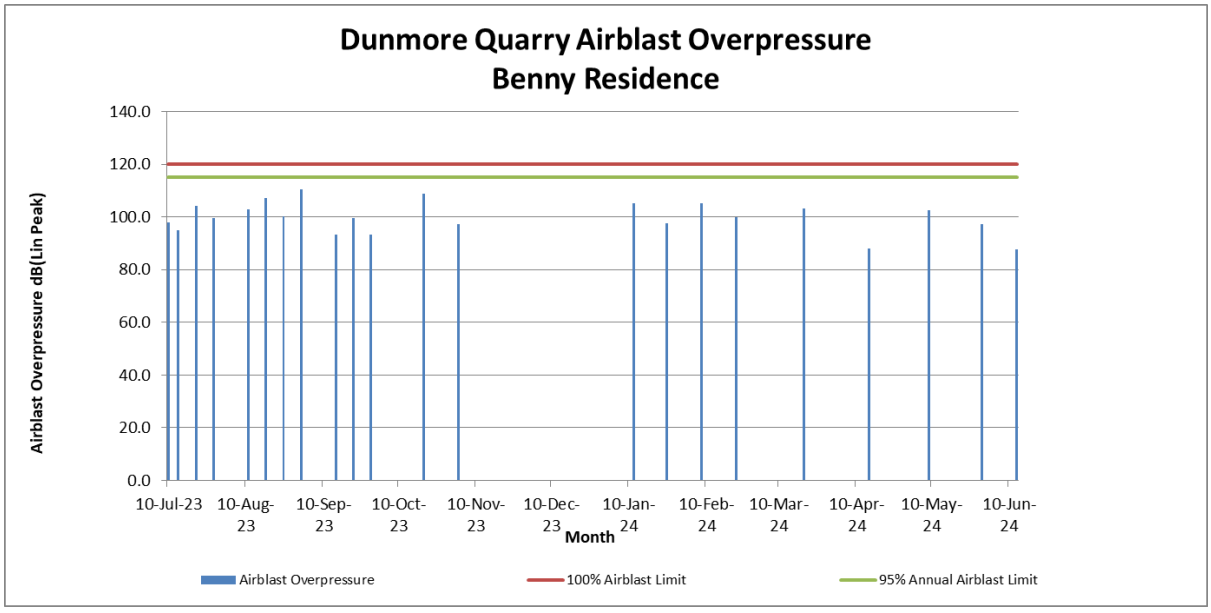


Figure 11 FY23 Overpressure Data

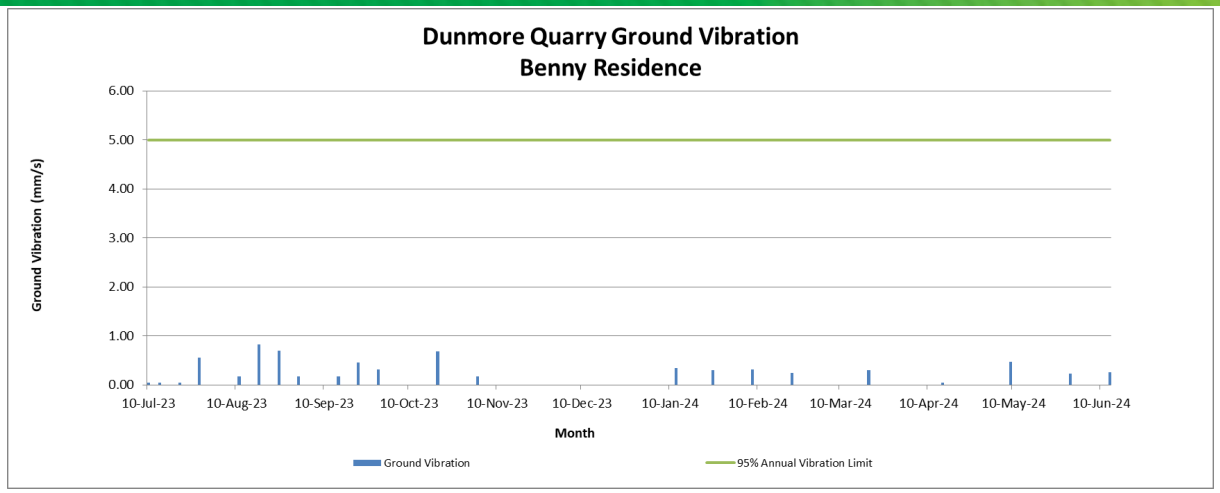


Figure 12 FY23 Ground Vibration Data

There were no blasts above the prescribed limits during the FY24 reporting period.

5.3.3. Blast Monitoring Long Term Analysis and Trends

A visual representation of historical blast monitoring data can be seen below in Figures 13 and 14. Blasts have been consistently managed below the criteria provided in the Conditions of consent.

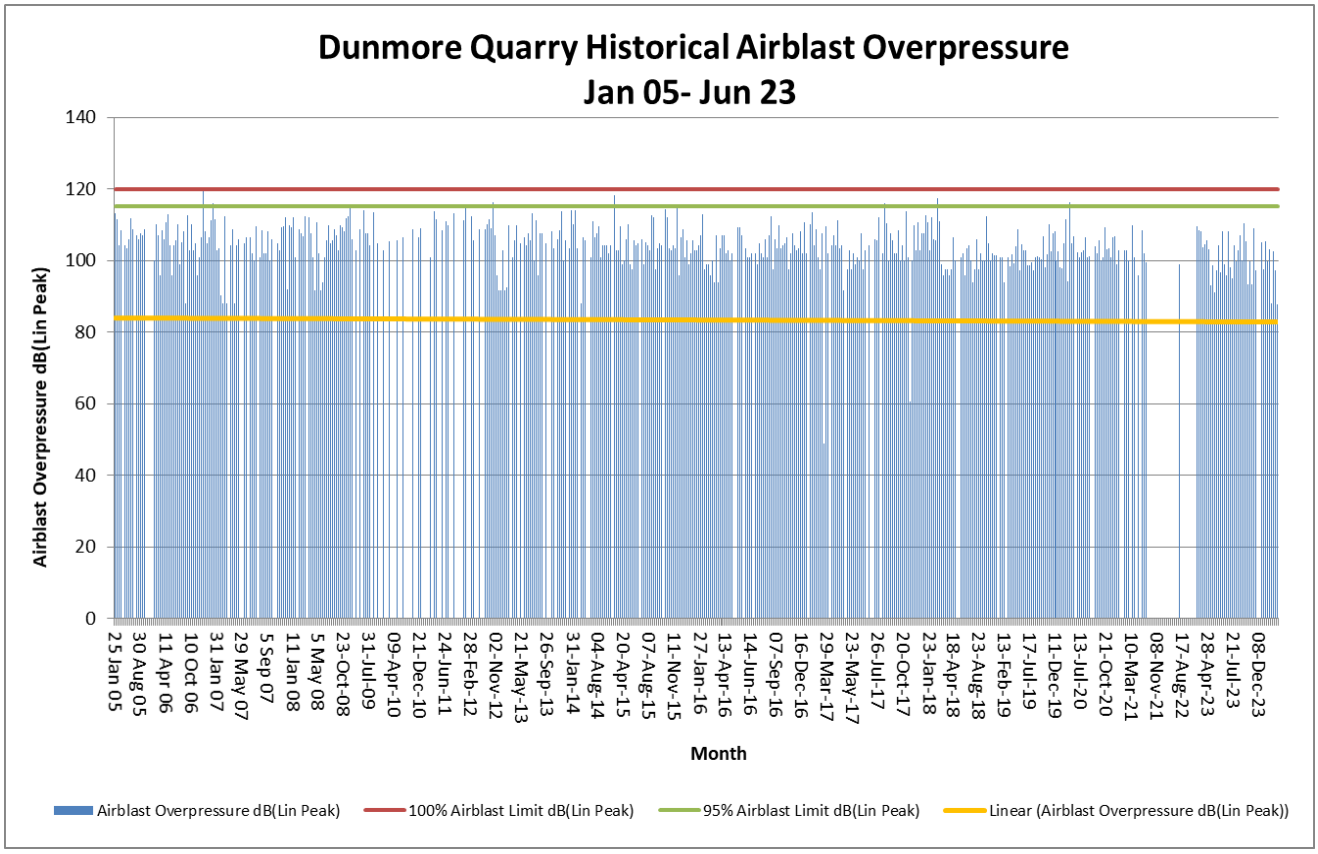


Figure 13 Historical Overpressure Data

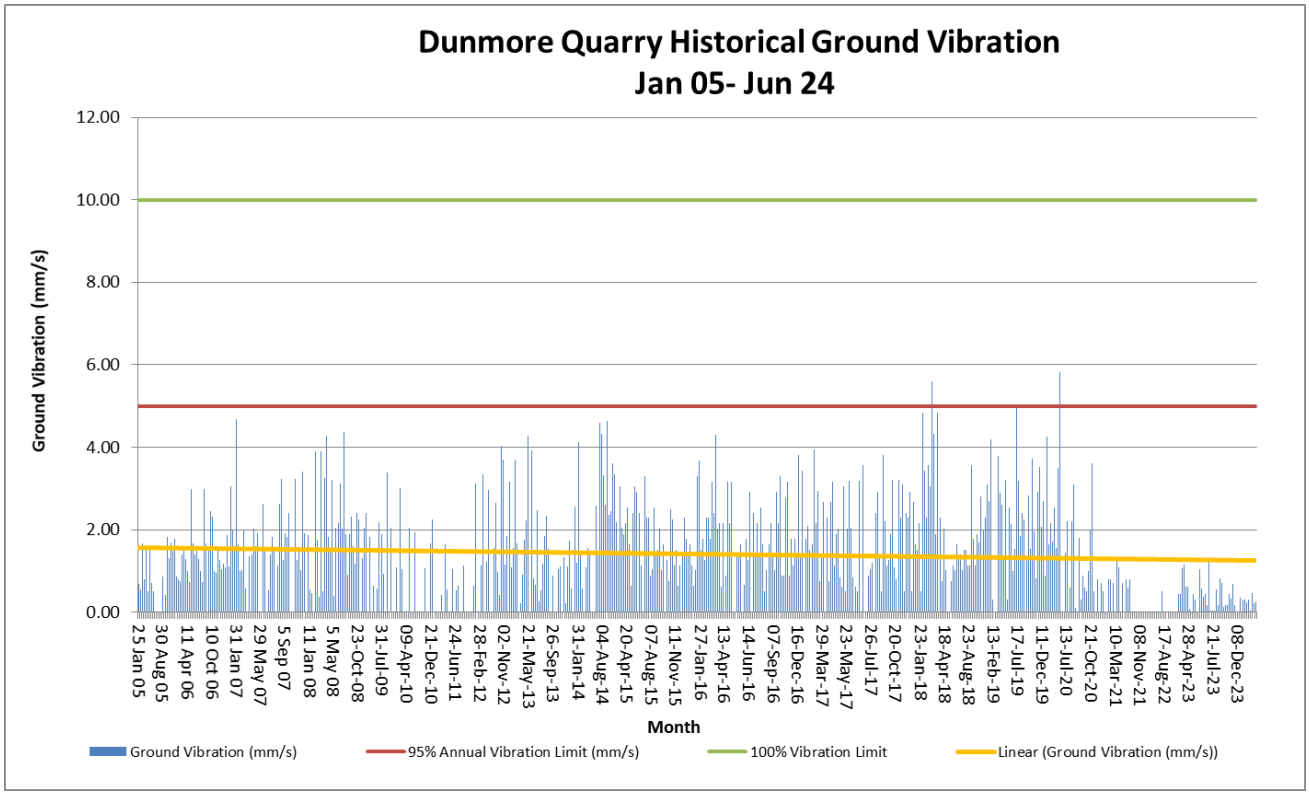


Figure 14 Historical Ground Vibration Data

5.3.4. Blast Monitoring Summary and Opportunities for Improvement

The blast data has confirmed compliance with the required assessment criteria but also indicate that blast management over recent years has resulted in an overall reduction in both overpressure and ground vibration at the nearest residential receptors. No additional blast management initiatives are therefore considered necessary, however the design of future blasting associated with the proposed 8 ha northern extension into the RIC slot will require further evaluation. Any additional blast management initiatives required will be detailed in a revised Blast Management Plan which will be prepared once the RIC proposal has been approved.

5.4. Noise Monitoring

Noise Monitoring is undertaken annually in winter to determine quarry contribution to noise at private residences. Monitoring results demonstrated compliance with prescribed assessment criteria during all monitored time periods.

5.4.1. Noise Monitoring Impact Assessment Criteria

S4.C4 outlines the relevant noise assessment criteria to be adopted for the annual monitoring, shown in Table 15 below. The location of these monitoring points are represented by NM-1 to NM-5 as displayed in Figure 15.

Noise monitoring is completed in July each year which typically represents the worst-case meteorological conditions for noise propagation.

Table 15 Noise Monitoring Impact Assessment Criteria

Receiver Location	Noise Limits dB (A)					
	LA_{eq} (15 minute)				LA_{eq} (1 minute)	
	Day (7am - 6pm)	Evening (6pm - 10pm)	Night (10pm - 7am)	Morning Shoulder (6am - 7am)	Night (10pm - 7am)	Morning Shoulder (6am - 7am)
Location K Stocker Residence (NM1)	49	44	38	47	48	55
Location O Dunmore Lakes (NM1)	49	44	38	47	48	55
Location J Creagan Residence	Negotiated Agreement in Place					
Location AA (NM5)	38	38	38	38	45	45
Locations AB and T (NM3)	36	36	36	36		
Location D, F, G and Z (NM4)	40	40	40	40		
Location S (NM2)	37	37	37	37		
Other privately owned residence	35	35	35	35		

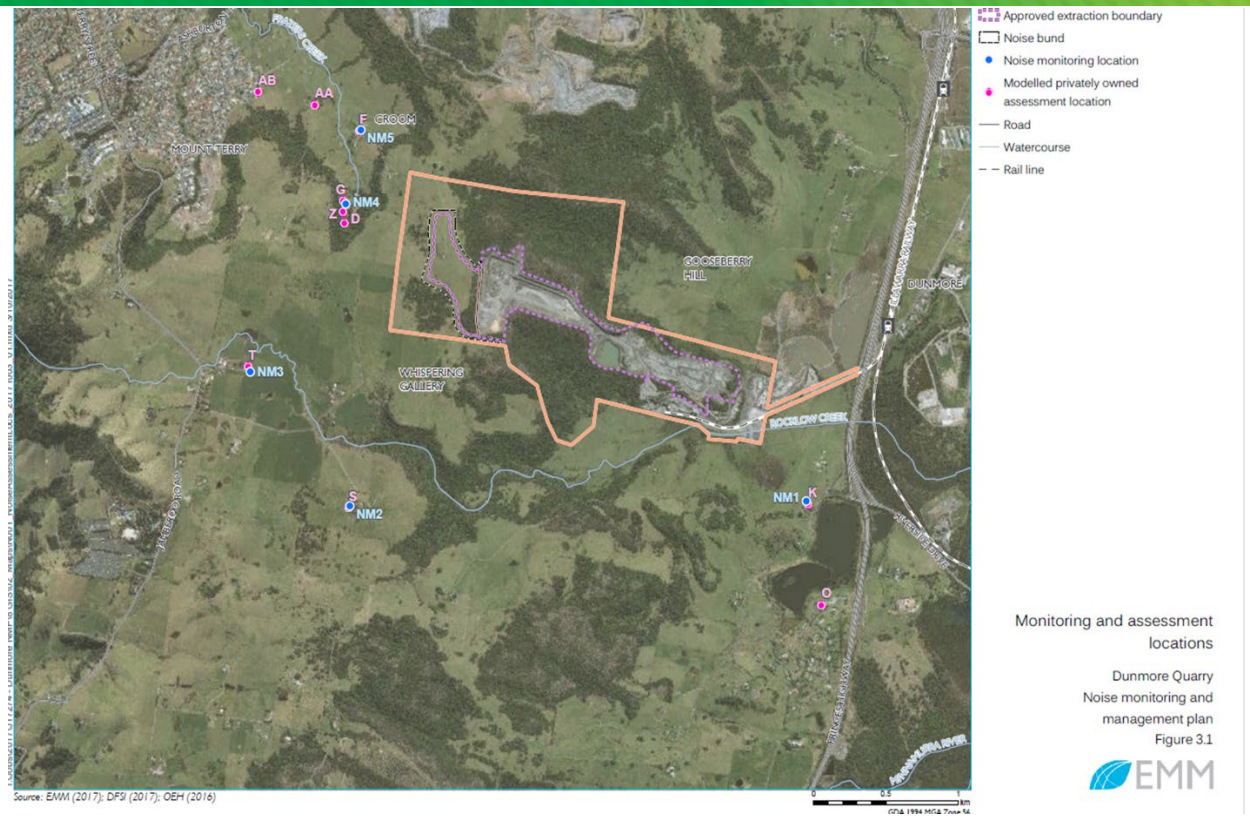


Figure 15 Noise Monitoring Locations

5.4.2. Noise Monitoring FY24 Performance Review

A summary of the attended noise monitoring results against the modelled MOD 9 quarry operations is shown below in Table 16. Noise monitoring is conducted at the end of each calendar year, consistent with previous review periods.

Table 66 Attended noise monitoring results

Post Modification 9 Noise Monitoring Results NM1 (representative of resident K and O)				
	Day	Evening	Morning Shoulder	
Noise	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(1min)}$
Limit	49	44	47	55
Predicted	35	35	35	
2018	40	40	40	50
2019	45	41	47	55
2020	49	44	47	55
2021	45	40	40	45
2022	40	36	40	47
2023	45	40	45	55
Post Modification 9 Noise Monitoring Results NM2 (representative of resident S)				
	Day	Evening	Morning Shoulder	
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(1min)}$
Limit	37	37	37	45
Predicted	35	35	35	
2018	30	30	30	32
2019	33	30	32	40
2020	36	35	37	45
2021	35	30	35	40
2022	33	31	31	45
2023	35	30	30	45
Post Modification 9 Noise Monitoring Results NM3 (representative of resident T)				
	Day	Evening	Morning Shoulder	
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(1min)}$
Limit	36	36	36	45
Predicted	35	35	35	

2018	35	35	35	40
2019	32	30	31	40
2020	35	35	35	45
2021	35	30	30	35
2022	30	30	30	45
2023	35	30	30	45

Post Modification 9 Noise Monitoring Results NM4 (representative of resident G,D,Z)				
	Day	**Evening**	**Morning Shoulder**	
	dB $LA_{eq(15min)}$	**dB $LA_{eq(15min)}$**	**dB $LA_{eq(15min)}$**	**dB $LA_{eq(1min)}$**
Limit	40	40	40	45
Predicted	35	35	35	
2018	30	30	30	30
2019	33	30	31	40
2020	35	35	35	45
2021	35	30	30	35
2022	40	40	40	45
2023	35	30	30	45

Post Modification 9 Noise Monitoring Results NM5 (representative of resident F, AA,AB)				
	Day	**Evening**	**Morning Shoulder**	
	dB $LA_{eq(15min)}$	**dB $LA_{eq(15min)}$**	**dB $LA_{eq(15min)}$**	**dB $LA_{eq(1min)}$**
Limit	40	40	40	45
Predicted	35	35	35	
2018	30	30	30	30
2019	35	30	34	40
2020	40	35	40	45
2021	30	30	30	35
2022	30	30	33	45
2023	30	30	35	45

During the reporting period monitoring points were denoted as compliant during all time windows. Prior to MOD 9, location K and O (now monitored under NM-1) had been

monitored separately. The land Location A was acquired by Boral in 2016 and as such is no longer monitored.

5.4.3. Noise Monitoring Long Term Analysis and Trends

There has only been seven years of monitoring under the current monitoring program post MOD 9 operations and over time trends will become more apparent. NM-1 has been monitored for a number of years as part of the previously approved monitoring program. The trends of NM-1 over the last 13 years can be seen below in Figure 16. A summary of the noise monitoring results post MOD 9 can be seen in Figures 17 to 21. The monitoring data, which is attached as Appendix C, demonstrates compliance with the noise assessment criteria.

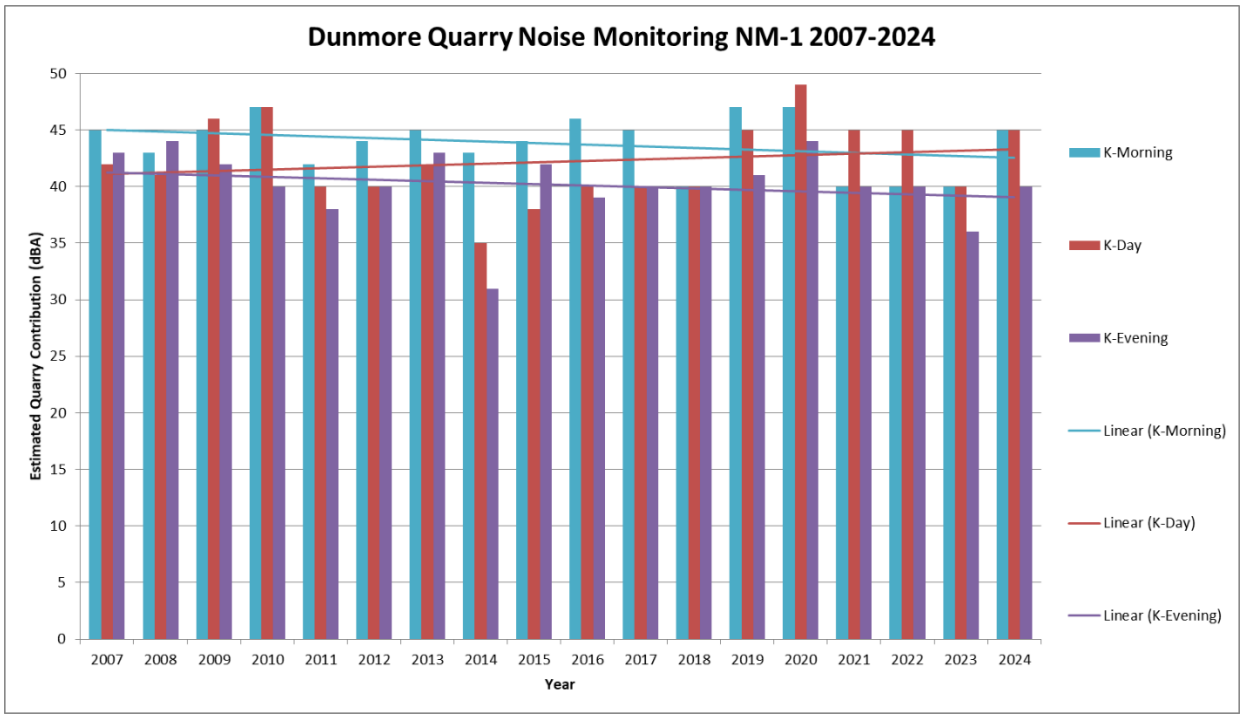


Figure 16 Long term noise monitoring at NM-1 results since 2007

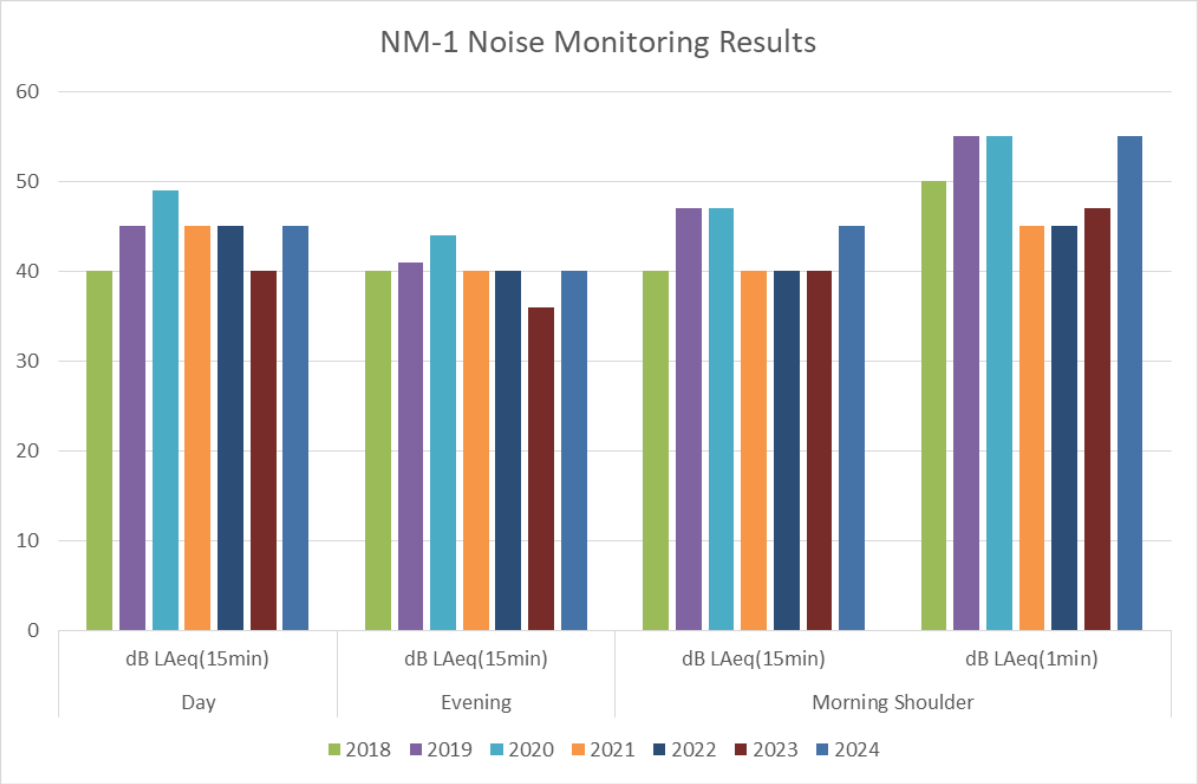


Figure 17 NM-1 Noise monitoring results since MOD-9

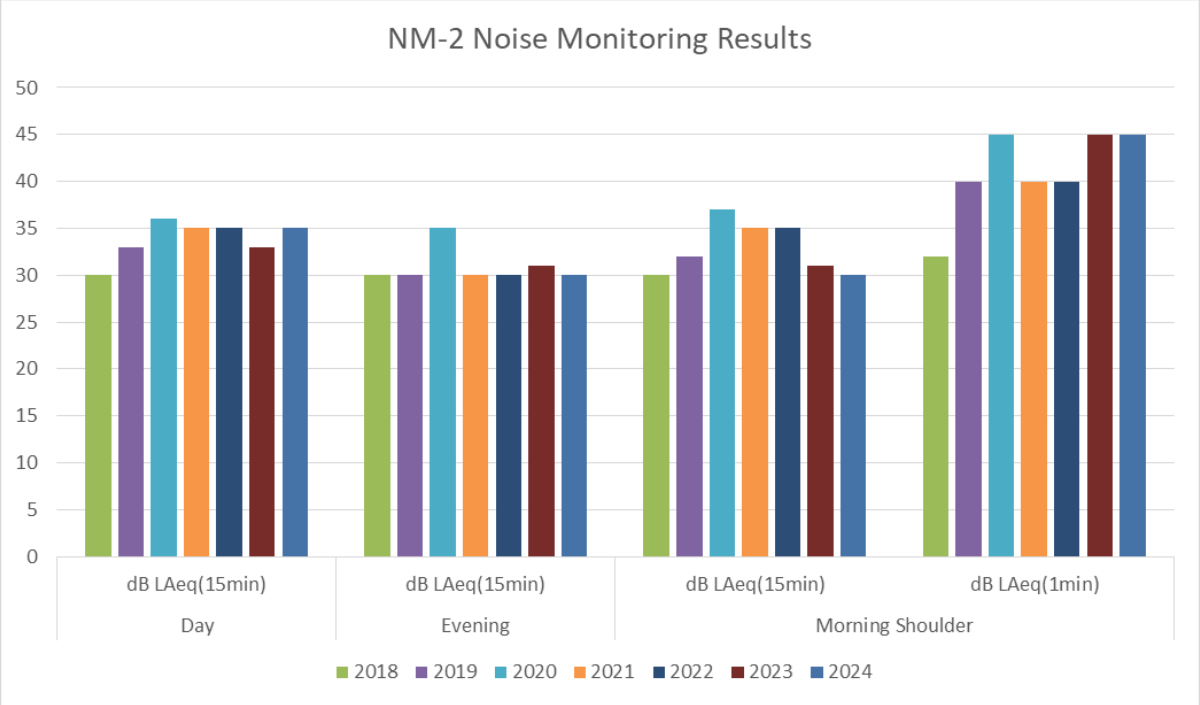


Figure 18 NM-2 Noise monitoring results since MOD-9

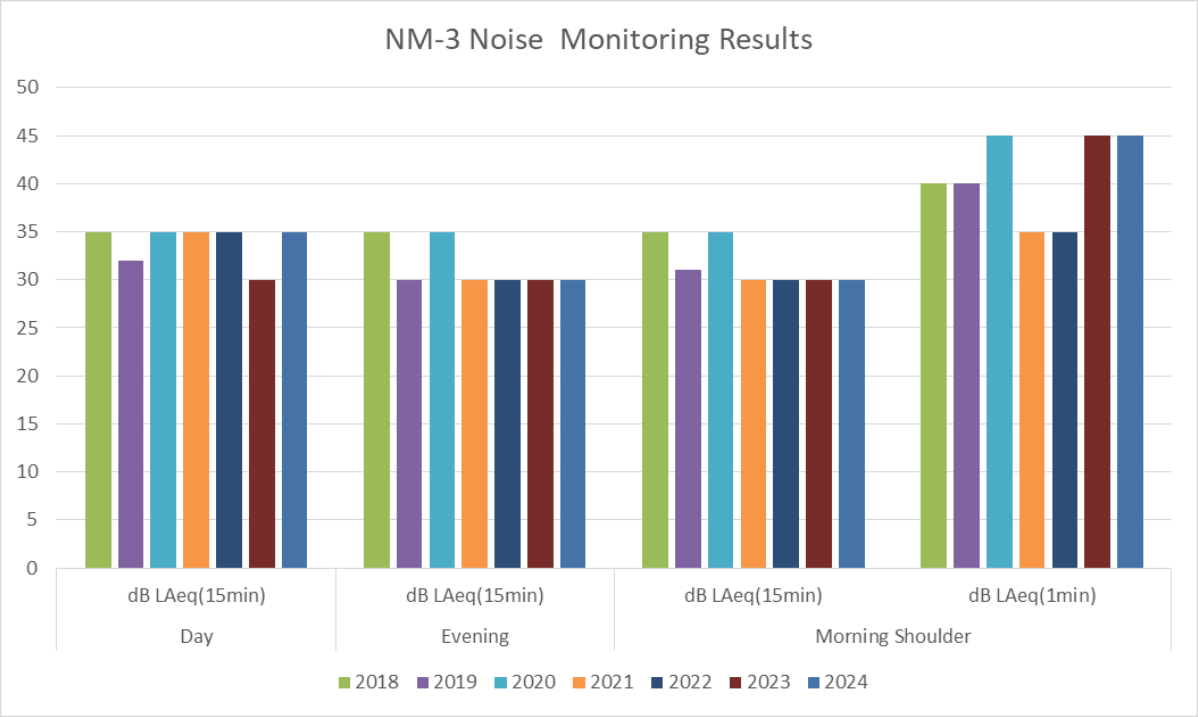


Figure 19 NM-3 Noise monitoring results since MOD-9

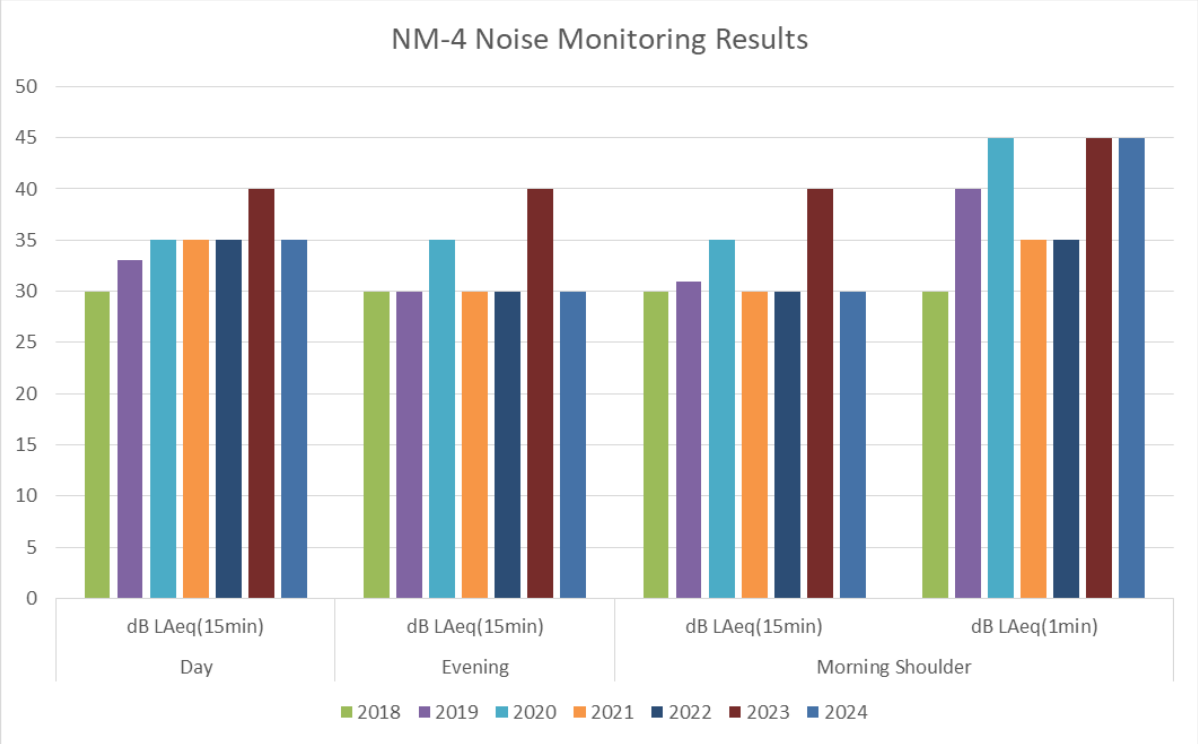


Figure 20 NM-4 Noise monitoring results since MOD-9

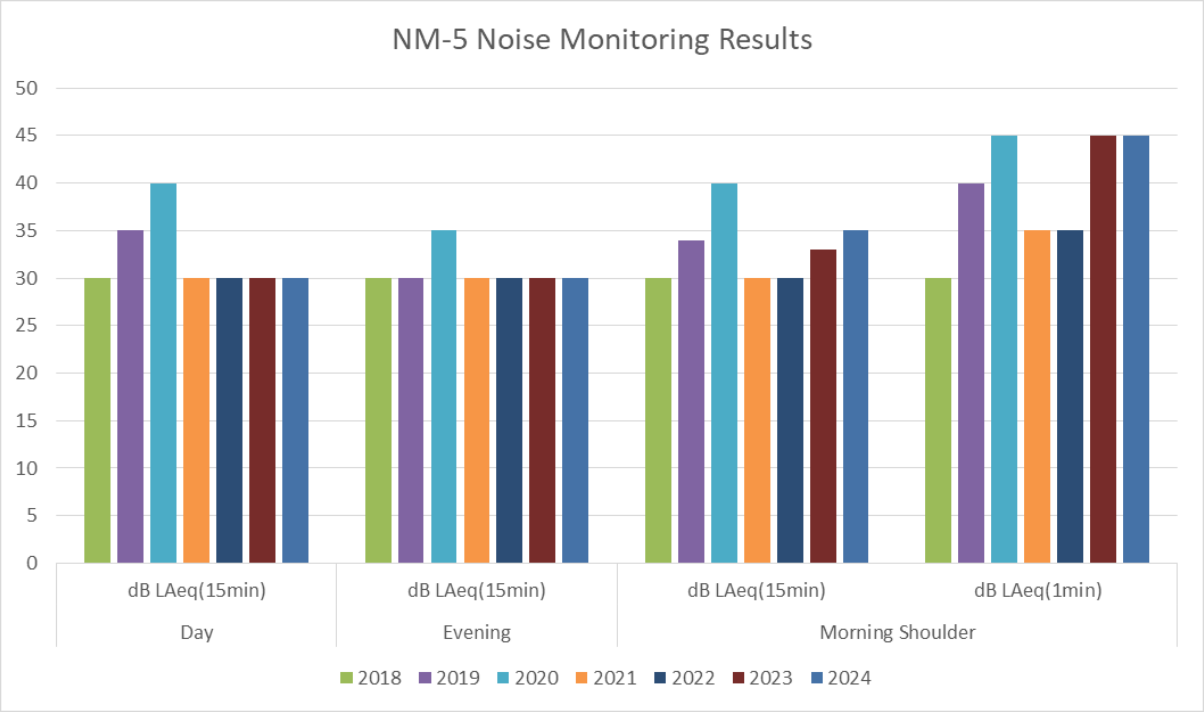


Figure 21 NM-5 Noise monitoring results since MOD-9

Typically noise measurements have decreased or remained stable over time at NM-1. Noise monitoring results at NM-1 to NM-5 were similar to the previous year and within compliance limits.

5.4.4. Noise Monitoring Summary and Opportunities for Improvement

As previously discussed, all monitoring points were measured below relevant limits. Noise monitoring will continue as per previous years.

5.5. Surface Water Monitoring

Dunmore Quarry operates under a well-established water management system which incorporates separation of clean water, largely through natural topographic features and the control of dirty water through a series of pollution control structures. The main pollution control structure is the Upper Dam which receives runoff from most of the extraction area. This is an in-pit sump constructed on the quarry floor and can only discharge via pumping to the Middle Dam. The Middle Dam discharges internally via channels and culverts to the Lower Dam which is licensed (EPL7) to discharge into Rocklow Creek. These structures contain the vast majority of dirty runoff from the quarry however some minor road drainage is directed into the silt ponds of the Dunmore Sand & Soil operation.

Under normal weather conditions, the water management system is a closed circuit with contained water being recycled for quarry uses such as dust suppression. Excess water is only discharged through the licensed discharge point following prolonged rainfall events. The license also recognises that during prolonged wet weather or intense storm events, discharges will occur into Rocklow Creek and that additional background monitoring within the creek is required in order to determine if any offsite impacts occur. The additional monitoring occurs on a daily basis during such discharges.

Figure 22 outlines the current monitoring points. There are three offsite discharge points for the operation as described below:

- EPL6 which is a controlled discharge from the Lower Dam using a biofiltration swale to treat water prior to entering Rocklow Creek.
- EPL7 which is the spillway of the Lower Dam which only discharges during high rainfall events.
- EPL10 which is the upper emergency spillway of Middle Dam. Water spilling from the main spillway of Middle Dam flows into the Lower Dam.

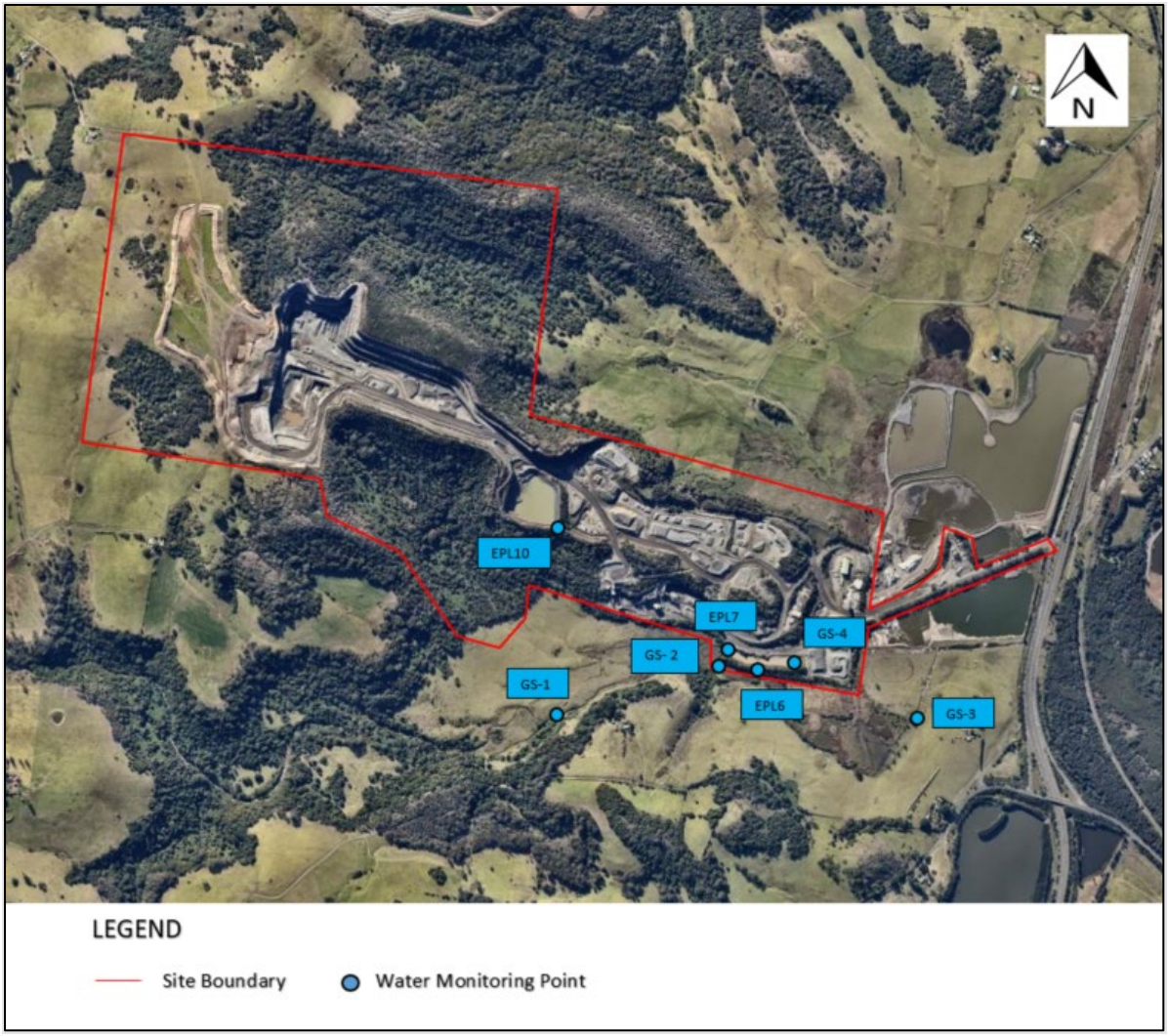


Figure 22 Surface water monitoring points

5.5.1. Surface Water Quality Impact Assessment

S4.C28 refers discharge limits to the limits imposed by EPL 77 which states that the site will comply with discharge limits from condition L2.4 and Section 120 of the *POEO Act*. EPL 77 describes discharge limits at the licenced discharge point for controlled discharge at the site via the bio-filtration swale at monitoring location EPL6. Total Suspended Solids must not exceed 50mg/L at this point.

A second discharge point is nominated in EPL 77 for uncontrolled discharge at the spillway at the Lower Dam at monitoring location EPL7. No TSS limits apply for EPL7 as it is a

spillway, which only typically discharges if the dam design capacity (designed to hold 90.7mm in 5 days) is exceeded.

Monthly monitoring is undertaken at the Lower Dam at GS-1, GS-2 and GS-3 at Rocklow Creek to determine ambient conditions upstream, in the immediate vicinity of the Lower Dam spillway and downstream respectively.

Monitoring is also undertaken daily during any discharge event via either the licenced discharge mechanism at EPL6, or via uncontrolled discharge via the Lower Dam spillway at EPL7. Upstream and downstream monitoring points at Rocklow Creek at GS3 are also sampled to determine if any impacts to water quality have occurred.

5.5.2. Surface Water Quality FY24 Performance Review

Monthly ambient water quality monitoring of the Lower Dam at GS-4/EPL#8 is shown below in Table 17. For comparison, monitoring points upstream (GS-1) and downstream (GS-2) of the Lower Dam are also shown to indicate the typical water quality along Rocklow Creek. Please note there are no discharge limits applicable to the ambient water quality of the dam as it is offline to Rocklow Creek during normal operations.

Monthly monitoring results at Rocklow Creek indicate the following:

- Ambient conditions upstream of the Lower Dam at GS-1 are generally lower values when compared to the WQOs and discharge limits. Despite this, the area is associated with water bodies that are impacted by active cattle grazing. Cattle tend to stir up water during grazing and are often observed within Rocklow Creek during monthly sampling events, especially during drought conditions.
- Ambient conditions in the vicinity of the mixing zone at GS-2 are typically within discharge limits. Occasional elevations can occur during high intensity flood events. Water levels can be low or dry during extended dry spells/drought.
- Ambient conditions at GS-3 downstream of Rocklow Creek are generally within the discharge parameters with the exception of TSS. This location is sometimes dry and affected by saline tidal inflow as well as being impacted by cattle grazing. During dry periods, water level tends to be quite low. Cattle tend to stir up water during grazing and are often observed within Rocklow Creek during monthly sampling events.

Table 17 Water quality monitoring results at GS-1, GS-4/EPL#8, and GS-2 over the reporting period.

	GS-1 Upstream of Rocklow				EPL#8 Lower Dam			
Month	pH	Turbidity (NTU)	EC (µS/cm)	TSS(mg/L)	pH	Turbidity (NTU)	EC (µS/cm)	TSS
Jul-23	7.4	2.7	337	6	8.1	120	563	81
Aug-23	6.8	1.6	384	12	8	230	509	189
Sep-23	6.7	1.4	377	3	7.9	210	484	177
Oct-23	7.5	2.8	403	5	8.1	240	447	213
Nov-23	6.9	1.1	469	6	8.1	210	443	168
Dec-23	7.1	1.7	381	7	8.1	180	507	132
Jan-24	7	1.7	314	4	8.1	180	530	154
Feb-24	7.6	1.3	410	5	8.2	75	487	132
Mar-24	8	10	384	23	8.2	950	353	598
Apr-24	7.6	6.2	297	11	7.4	80	542	46
May-24	7.7	1.6	268	2	7.8	6.9	500	73
Jun-24	7.4	2.5	274	3	7.5	65	488	29
FY24 Av	7.3	2.9	358.2	7.3	8.0	212.2	487.8	166.0

	GS-2 Downstream of Rocklow Mixing Zone				GS-3 Downstream of Rocklow at Property Boundary			
Month	pH	Turbidity (NTU)	EC (µS/cm)	TSS(mg/L)	pH	Turbidity (NTU)	EC (µS/cm)	TSS(mg/L)
Jul-23	7	14	492	11	6.6	55	534	45
Aug-23	7.3	80	457	55	7	50	562	72
Sep-23	6.9	6.9	493	13	6.8	40	852	36
Oct-23	7.4	7.3	526	14	7	65	849	163
Nov-23	6.8	8.4	477	18	6.6	9.4	520	22
Dec-23	7.1	3.8	407	11	7.1	11	455	23
Jan-24	7.6	100	497	80	7.2	7.7	422	8
Feb-24	7.9	120	489	97	7.2	10	459	29
Mar-24	8.3	1800	342	967	7.2	21	334	39
Apr-24	7.5	11	331	14	7.4	22	374	14
May-24	7.6	310	506	302	7.6	9.4	367	25
Jun-24	7.4	55	471	38	7.4	16	357	11
FY24 Av	7.4	209.7	457.3	135.0	7.1	26.4	507.1	40.6

There were six major rain events in the reporting period which led to discharge from the Lower Dam via the spillway at EPL7. These events include:

- 28-30 November 2023: 109 mm.
- 24-28 December 2023: 120 mm.
- 3-7 April 2024: 253 mm.
- 3-7 May 2024: 122 mm.
- 9-13 May 2024: 172 mm.
- 6-8 June 2024: 192 mm.

These events were outside the dam design capacity, which are designed to hold a 95th percentile 5-day rainfall event (90.7mm). During instances where sampling points were inaccessible due to site flooding, sampling was delayed due to safety and access concerns and the EPA were notified and satisfied with the arrangements.

The results of wet weather discharge monitoring over the reporting period is summarised in Table 18.

Table 18 Wet Weather Discharge Monitoring

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#7	29/11/2023	8	15	62	338
EPL#9	29/11/2023	6.5	4.0	33	269
GS-1	29/11/2023	7.4	21	35	333
EPL#7	30/11/2023	7.1	13	24	310
EPL#9	30/11/2023	6.8	19	32	295
GS-1	30/11/2023	7.2	12	7.0	313
EPL#7	1/12/2023	7	19	56	339
EPL#9	1/12/2023	6	12	16	328
GS-1	1/12/2023	7.3	4.0	8	339
EPL#7	2/12/2023	7.5	4.9	2.0	348
EPL#9	2/12/2023	7.9	11	12	308
GS-1	2/12/2023	7.6	5.1	2.0	383
EPL#7	3/12/2023	8.1	32	17	362
EPL#9	3/12/2023	7.8	7.7	8.0	430
GS-1	3/12/2023	8.1	3.1	1.0	365
EPL#7	4/12/2023	8.2	5.4	14	369
EPL#9	4/12/2023	7.8	3.0	4.0	421
GS-1	4/12/2023	8.0	2.2	2.0	367
EPL#7	5/12/2023	7.4	28	21	401
EPL#9	5/12/2023	7.4	5.6	10	407
GS-1	5/12/2023	8.1	3.0	1.0	365
EPL#7	6/12/2023	8.2	4.8	10	381
EPL#9	6/12/2023	7.5	9	5.0	423
GS-1	6/12/2023	6.9	1.3	1.0	371
EPL#7	20/12/2023	7.7	55	39	390

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#9	20/12/2023	7.2	30	44	330
GS-1	20/12/2023	7.4	10	7	270
EPL#7	22/12/2023	8.1	150	86	441
EPL#9	22/12/2023	7.4	38	60	342
GS-1	22/12/2023	7	42	9	275
EPL#7	23/12/2023	7.8	160	86	439
EPL#9	23/12/2023	7	36	60	335
GS-1	23/12/2023	6.9	41	9	245
EPL#7	24/12/2023	7.8	130	86	431
EPL#9	24/12/2023	7.8	35	62	325
GS-1	24/12/2023	6.9	30	8.5	224
EPL#7	25/12/2023	7.7	8.8	22	258
EPL#9	25/12/2023	6.8	10	18	326
GS-1	25/12/2023	6.9	6.4	12	251
EPL#7	26/12/2023	7.7	25	30	176
EPL#9	26/12/2023	7.2	13	18	215
GS-1	26/12/2023	7.5	19	22	218
EPL#7	27/12/2023	7.1	29	29	234
EPL#9	27/12/2023	6.8	6.5	28	114
GS-1	27/12/2023	6.9	6.6	33	120
EPL#7	28/12/2023	7.9	45	43	247
EPL#9	28/12/2023	6.9	12	22	231
GS-1	28/12/2023	7.1	3.9	26	102
EPL#7	29/12/2023	7.8	23	144	372
EPL#9	29/12/2023	6.9	10	25	255
GS-1	29/12/2023	6.9	4.5	3	242
EPL#7	30/12/2023	7.9	170	120	359
EPL#9	30/12/2023	6.7	5.2	23	276
GS-1	30/12/2023	7.1	9.1	8	307
EPL#7	31/12/2023	7.2	95	78	263
EPL#9	31/12/2023	6.9	6.5	25	296
GS-1	31/12/2023	6.9	7.2	35	265
EPL#7	1/01/2024	7.5	120	147	355
EPL#9	1/01/2024	6.9	3.2	22	321
GS-1	1/01/2024	7	4.5	30	284
EPL#7	3/01/2024	6.7	95	80	147
EPL#9	3/01/2024	6.5	9.9	10	174
GS-1	3/01/2024	6.5	37	35	103
EPL#7	4/01/2024	6.7	95	86	149
EPL#9	4/01/2024	6.5	10	18	170
GS-1	4/01/2024	6.5	39	39	106

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#7	2/01/2024	8.1	28	86	431
EPL#9	2/01/2024	7.4	1.3	60	343
GS-1	2/01/2024	7	2.6	9	280
EPL#7	4/01/2024	7.5	6.1	147	412
EPL#9	4/01/2024	6.9	2.6	22	350
GS-1	4/01/2024	7	0.95	30	298
EPL#7	5/01/2024	7.2	34	78	388
EPL#9	5/01/2024	6.9	5.2	25	363
GS-1	5/01/2024	6.9	1.6	35	300
EPL#7	6/01/2024	7.8	34	144	408
EPL#9	6/01/2024	6.9	3.7	25	331
GS-1	6/01/2024	6.9	1.4	3	312
EPL#7	7/01/2024	7	110	149	371
EPL#9	7/01/2024	6.8	4.3	21	366
GS-1	7/01/2024	6.9	6.5	28	305
EPL#7	8/01/2024	7.4	90	151	424
EPL#9	8/01/2024	6.9	5	19	376
GS-1	8/01/2024	6.9	3.5	28	306
EPL#7	9/01/2024	6.9	85	151	370
EPL#9	9/01/2024	6.9	6.4	19	368
GS-1	9/01/2024	7.8	4.2	28	307
EPL#7	10/01/2024	7.8	100	150	412
EPL#9	10/01/2024	7.2	5.8	19	350
GS-1	10/01/2024	7.4	5.1	28	298
EPL#7	11/01/2024	7.2	32	25	392
EPL#9	11/01/2024	7.2	13	12	375
GS-1	11/01/2024	7.1	9.7	2	291
EPL#7	12/01/2024	7.1	12	18	380
EPL#9	12/01/2024	7	2.2	14	398
GS-1	12/01/2024	7.2	0.9	3	308
EPL#7	13/01/2024	7.2	15	20	405
EPL#9	13/01/2024	7	7.2	11	400
GS-1	13/01/2024	7.1	0.85	5	311
EPL#7	14/01/2024	7.2	14	17	423
EPL#9	14/01/2024	7.1	4.8	12	413
GS-1	14/01/2024	7	0.75	5	311
EPL#7	15/01/2024	7.3	35	29	452
EPL#9	15/01/2024	7.2	6.8	10	409
GS-1	15/01/2024	7	1.6	4	316
EPL#7	16/01/2024	7.1	18	22	431
EPL#9	16/01/2024	7.2	6.1	8	417

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
GS-1	16/01/2024	7.1	1.2	6	315
EPL#7	17/01/2024	7.1	18	21	398
EPL#9	17/01/2024	7.7	7.8	14	494
GS-1	17/01/2024	6.9	1.1	10	317
EPL#7	18/01/2024	7.6	100	80	497
EPL#9	18/01/2024	7.2	7.7	8	422
GS-1	18/01/2024	7	1.7	4	314
EPL#7	19/01/2024	7	5.9	20	358
EPL#9	19/01/2024	7.2	4.8	21	424
GS-1	19/01/2024	7.1	1	7	318
EPL#7	20/01/2024	7.3	4.5	13	358
EPL#9	20/01/2024	7.1	11	31	432
GS-1	20/01/2024	7.1	1.3	3	324
EPL#7	22/01/2024	8.1	100	91	530
EPL#9	22/01/2024	7.3	14	32	376
GS-1	22/01/2024	7	1.1	4	332
EPL#7	23/01/2024	8.1	110	83	529
EPL#9	23/01/2024	7.7	9.2	22	477
GS-1	23/01/2024	6.9	1.9	12	326
EPL#7	24/01/2024	7.8	150	173	534
EPL#9	24/01/2024	7.1	8.7	15	441
GS-1	24/01/2024	6.8	8.5	26	340
EPL#7	25/01/2024	7.4	60	45	523
EPL#9	25/01/2024	7	8.8	14	449
GS-1	25/01/2024	6.8	2.1	13	334
EPL#7	26/01/2024	8	75	63	539
EPL#9	26/01/2024	7	8.9	12	460
GS-1	26/01/2024	7.9	9.7	27	395
EPL#7	27/01/2024	7.8	100	118	537
EPL#9	27/01/2024	7	24	41	466
GS-1	27/01/2024	6.8	1.6	3	334
EPL#7	28/01/2024	7.1	31	27	516
EPL#9	28/01/2024	7	14	21	456
GS-1	28/01/2024	6.9	2.1	2	334
EPL#7	29/01/2024	7.3	34	28	500
EPL#9	29/01/2024	7	16	32	451
GS-1	29/01/2024	6.8	2.8	9	329
EPL#7	30/01/2024	6.8	8.4	17	401
EPL#9	30/01/2024	7.1	9.4	13	477
GS-1	30/01/2024	6.8	1.3	4	329
EPL#7	6/02/2024	6.9	36	67	357

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#9	6/02/2024	7	16	30	439
GS-1	6/02/2024	7.9	3.4	21	372
EPL#7	7/02/2024	7.8	380	308	436
EPL#9	7/02/2024	6.9	11	31	456
GS-1	7/02/2024	6.8	1.5	18	333
EPL#7	8/02/2024	7.7	230	217	440
EPL#9	8/02/2024	7	6.2	31	449
GS-1	8/02/2024	7	2	20	366
EPL#7	9/02/2024	7.9	70	123	464
EPL#9	9/02/2024	7.1	4.9	11	424
GS-1	9/02/2024	7	0.75	6	376
EPL#7	15/02/2024	7.9	120	97	489
EPL#9	15/02/2024	7.2	10	29	459
GS-1	15/02/2024	7.6	1.3	5	410
EPL#7	16/02/2024	8.2	120	101	509
EPL#9	16/02/2024	7.1	11	12	457
GS-1	16/02/2024	6.9	1.4	6	359
EPL#7	17/02/2024	8	210	201	505
EPL#9	17/02/2024	7	18	47	502
GS-1	17/02/2024	6.9	1.2	10	359
EPL#7	18/02/2024	8.1	110	72	503
EPL#9	18/02/2024	7.1	7.6	12	474
GS-1	18/02/2024	6.9	2.3	4	358
EPL#7	19/02/2024	8.1	160	100	504
EPL#9	19/02/2024	7.1	15	24	472
GS-1	19/02/2024	6.9	2.2	12	358
EPL#7	20/02/2024	8.2	180	124	502
EPL#9	20/02/2024	7.1	15	20	471
GS-1	20/02/2024	6.8	1.6	8	354
EPL#7	21/02/2024	8.1	210	139	477
EPL#9	21/02/2024	8	11	26	475
GS-1	21/02/2024	7	1.4	6	346
EPL#7	22/02/2024	8.2	130	75	475
EPL#9	22/02/2024	7.4	7.5	15	457
GS-1	22/02/2024	7	1.6	6	351
EPL#7	26/02/2024	7.9	290	525	519
EPL#9	26/02/2024	7.3	7.4	15	454
GS-1	26/02/2024	7.1	1.4	3	371
EPL#7	27/02/2024	8	80	81	499
EPL#9	27/02/2024	7.6	7.2	8	501
GS-1	27/02/2024	6.9	1.5	4	372

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#7	28/02/2024	7.9	85	98	507
EPL#9	28/02/2024	7.2	8.4	12	469
GS-1	28/02/2024	7	1.2	2	371
EPL#7	19/03/2024	8.3	1800	967	342
EPL#9	19/03/2024	7.2	21	39	334
GS-1	19/03/2024	8	10	23	384
EPL#7	20/03/2024	8.2	500	372	368
EPL#9	20/03/2024	6.9	24	20	346
GS-1	20/03/2024	7.3	8.2	6	352
EPL#7	21/03/2024	8	300	243	386
EPL#9	21/03/2024	7	17	13	367
GS-1	21/03/2024	7	5.3	6	339
EPL#7	8/04/2024	6.6	400	271	322
EPL#9	8/04/2024	6.6	25	9	233
GS-1	8/04/2024	6.7	16	2	218
EPL#7	9/04/2024	6.7	600	605	355
EPL#9	9/04/2024	6.8	23	14	254
GS-1	9/04/2024	6.8	13	5	229
EPL#7	10/04/2024	6.7	13	6	257
EPL#9	10/04/2024	6.7	22	32	272
GS-1	10/04/2024	6.8	12	2	244
EPL#7	11/04/2024	6.7	6.9	2	270
EPL#9	11/04/2024	6.8	12	10	282
GS-1	11/04/2024	6.8	7.5	4	259
EPL#7	12/04/2024	7.4	210	176	412
EPL#9	12/04/2024	7.5	14	14	295
GS-1	12/04/2024	7.4	7	5	258
EPL#7	3/05/2024	7.2	70	47	532
EPL#9	3/05/2024	6.8	45	17	383
GS-1	3/05/2024	6.8	2.8	8	315
EPL#7	4/05/2024	7.4	180	88	497
EPL#9	4/05/2024	7.2	50	25	420
GS-1	4/05/2024	7.4	22	16	360
EPL#7	5/05/2024	7.5	400	287	341
EPL#9	5/05/2024	7	26	16	228
GS-1	5/05/2024	6.8	50	26	217
EPL#7	6/05/2024	7.3	450	282	289
EPL#9	6/05/2024	7	38	27	197
GS-1	6/05/2024	6.8	25	15	193
EPL#7	7/05/2024	7.4	600	340	278
EPL#9	7/05/2024	6.8	45	17	195

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
GS-1	7/05/2024	6.9	30	12	189
EPL#7	8/05/2024	7.2	200	151	289
EPL#9	8/05/2024	7.2	33	15	224
GS-1	8/05/2024	7.2	24	7	224
EPL#7	9/05/2024	8.1	400	314	439
EPL#9	9/05/2024	7.3	40	27	266
GS-1	9/05/2024	7.4	21	20	228
EPL#7	10/05/2024	7.5	380	289	413
EPL#9	10/05/2024	7.2	40	25	261
GS-1	10/05/2024	7.3	21	7	225
EPL#7	13/05/2024	7.6	400	522	308
EPL#9	13/05/2024	7.9	70	51	461
GS-1	13/05/2024	7.5	32	12	156
EPL#7	14/05/2024	7.7	500	560	413
EPL#9	14/05/2024	7.4	40	22	219
GS-1	14/05/2024	7.2	24	8	185
EPL#7	15/05/2024	7.2	45	20	259
EPL#9	15/05/2024	7.2	27	13	246
GS-1	15/05/2024	7.2	21	5	212
EPL#7	16/05/2024	7.1	35	20	284
EPL#9	16/05/2024	7.1	22	12	258
GS-1	16/05/2024	7	19	8	210
EPL#7	17/05/2024	7.4	150	133	470
EPL#9	17/05/2024	7	24	19	271
GS-1	17/05/2024	7.1	17	10	217
EPL#7	18/05/2024	7.7	140	117	486
EPL#9	18/05/2024	7.6	20	17	277
GS-1	18/05/2024	7.6	14	8	230
EPL#7	19/05/2024	7.5	250	140	491
EPL#9	19/05/2024	7.5	16	14	291
GS-1	19/05/2024	7.4	14	8	236
EPL#7	20/05/2024	7.4	8.6	4	261
EPL#9	20/05/2024	7.3	13	8	300
GS-1	20/05/2024	7.2	9.4	2	238
EPL#7	21/05/2024	7.3	18	14	372
EPL#9	21/05/2024	7.4	13	7	302
GS-1	21/05/2024	7.4	8	1	243
EPL#7	22/05/2024	7.5	80	54	479
EPL#9	22/05/2024	7.6	15	9	312
GS-1	22/05/2024	7.4	7.1	2	249
EPL#7	23/05/2024	7.6	85	69	484

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#9	23/05/2024	7.5	14	6	323
GS-1	23/05/2024	7.6	5.7	2	257
EPL#7	24/05/2024	7.4	45	31	394
EPL#9	24/05/2024	7.3	22	20	326
GS-1	24/05/2024	7.3	12	1	253
EPL#7	25/05/2024	7.3	17	73	496
EPL#9	25/05/2024	7.2	7.8	17	330
GS-1	25/05/2024	7.2	4.2	7	267
EPL#7	26/05/2024	7.5	3.4	74	498
EPL#9	26/05/2024	7.5	8.4	20	348
GS-1	26/05/2024	7.5	2.5	9	263
EPL#7	27/05/2024	7.5	85	69	491
EPL#9	27/05/2024	7.5	19	17	381
GS-1	27/05/2024	7.6	2.8	5	268
EPL#7	28/05/2024	7.6	80	64	498
EPL#9	28/05/2024	7.6	5	21	364
GS-1	28/05/2024	7.6	3.2	4	268
EPL#7	29/05/2024	7.6	310	302	506
EPL#9	29/05/2024	7.6	9.4	25	367
GS-1	29/05/2024	7.7	1.6	2	268
EPL#7	30/05/2024	7.5	23	71	500
EPL#9	30/05/2024	7.5	40	26	384
GS-1	30/05/2024	7.5	2.3	3	270
EPL#7	31/05/2024	7.7	100	67	513
EPL#9	31/05/2024	7.5	22	7	368
GS-1	31/05/2024	7.4	3.2	7	275
EPL#7	1/06/2024	7.5	80	59	477
EPL#9	1/06/2024	7.4	36	28	385
GS-1	1/06/2024	7.4	4.1	12	276
EPL#7	2/06/2024	7.6	170	143	488
EPL#9	2/06/2024	7.5	20	12	395
GS-1	2/06/2024	7.4	4.8	7	282
EPL#7	3/06/2024	7.5	150	161	460
EPL#9	3/06/2024	7.4	25	19	399
GS-1	3/06/2024	7.4	3.8	11	283
EPL#7	4/06/2024	7.5	85	69	495
EPL#9	4/06/2024	7.2	240	402	375
GS-1	4/06/2024	7.3	4	23	286
EPL#7	5/06/2024	7.5	100	77	494
EPL#9	5/06/2024	7.3	26	23	378
GS-1	5/06/2024	7.3	2.9	8	284

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
EPL#7	6/06/2024	7.6	850	563	430
EPL#9	6/06/2024	7.4	60	56	297
GS-1	6/06/2024	7.3	55	39	248
EPL#7	11/06/2024	7.5	55	32	331
EPL#9	11/06/2024	7.4	21	10	245
GS-1	11/06/2024	7.4	17	6	211
EPL#7	12/06/2024	7.5	110	117	444
EPL#9	12/06/2024	7.5	20	12	262
GS-1	12/06/2024	7.4	24	5	223
EPL#7	13/06/2024	7.4	190	268	452
EPL#9	13/06/2024	7.4	16	6	267
GS-1	13/06/2024	7.6	14	3	226
EPL#7	14/06/2024	7.4	100	89	452
EPL#9	14/06/2024	7.4	15	2	288
GS-1	14/06/2024	7.3	11	5	235
EPL#7	15/06/2024	7.2	95	63	439
EPL#9	15/06/2024	7.3	23	5	289
GS-1	15/06/2024	7.4	13	2	245
EPL#7	16/06/2024	7.1	95	73	456
EPL#9	16/06/2024	7.0	15	2	296
GS-1	16/06/2024	7.1	12	3	261
EPL#7	17/06/2024	8.1	60	39	437
EPL#9	17/06/2024	7.4	14	8	316
GS-1	17/06/2024	6.9	8.4	2	264
EPL#7	18/06/2024	8.1	80	68	484
EPL#9	18/06/2024	8.1	10	2	323
GS-1	18/06/2024	7.0	5.9	2	267
EPL#7	19/06/2024	7.7	34	37	324
EPL#9	19/06/2024	6.9	31	17	319
GS-1	19/06/2024	6.8	7.1	2	264
EPL#7	20/06/2024	7.7	55	53	429
EPL#9	20/06/2024	7.1	16	3	336
GS-1	20/06/2024	6.9	4.3	2	267
EPL#7	21/06/2024	7.1	70	50	483
EPL#9	21/06/2024	7.2	17	9	335
GS-1	21/06/2024	7.3	20	32	271
EPL#7	22/06/2024	7.3	65	59	475
EPL#9	22/06/2024	7.4	16	14	342
GS-1	22/06/2024	7.5	6	4	272
EPL#7	23/06/2024	7.3	60	55	476
EPL#9	23/06/2024	7.2	26	31	361

Sample ID	Date	pH	Turbidity (NTU)	Conductivity (µS/cm)	TSS (mg/L)
GS-1	23/06/2024	7.3	3.3	5	272
EPL#7	24/06/2024	7.3	55	41	469
EPL#9	24/06/2024	7.3	23	30	390
GS-1	24/06/2024	7.4	3.6	7	273
EPL#7	25/06/2024	7.4	60	66	483
EPL#9	25/06/2024	7.4	5	30	369
GS-1	25/06/2024	7.5	23	5	312
EPL#7	26/06/2024	7.4	55	38	471
EPL#9	26/06/2024	7.4	16	11	357
GS-1	26/06/2024	7.4	2.5	3	274
EPL#7	27/06/2024	7.5	65	55	477
EPL#9	27/06/2024	7.4	19	10	368
GS-1	27/06/2024	7.5	2.6	5	279
EPL#7	28/06/2024	8.6	50	38	463
EPL#9	28/06/2024	8.2	31	19	372
GS-1	28/06/2024	8.1	2.9	2	283
EPL#7	30/06/2024	7.9	55	52	418
EPL#9	30/06/2024	7.8	24	22	395
GS-1	30/06/2024	7.9	13	29	285

Elevated TSS levels occurred after all significant rainfall events at EPL#7 as indicated in Table 18. As noted above all six flood events were well above the dam holding capacity of 90.7mm causing discharge via the designed spillway. The spillway is designed with gabion rock and riparian zone reeds in the immediate vicinity. Downstream water levels at GS-3 were similar to upstream levels during all spillway discharge events. No breach of consent condition occurred as the rainfall event was outside of the design capacity of the dam as denoted by S4.C30.

5.5.3. Surface Water Long Term Analysis and Trends

The Lower Dam (GS-4/EPL#8) ambient water quality for FY24 exhibited readings that were above average for TSS, close to average for turbidity, above average for pH and below average for Conductivity. These trends are attributed to above average rainfall and extreme flooding events experienced throughout the reporting period. These trends are visible in Figures 23 to Figure 26 below.

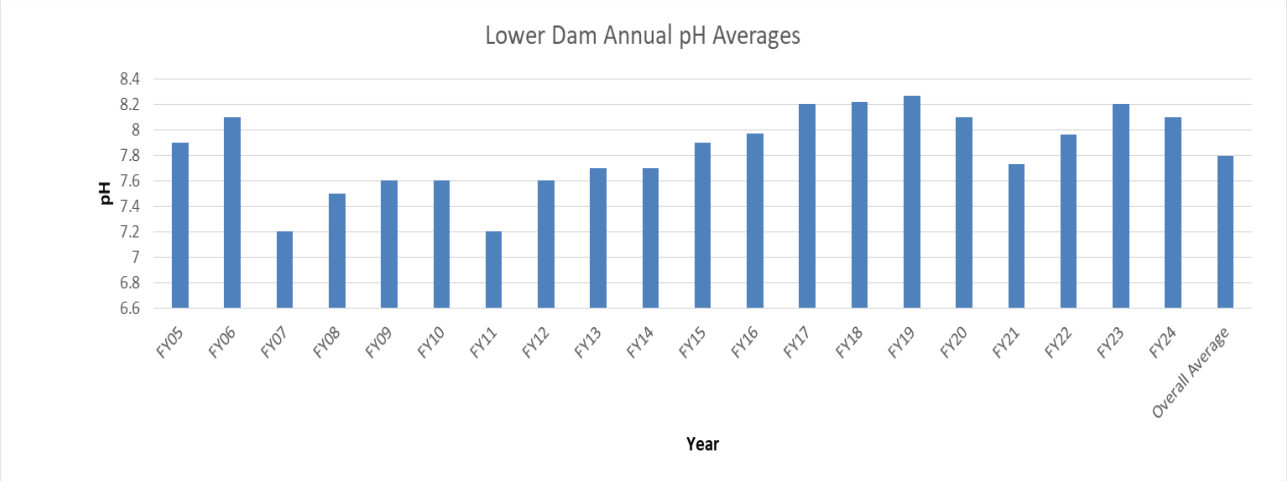


Figure 23 Lower Dam Annual pH Averages

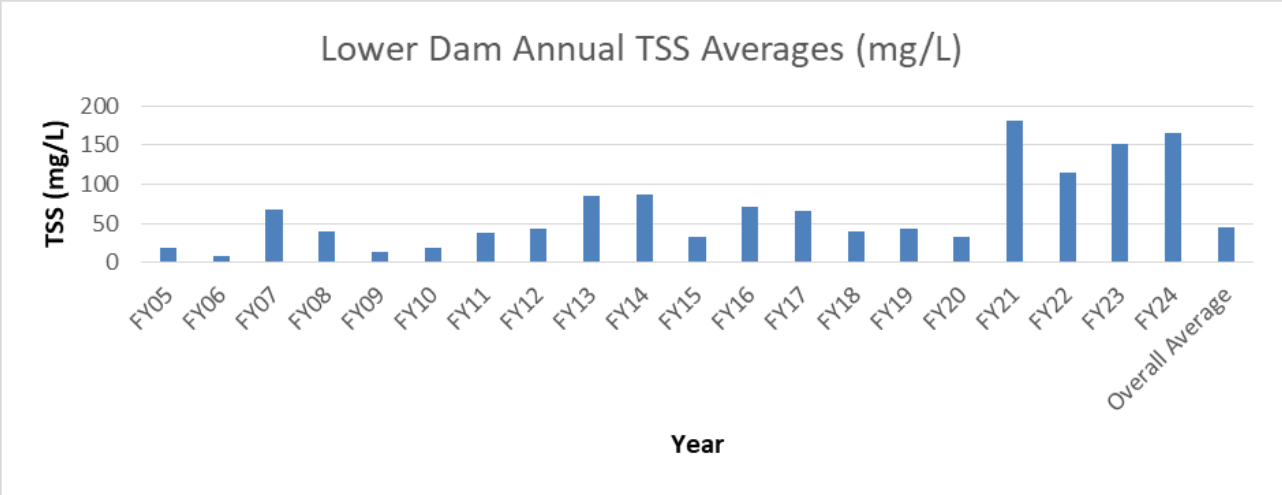


Figure 24 Lower Dam Annual TSS Averages

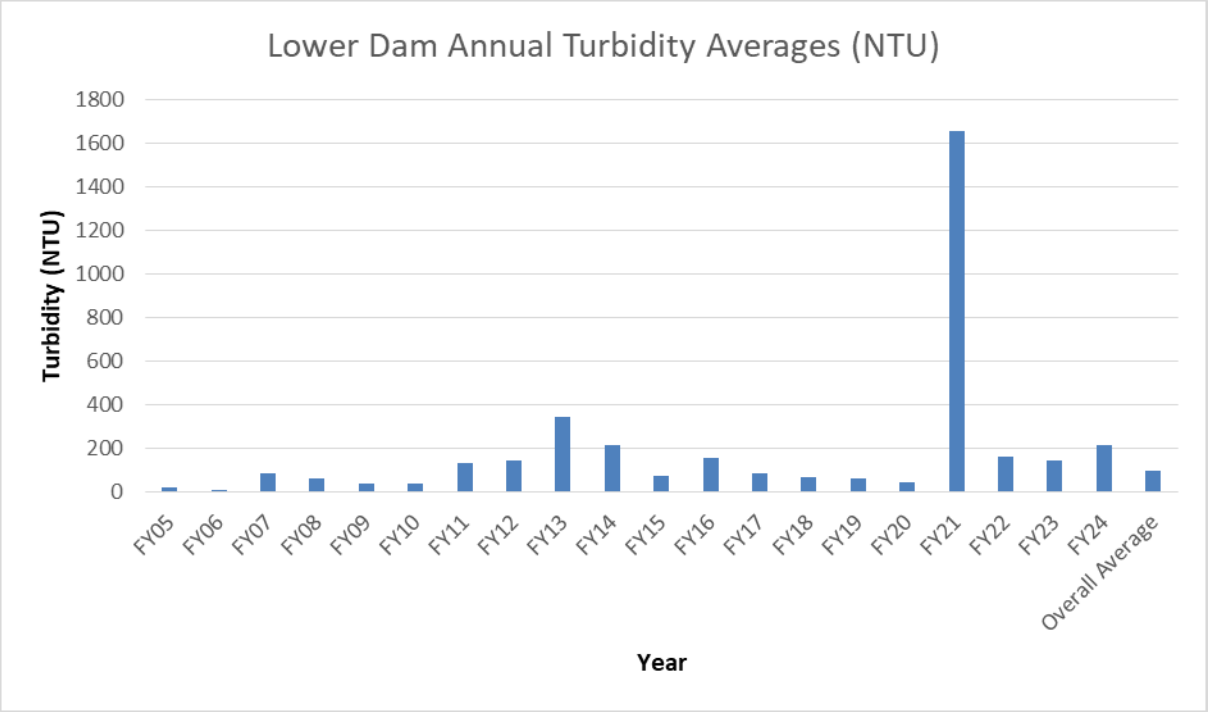


Figure 25 Lower Dam Annual Turbidity Averages

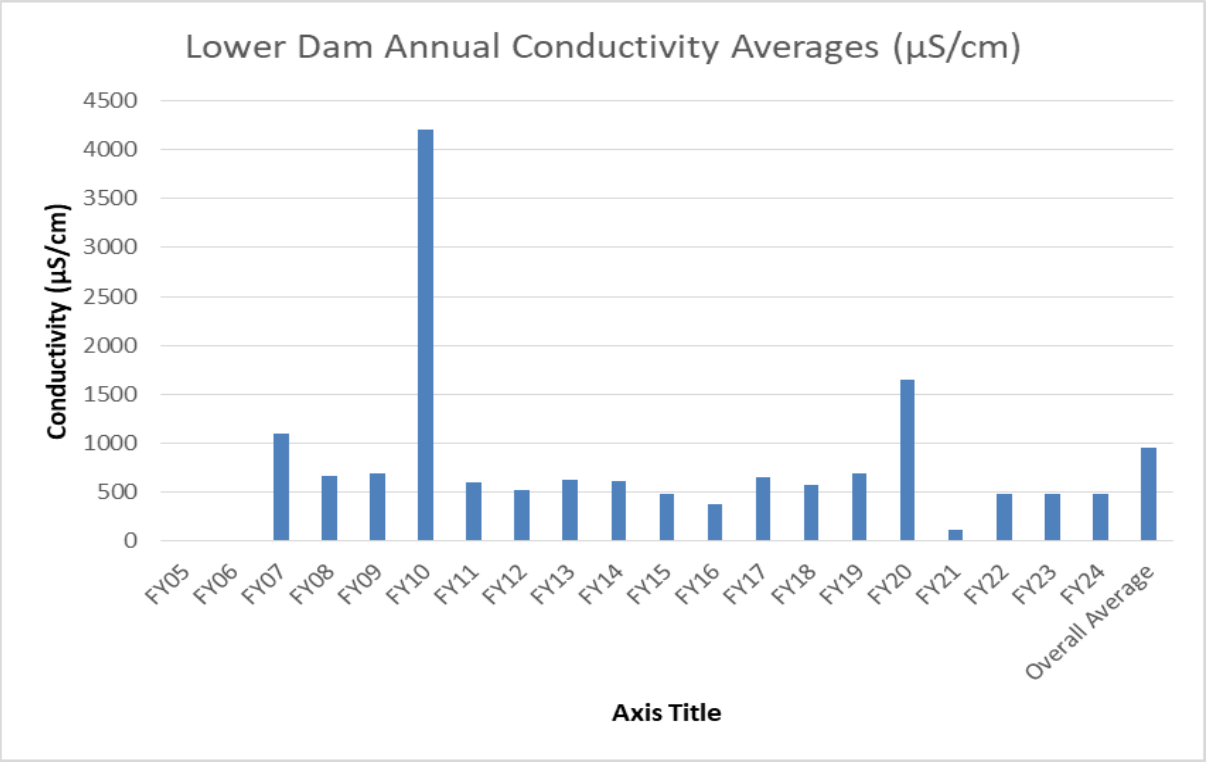


Figure 26 Lower Dam Annual Conductivity Averages

5.5.4. Water Balance and Consumption

The majority of surface water runoff from the quarry is captured in the sites' water management dams. Captured surface water runoff is either used as process water within the quarry operations (e.g. for dust suppression), lost to evaporation or seepage, or discharged to receiving waters.

The quarry is licenced to take surface water from Rocklow Creek. This allocation, under WAL#25152, is 227ML/year and is extracted via a 100mm centrifugal pump. No water take was initiated from Rocklow Creek during the reporting period.

All process water was sourced by either the Lower Dam, Middle Dam or Croome Sumps, which are offline from Rocklow Creek as per water management upgrades undertaken in 2008 under MOD 4. The Location of water storage infrastructure is shown below in Figure 27.

Figure 27 Water Storage Locations

The updated WMP outlines a range of water balance scenarios based on different climate conditions. The wet year scenarios (90th percentile 1,658mm rainfall) best reflects rainfall for the FY24 period (annual rainfall was 1,616mm) as shown in Figure 28. As a result, the process water use was modelled to be 176ML for the reporting period with a change of storage of +137ML over the year within the three dam storages, indicating that water take was well within licenced volumes.

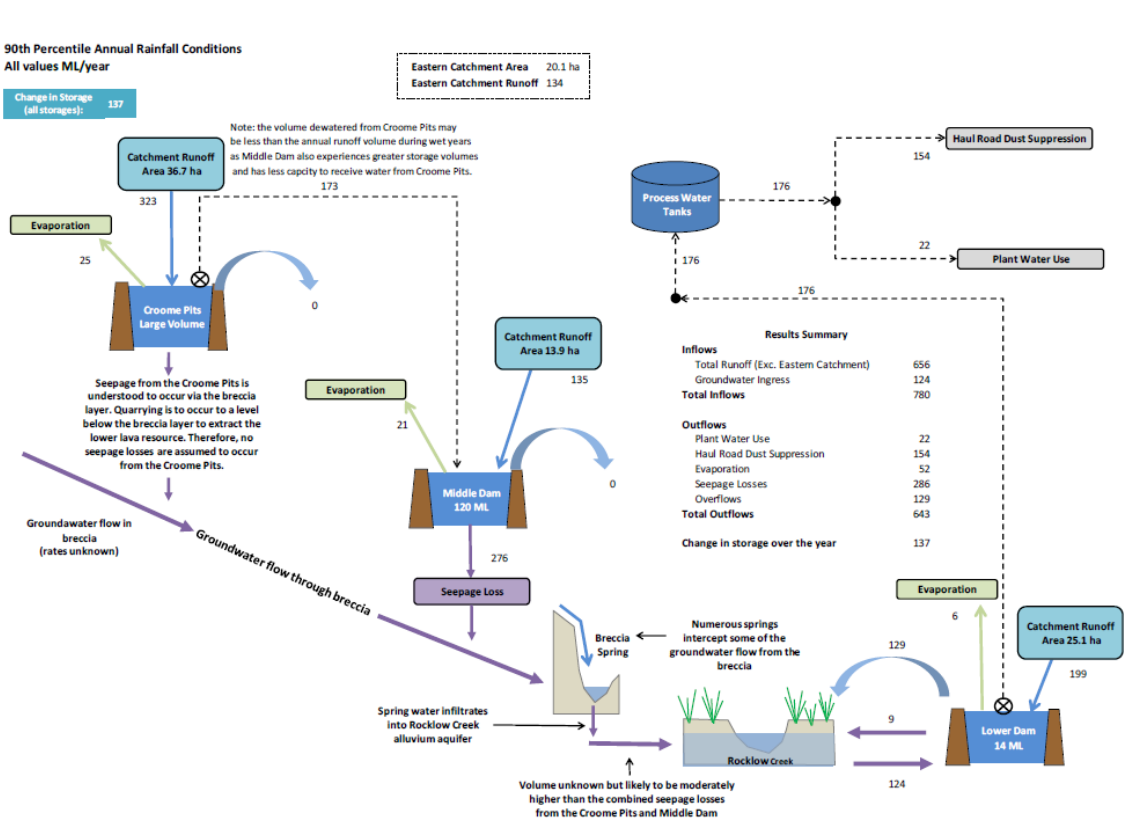


Figure 4.8 Existing water management system: typical wet year results

Figure 28 Existing water management system: typical wet year water balance

5.5.5. Surface Water Quality Summary and Opportunities for Improvement

The water management system has been progressively updated over the past few years. The main changes have included:

- An increase in storage capacity of the Middle Dam and the improved spillway arrangement;
- An upgraded drainage system between the Middle Dam and the Lower Dam;
- An upgraded water recycling ability for the quarry;
- An extended ambient water quality program.

The improvements to the water management system outlined in the updated WMP will reduce the instances where Rocklow Creek inundates the Lower Dam causing it to fill up. A summary of these improvements is reproduced in Table 19 below and have been addressed in the updated WMP. This work will commence in the next reporting period.

Table 19 Proposed Water Management System Improvements

Proposed Modification	Outcome
Relocate spillway to south-east side of the dam where Rocklow Creek levels are expected to be lower during large runoff events.	• Significantly reduce the frequency of uncontrolled inflows from Rocklow Creek inundating the Lower Dam. • Improve water treatment function of Lower Dam during Rocklow Creek flood events.

Relocate primary sedimentation chamber to western end of dam. Raise embankment at existing spillway location from 2.8 to 4.0 m AHD.	• Inflows will occur at the opposite end of the dam to outflows, resulting in longer residence time and improved sediment treatment function. • Provide vehicle access to primary sedimentation chamber to allow for sediment removal as required.
Extend the dam footprint to the east by approximately 1,600m2 and excavate to 2.0 m AHD.	• Provide an additional 1.1 ML of storage above 2.0 m AHD. • Establish a macrophyte zone near the dam outlet.
The relocated spillway will have an invert level of 3.1 m AHD1, which will be 300 mm higher than the existing level (2.8 m AHD).	• Reduce the frequency of Rocklow Creek floodwaters inundating the Lower Dam. • Provide an additional 2.0 ML of storage above 2.0 m AHD.
Establish macrophyte zone within extended dam footprint area.	• Provide beneficial water quality treatment during significant rainfall (discharge) events.

5.6. Ground Water Monitoring

An annual groundwater monitoring report has been prepared by EMM Consulting Pty Ltd, in accordance with condition 43. This report is included in full within Appendix E. The monitoring program uses the established down gradient bores at Dunmore Sand and Soil (DG-31, DG-59 and BH-F) and four established up gradient bores at Dunmore Quarry (GW-1, GW-2 and GW-3). Location of Groundwater monitoring bores are shown below in Figure 29.

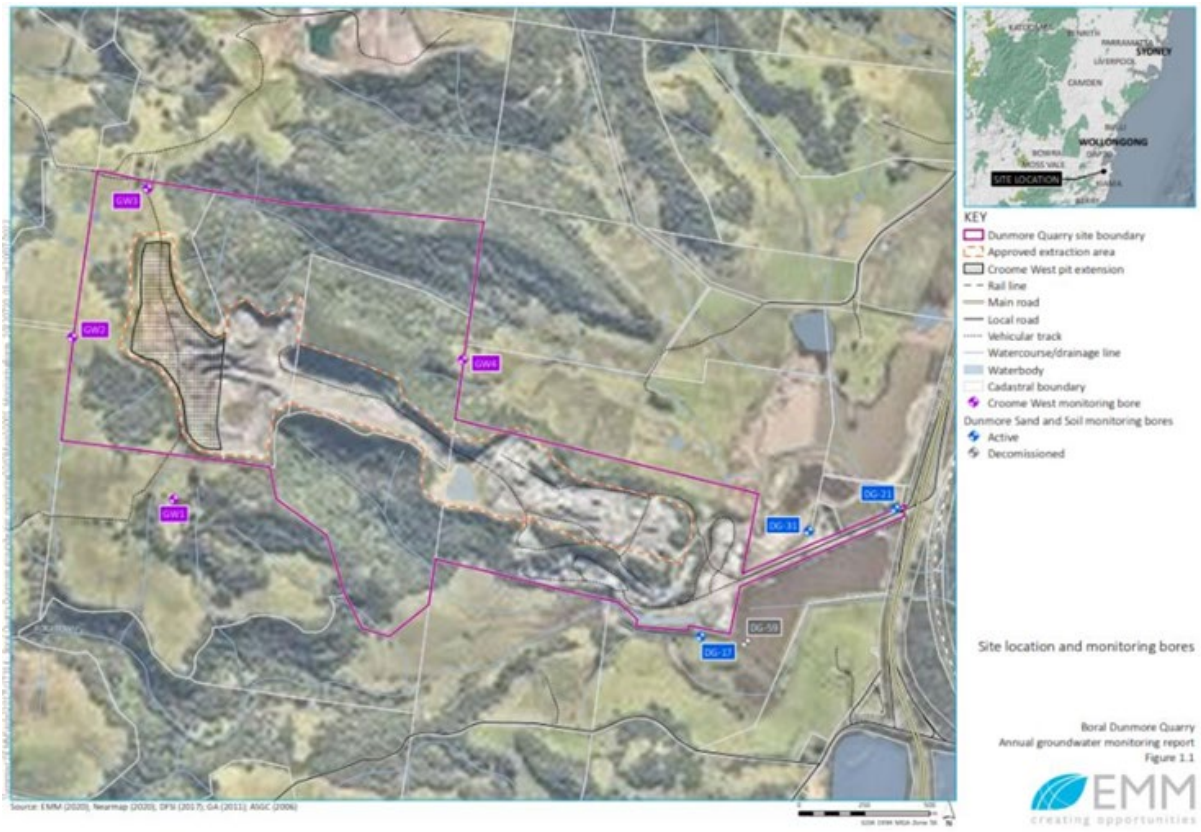


Figure 29 Groundwater Monitoring Bores

The monitoring bores are located up hydraulic gradient from current quarrying activities and are therefore considered representative of baseline conditions (both water levels and quality). Groundwater monitoring for the up-gradient bores includes six-hourly groundwater level measurements and six monthly groundwater sampling events.

5.6.1. Groundwater Monitoring Impact Assessment Criteria

Groundwater impacts relating to quality and water levels downgradient are assessed in relation to the up-gradient (baseline) conditions located in bores GW-1, GW-2, GW-3 and GW-4 and against the site conceptual model which was formulated as part of the MOD 9 Croome West Expansion.

5.6.2. Groundwater Monitoring FY24 Performance Review

Groundwater levels are recorded every six-hours allowing water level trends to be identified in the alluvium and the Bumbo Latite. Continued six monthly sampling of water quality at the Croome West sites and quarterly sampling at the DSS sites has also established useful trends.

The main findings for the FY24 monitoring year regarding water levels are:

- Groundwater levels in the alluvium (DG-17, DG-31 and DG-21) are comparable to previous monitoring events and are generally less than 3 metres below ground level (mbgl). The shallow alluvium shows a direct and immediate response to rainfall at DG-17 and DG-31. The groundwater level at DG-21 does not respond to rainfall recharge.

- The groundwater level at GW1 has historically shown a direct response to rainfall recharge during periods of above average rainfall. Comparatively, GW2 and GW3 show little to no response to rainfall.
- Groundwater quality data collected during the FY23 monitoring year was generally consistent with previous years. It was noted that a shift towards a more bicarbonate dominant water type was observed at GW1 and GW4, indicating increased groundwater mixing.
- The dissolved metal results were comparable to previous sampling results. Iron was typically higher in the alluvial groundwater and manganese was typically higher at the Latite monitoring bores GW1 and GW2.
- Nitrate results at GW3 continue to be an order of magnitude higher than the other Latite and alluvial bores, which could be related to the Breccia layer. Total phosphorus results continue to be an order of magnitude higher at DG-17 compared to the other alluvial and Latite bores.

The results for the FY24 monitoring year are consistent with the conceptual model for the project. There does not appear to be any impact on groundwater levels or quality in the Bumbo Latite or Kiama Sandstone associated with the Croome West pit extension activities.

5.6.3. Groundwater Monitoring Summary and Opportunities for Improvement

As per S4.C43: *on the provision of two years of monitoring data that shows negligible impact on the regional groundwater network the Planning Secretary may agree to suspend monitoring of regional groundwater levels and/or quality.* The two-year groundwater monitoring period has shown negligible impact to the monitored groundwater system.

However, in the interest of collecting additional groundwater site data and continuing groundwater monitoring whilst Boral are still continuing extraction in the Croome West pit, it is proposed to continue with the current monitoring regime at the quarry.

5.7. Flora and Fauna Management and Rehabilitation

Most areas of the site are currently operational and as such rehabilitation is not able to commence on the majority of areas within the quarry until the completion of extraction activities. When practical, progressive rehabilitation of the site will be undertaken in conjunction with on-going quarrying works. Hydroseeding of the Croome West Bund is now well established with trees as shown below in Figure 30.

Figure 30 Hydroseeding cover and trees over Croome West Bund

Rehabilitation activities undertaken to date have been in accordance with the updated Flora and Fauna Management by EMM (2019) and Rehabilitation Management Plan prepared by Arcadis (2016).

There are three (3) designated conservation areas for Dunmore Quarry as shown in Figure 31 below. These areas are referred to as the Compensatory Habitat Area (CHA), Remnant Vegetation Conservation Area (RCVA), and Offset Area (OA). Works in the last reporting period focussed on the CHA and OA and are summarised in the Annual Monitoring report located in Appendix F.

In addition, following the approval of Modification 13, a Biodiversity Stewardship Agreement (BSA) is in the process of being set up, which will generate a new rehabilitation corridor. The exact parameters and completion criteria are yet to be determined.

Mod 13 approval conditions also require the translocation of specific vegetation types from the disturbance area to land associated with the future BSA. A procedure is in place for the translocation work which will be undertaken in the next reporting period.

In the last 12 months, rehabilitation within the quarry itself has continued on the Croome West amenity bund.

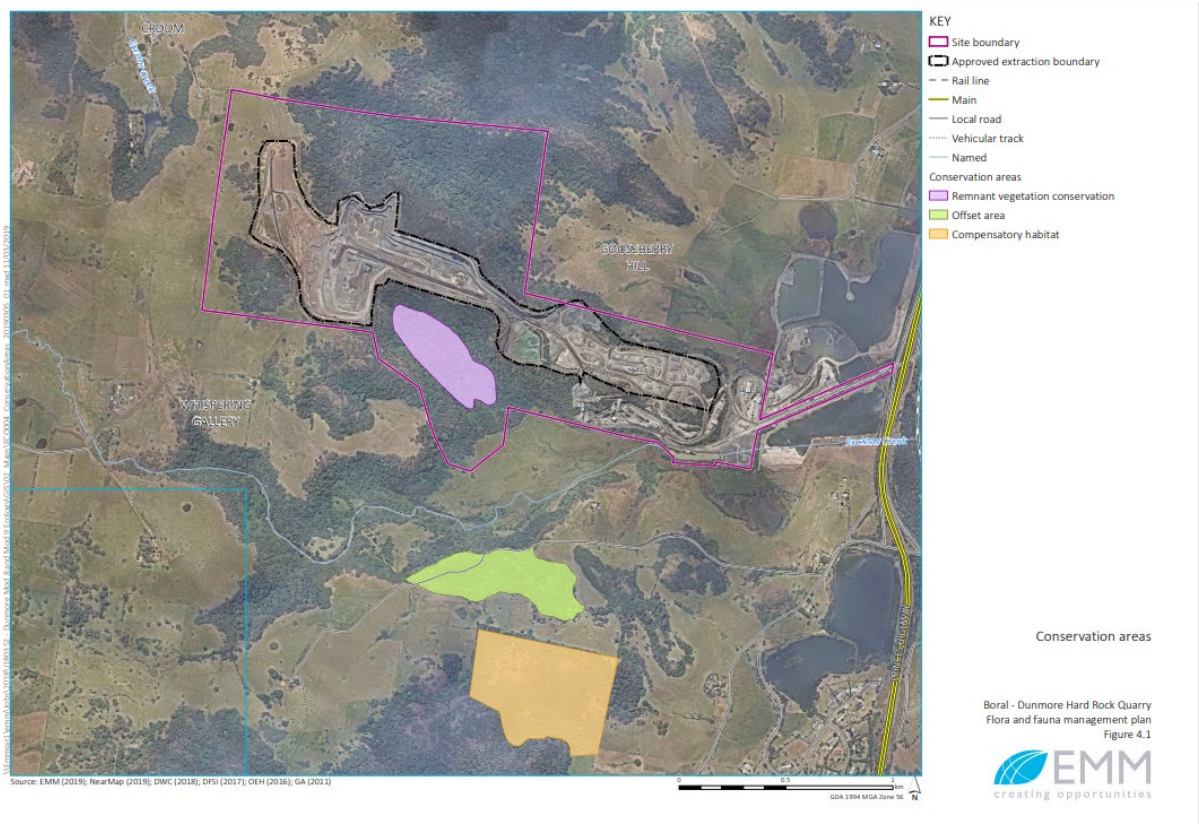


Figure 31 Conservation Areas

5.7.1. Flora and Fauna Impact and Rehabilitation Assessment Criteria

Completion criteria were designed in the updates to the FFMP, which was approved June 2019.

The following completion criteria are outlined for the Compensatory Habitat Area (CHA):

- establishment of a dominant native canopy cover across the Compensatory Habitat Area, as per below:
  - midstory canopy cover of 50% for areas of Melaleuca Armillaris Tall Shrubland; and
  - overstory canopy cover of 15% for areas of Illawarra Lowlands Grassy Woodland;
- removal of woody weeds across the Compensatory Habitat Area; and
- reduction in exotic groundcover to less than 30% over five consecutive monitoring periods.

Once these completion criteria have been met, no further management of this area is required under this FFMP and Conditions 46(a) and 49 are deemed to have been satisfied.

The following completion criteria are outlined for the Remnant Vegetation Conservation Area (RCVA):

- maintenance of high-quality intact remnants, with no significant change in cover of native species;
- establishment of a dominant native canopy cover of 15% in the lower (south-eastern) portion of the Remnant Vegetation Conservation Area; and

- Establishment of a predominantly native (>50%) groundcover, with maintenance of this native groundcover over five consecutive monitoring periods.

Once these completion criteria have been met, no further management of this area is required under this FFMP, and Conditions 46(b) and 50 are deemed to have been satisfied.

There are no completion criteria set for the Offset Area (OA) as the area is managed via an in-perpetuity arrangement via a Conservation Agreement. A Conservation Agreement between the Minister administering the *National Parks and Wildlife Act (1974)* and Boral Resources for Dunmore Quarry was signed by NSW Minister for the Environment on February 2011. The NSW Minister for the Environment confirmed signing the Dunmore Quarry Conservation Agreement and acknowledged that the Conservation Agreement satisfied condition 46A of DA 470-11-2003, for the long term security of the Offset Area.

5.7.2. Flora and Fauna and Rehabilitation FY24 Performance Review

A summary of the bushland regeneration works undertaken within the three active bushland restoration zones is outlined in Bushland Restoration Project Final Report contained in Appendix F.

5.7.2.1. Zone 1 Remnant Vegetation Conservation Area

Zone 1 consists of a large gully with a south easterly aspect and a drainage line that forms part of the Rocklow Creek catchment. The 15 hectare site contains a subtropical rainforest with a diverse range of canopy species including Sassafras (*Doryphora sassafras*), Myrtle Ebony (*Diospyros pentamera*) and all five of the local Fig (*Ficus sp.*) species. An abundance of vines also exist within this remnant vegetation area including Round Vine (*Legnephora moorei*), Kangaroo Grape (*Cissus Antarctica*) and Milk Vine (*Marsdenia spp.*), and many species of ferns are present as epiphytes, lithophytes and within the ground layer. Large amounts of woody weeds and Lanatana have invaded this area. Works within this zone consisted of primary weed control targeting woody weeds throughout established approximately 20 year old revegetation. Large amounts of Wild Tobacco and Lantana were dominating the revegetation areas on the southern side of the creek while encroachment of Kikuyu was impacting the plantings on the northern side of the creek. A total of 25,000m² of primary weed control was carried out within this zone.

Infill planting was scheduled for this zone but the fencing has fallen into disrepair..

5.7.2.2. Zone 2 Offset Area

This contract period bush regeneration works focused on secondary and primary weed control within the woodland and rainforest remnants and the rainforest ecotone at the eastern extent of this zone. Regeneration of native canopy species within these areas this year has been rapid and a connected sub-canopy exists within the Rain Forest remnant.

Primary weed control was carried out at the eastern extent of this zone during the contract period. Additional populations of the threatened plant species White Wax Flower (Cynanchum elegans) were located within the ecotone between the rainforest and woodland remnants. Mass regeneration of Illawarra Zieria (Zieria granulata) has been observed within some areas and Homalanthus stillingiifolius has emerged within the site and is regenerating naturally and secondary populations of this regionally rare plant can be found throughout the site.

5.7.2.3. Zone 3 Compensatory Habitat Area

The CHA zone is located south of Rocklow Road and consists of a large bushland remnant on a hilltop with a small ephemeral creek line within a gully to the south of the hill. The total site area of this zone covers approximately 23.1 hectares. The majority of this zone is perched on the rocky hillside and supports the *Melalecua armillaris* tall shrubland vegetation community. The gully drops at the southern end of the zone, which is well defined by the presence of rainforest species and some very impressive land large Moreton Bay Fig (*Ficus* macrophylla) trees.

Extensive revegetation has been carried out within this zone within the southern gully and on the eastern and western edges of the zone. Hundreds of thousands of trees have been planted within this zone and are now reaching maturity. Many open areas that have been cleared of vegetation also exist within this zone with the majority of these clearings occurring on the rocky hill tops.

Works within this contract period focused heavily on primary weed control throughout established revegetation areas. Works commenced for the northern fence line that defines this zone and have continued south covering over 2ha. The western fence line defined the boundary of this work area and an old dry-stone wall that divides the revegetation areas from the natural bushland was defining the eastern boundary.

Work continued south focusing on primary weed control within the Melaleuca armillaris Tall Shrubland vegetation community and many individual plants of the threatened species Illawarra Zieria (Zieria granulata) were uncovered within this area.

Primary weed control works continued eastward from this point and a large subtropical rainforest remnant was reached that is dominated by several large and very old Ficus macrophylla.

5.7.2.4. Rapid Visual Assessment

An annual Rapid Visual Assessment of the rehabilitation areas associated with the development was undertaken in November 2023. The outcomes and recommendations were as follows:

Outcomes

RVA observations were undertaken in the Offset Area as shown in Figure 5. No significant disturbances and threats to rehabilitation success were found.

It was noted that weeds identified in the FFMP and Good Bush monitoring reports are present and being managed. No feral animals were identified however it is anticipated that some feral animals exist and may require management.

Regeneration works and monitoring are undertaken by Good Bush. Significant bush regeneration works were noted during the observations. The FFMP points to the Conservation

Agreements for management and monitoring requirements. The Conservation Agreements detail management which is beyond the commitments made in the letter from Boral to the Department dated 22 September 2008 titled Dunmore Quarry – Revised Offset for Quarry Extension outlined in condition 45 (c) of the approval. As the Conservation Agreement is the latest document the management described in it apply to this offset. A comparison of photo

monitoring points in annexure B of the Conservation Agreement and those provide in the Good Bush Natural Area Restoration Report 2023 is not possible since these points appear to differ in location.

The current management/monitoring of the offset site as required by the Conservation Agreement are observed to need improvement and alignment.

Recommendations

The FFMP points to the Conservation Agreement for management and monitoring requirements. A review of the management and monitoring requirements in the Conservation Agreement to develop a clear view of actions is recommended. A clear scope of works may then be developed for offset management and budgeting.

The Conservation Agreement is a perpetuity agreement. These types of agreements require some strategic thinking on where and when intensive works finish and where and when maintenance works continue. They also require strategic thinking of an exit strategy once the quarry closes. Long term budgets will help inform Boral to assist in financing in perpetuity.

5.7.3. Flora and Fauna and Rehabilitation Summary and Opportunities for Improvement

Works will continue in line with the completion criteria thresholds during the next reporting period.

A review of the fencing requirements will be undertaken for Zone 1.

An annual Rapid Visual Assessment will be undertaken again in November.

Rehabilitation will be undertaken with the translocation work associated with Mod 13 and the work to establish a BSA will commence.

5.8. Heritage Conservation

Dunmore Quarry operate under an Aboriginal Cultural Heritage Management Plan which details the required Aboriginal heritage management and mitigation measures. The plan was prepared in consultation with OEH and Registered Aboriginal Parties and is available on the Boral Dunmore website. Archaeological salvage excavation and mitigation measures have been completed. Boral has undertaken environmental studies for the approved Mod 13 quarry pit extension.

5.9. Waste Minimisation

Boral is committed to continuing non-production waste management minimisation in accordance with the waste hierarchy and minimising the amount of waste sent to landfill. To achieve this, all liquid and solid wastes are classified and sorted so they can be appropriately re-used or recycled. Waste is managed by appropriately licenced sub-contractors and entered into a waste tracking register.

To deter illegal dumping, Shellharbour Council installed cameras around the surrounds of Dunmore Quarry and Dunmore Sand and Soil. Council indicated that two prosecutions have resulted from investigations, in previous reporting periods, aided by the installation of the cameras.

Boral is committed to ensuring its extraction and processing activities produces minimal waste rock material. Approximately 30% of the hard rock processed at Dunmore Quarry

becomes material of less than 4mm in diameter, which are known as quarry fines. In the past, quarry fines were considered a product waste and stockpiled due to having no steady market, however the material is now used in manufactured sand (as opposed to natural sand) production.

5.9.1. Waste Tracking Register

A detailed breakdown of the waste collected on-site during the reporting period is shown below in Table 20. Yearly trends are shown in Table 21.

Table 20 Waste Tracking Data

Month	General Waste (t)	Cardboard (t)	Commingle (t)	Timber (t)	Scrap Metal (t)	Oil & Oily Water (L)	Effluent (L)	Filter (t)*	Rags (t)**
Jul-23	6.35	0.17	0.04	1.06	0	0	15,000	0	0
Aug-23	1.34	0.13	0.05	0	0	0	27,800	0	0
Sep-23	1.69	0.11	0.03	0	0	0	0	0	0
Oct-23	6.71	0.04	0.04	1.34	0	0	24,000	0	0
Nov-23	0.99	0.03	0.02	0	0	0	5,000	0	0
Dec-23	7.85	0.13	0.04	0.98	0	0	14,800	5.85	0
Jan-24	1.22	0.10	0.02	0	0	0	28,500	0	0
Feb-24	1.17	0.05	0.05	0	0	0	24,000	0.62	0
Mar-24	4.13	0.11	0.04	0	0	0	32,380	0	0
Apr-24	4.21	0.05	0.04	1.78	0	0	22,000	0.62	0
May-24	3.41	0.07	0.04	3.48	0	0	20,000	0.41	0
Jun-24	1.03	0.08	0.04	0	0	45,000	30,000	0	0
Total	**40.10**	**1.07**	**0.45**	**8.64**	**0**	**45,000**	**243480**	**7.49**	**0**

Table 21 Historical Waste Data

Waste Classification		FY20	FY21	FY22	FY23	FY24
Solid Waste	General Waste (t)	34.398	37.237	36.951	55.89	40.10
	Cardboard Tonnes (t)	3.355	2.32	1.623	1.44	1.07
	Timber Tonnes (t)	10.24	10.24	1.16	4.60	8.64
	Comingle Recycling (t)	3.825	0.255	0.266	0.42	0.45
	Used Oil Filters/ Rags (t)	1.072	2.46	8.2	12.07	7.49
	Scrap Metal (t)	79.64	557.46	0	0	0
Liquid Waste	Oil/Oily Water Litres (L)	68,883	41,900	17,280	53,000	45,000
	Effluent Litres (L)	190,000	170,208	11,111	303,500	243,480
	Other Litres (L)	0	0	0	0	0

The quantity of waste in FY24 was consistent with historical results across all categories, in accordance with Table 21.

We continue to track tyre management.

5.9.2. Waste Minimisation Opportunities for Improvement

Further work will continue with subcontractors to optimise the record keeping for waste collection data. Work will continue to consolidate the recycling improvements undertaken in FY24. The centralised waste management contract continues with Cleanaway, assisting in the tracking and reporting of waste.

5.10. Incident and Emergency Response

The following management actions were undertaken in regard to incident and emergency response.

- The Pollution Incident Response Management Plan was reviewed and updated in April 2024. The current version is available online at https://www.boral.com.au/our-commitment/environmental-reporting.

5.11. Dangerous and Hazardous Goods Storage

Storage of dangerous goods and hazardous material have continued as per established operations. All dangerous goods and chemicals are handled and transported in accordance with the AS1940 and AS25956 and the Dangerous Goods Code and S4.C72.

5.12. Independent Environmental Audit

In November 2023, an Independent Environmental Audit was undertaken.

Noting that there are a number of matters that require improvement, the overall environmental performance based on the observed condition of the site, the low number of non-compliances and incidents, and low number of complaints, is considered '**Satisfactory**'. There were a total of five non-compliances identified, detailed in Appendix G.

6. Community

The Dunmore Quarry Community Consultative Committee (CCC) continues to serve as a valuable dialogue between Boral and the local community with valuable input and feedback being provided by the community regarding quarry operations and plans. The CCC is run as per S5.C6 and the Departments Community Consultative Committee Guidelines for State Significant Developments (2016).

Members include:

- An independent chairperson.
- At least 2 representatives from Boral (typically the environmental co-ordinator and quarry manager).
- A member from Shellharbour City Council.
- Three local community representatives.

Members are informed of the environmental performance of the site, provided with an update on operations, and given a chance to tour the site and ask questions they may have regarding the operation. CCC members have also been diligent in disseminating the information from the meetings to other interested community members in the local area. The minutes of each meeting is published in the Boral website.

https://www.boral.com.au/locations/boral-dunmore-operations

The CCC met twice during the FY24 reporting period (28 February 2024 and 22 August 2024).

6.1. Environmental Complaints Management

There were no environmental complaints received during the reporting period.

A graph showing the community complaints over time can be seen in Figure 32.

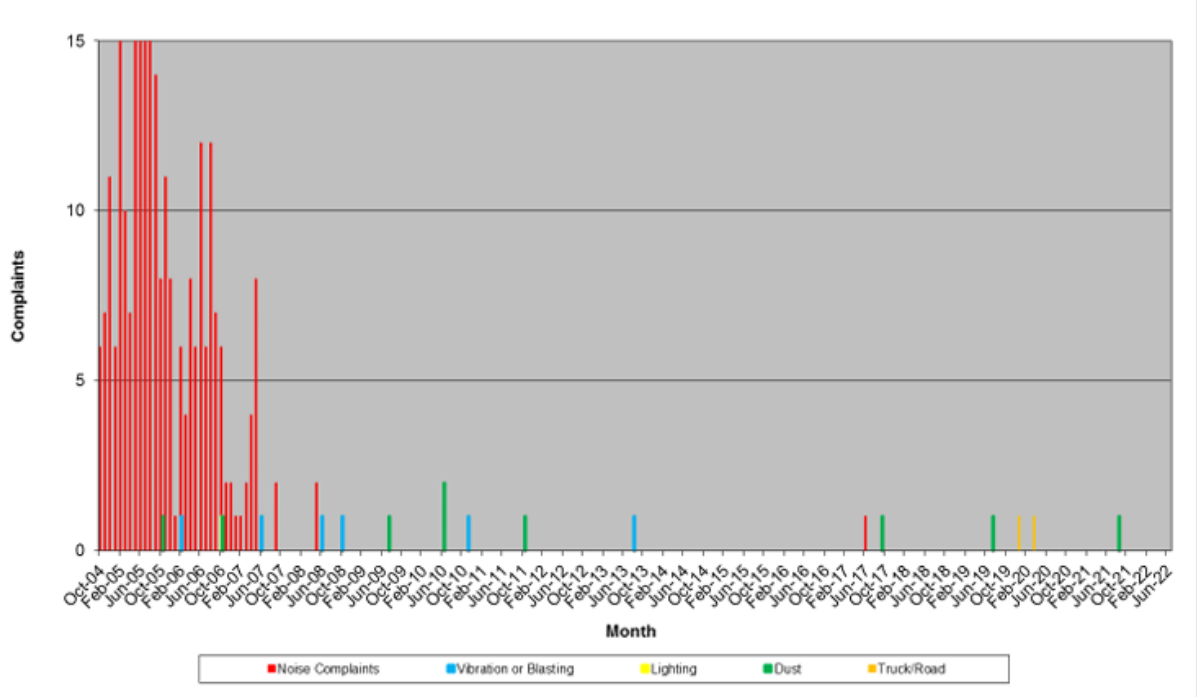


Figure 32 Historical Community Complaints

6.2. Summary of Regulatory Notifications

Zero regulatory notifications were received during the FY24 reporting period.

7. Activities to be completed by the Next Reporting Period

A number of actions have been identified for the next reporting period. A number of these are associated with the approval of Modification 13.

Table 22 Activities to be Completed by the Next Reporting Period (FY25)

Reference	Description of Action
AR 1	Real time Air quality system to be commissioned and in place
AR 2	Management plans to be updated and approved in line with Modification 13 consent requirements
AR 3	Translocation rehabilitation works to be established.
AR 4	BSA establishment works commenced
AR 5	Lower dam works commenced
AR 6	Fencing at rehabilitation areas to be reviewed with a plan to repair or/ replace as necessary
AR 7	Undertake Rapid Visual assessment
AR 8	Complete audit recommendations

8. Conclusion

Dunmore Quarry has continued to focus on ensuring the environment and neighbouring community are not adversely impacted by quarry operations. Throughout this reporting period extraction and processing of quarry materials has remained consistent with previous years.

The FY24 period had a strong focus on maintaining regulatory compliance and optimising management actions established in the FY23 reporting period.

The next reporting period will continue to focus on continuing to ensure compliance and optimising processes to allow this.

9. Appendix A Meteorological Monitoring Locations Data and Graphs

The location of the onsite weather station is shown Figure 33 below.

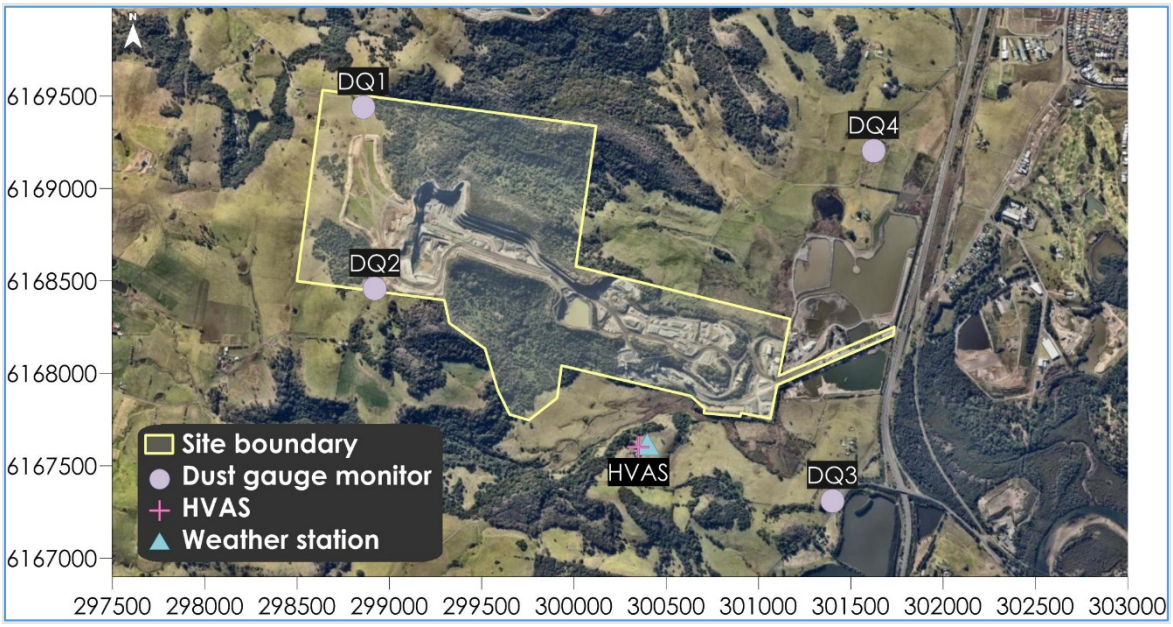


Figure 33 Meteorological Monitoring Locations

A monthly review of weather data is undertaken by the environmental co-ordinator. Important meteorological conditions assessed are rainfall, wind speed direction and atmospheric stability.

Rainfall data has been collected since FY2003. A summary of the rainfall measured from the Dunmore Quarry weather station is shown below in Table 23. Values shown in red relate to periods where rainfall was above the regional average.

Table 23 Rainfall Data Summary

Rainfall (mm)			
Month	**Current Reporting Period**	**Site Average**	**Regional Average**
July	56.8	78.4	49
August	67.6	67.6	53.5
September	53.4	52.3	42.7
October	22.4	77.5	64.5
November	216.2	97.4	83.1
December	207.4	87.7	67
January	57.4	88.9	72.9
February	71.8	151.9	140.5

March	80.8	162.8	122.3
April	261	100.9	73.8
May	296	88.5	55.8
June	225	109.9	93.7
Total	1615.8	1144.3	925.6

Table 24 Historical Rainfall Data

	Rainfall (mm)																						
Month	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	Site Average	Regional Average
July	20	23.5	54.2	41	96	30.5	63.5	35.5	78	194	39	61.7	5	48	97.5	25	6	20.5	264.2	14.8	450	56.8	78.4	49
August	13.5	38.5	23	3	42.5	58.5	39	0.5	72	85.5	4.5	17	252	327	76	39	31	39	187.1	73.4	39.4	67.6	69.5	53.5
September	14	7.5	40.6	33	101	39	56	19.5	145.5	58.5	11.5	85.5	48.7	82	51	1	41.5	59.5	11.3	46.37	145.2	53.4	52.3	42.7
October	6.5	49	245.4	48	0	17	79	125.5	126	124.5	83.5	6.5	102.5	36.5	32	14.5	128	38.5	114.4	61.85	243.8	22.4	77.5	64.5
November	17	149.5	126.8	144.5	39.5	161.5	46.5	65	198	163.5	25	173	24	48	33	85	92	25.5	83	164.1	61.2	216.2	97.4	83.1
December	70	40.5	136.2	36.5	54	120	112.5	80.5	147.5	63	32	70.5	233.5	116.5	58	53	90.5	2.5	83.8	78.36	41.8	207.4	87.7	67
January	68	30.5	128.8	90	0	65.5	9.5	79	59.5	50.5	183	43.5	192.5	155.5	32.5	36	143.5	65	189.3	151	125	57.4	88.9	72.9
February	112	70	180.4	87.1	186.5	351.5	107.5	197.5	48	257.5	142.5	59	112.5	29.5	283	128.5	35.5	272.5	88.4	295.8	225.4	71.8	151.9	140.5
March	121	84	118	43.5	67.5	36.5	39	74	362.5	196	23.5	326	57	145	441	41.5	156.5	65.5	278.5	670.6	153	80.8	162.8	122.3
April	91.5	200	24.4	8	145	90.5	106	63	37.4	87.5	136	64.5	305	37.5	40.5	26.1	48.5	85	5.9	216.8	140.4	261	100.9	73.8
May	427.5	43.5	85.6	65.5	23	8	20	80.5	58.3	9.5	81	13	53.5	35.5	51.5	44	13.5	52	206.1	202.8	77.6	296	88.5	55.8
June	74.5	42	84.4	124	318.5	85.5	67	52	92	89	239	34	76	429	57	133.5	103	35	44	1.8	12.6	225	109.9	93.7
Total	1036	778.5	1248	724.1	1074	1064	745.5	872.5	1425	1379	1001	954.2	1462	1490	1253	627.1	889.5	760.5	1556	1978	1715	1616	1144.3	925.6

Monthly wind roses and seasonal wind roses are shown in Figure 34 to Figure 45. Please note calm is defined as winds averaging less than 0.3m/s over the averaging period.

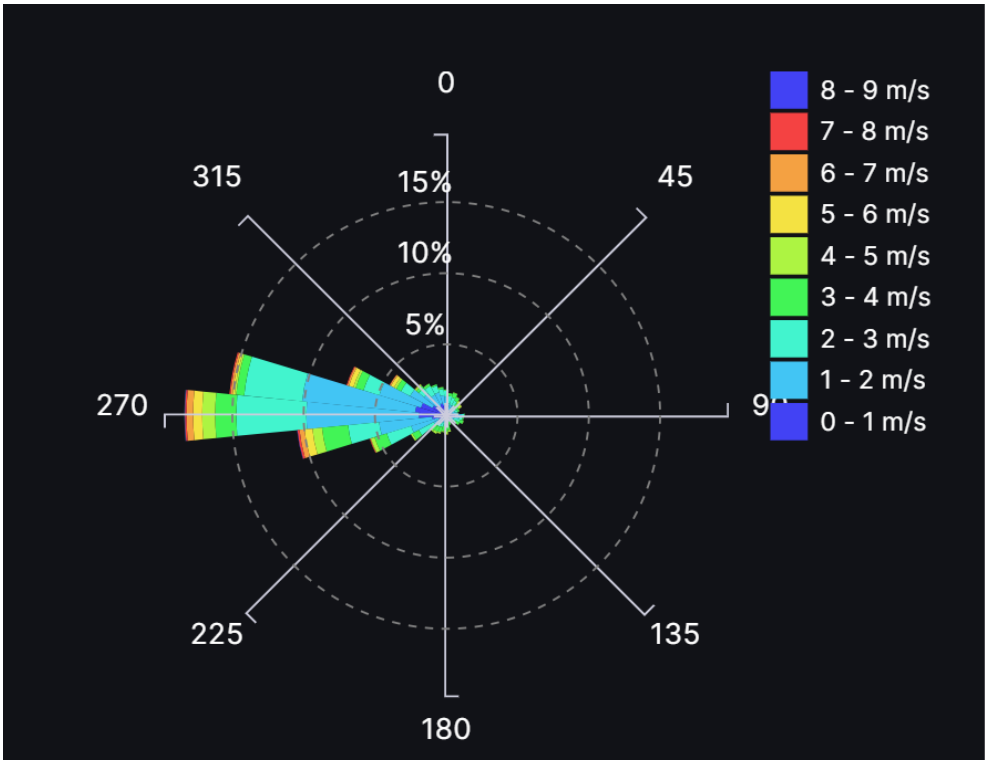


Figure 324 July 2023 Wind Rose

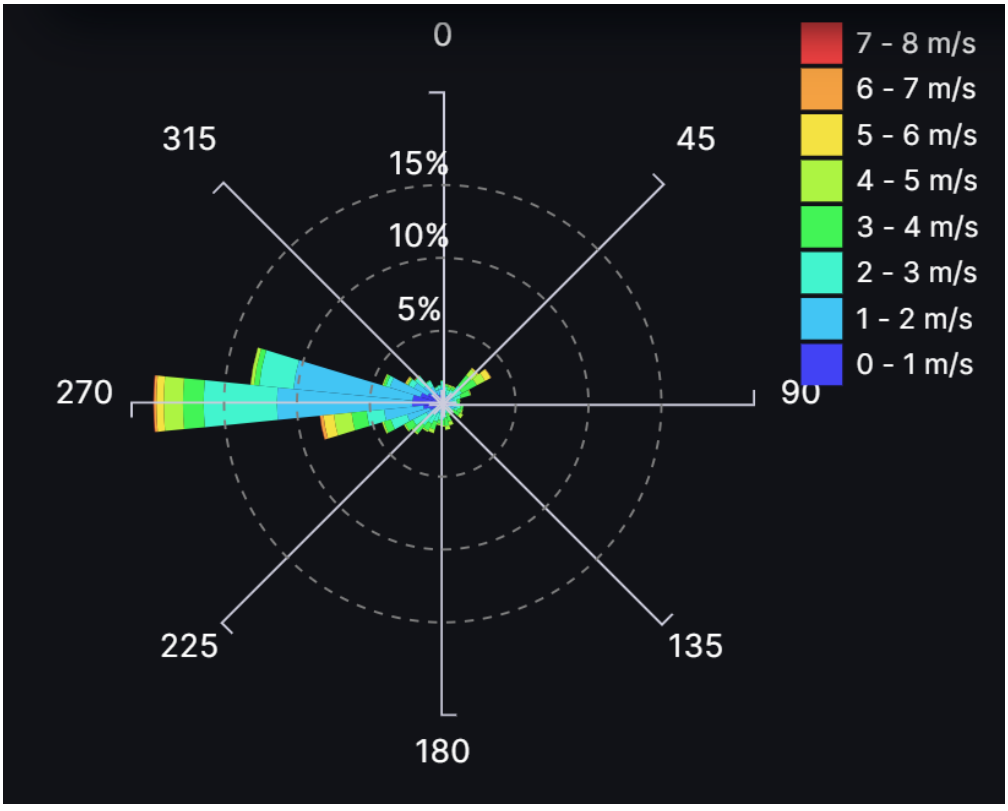


Figure 35 August 2023 Wind Rose

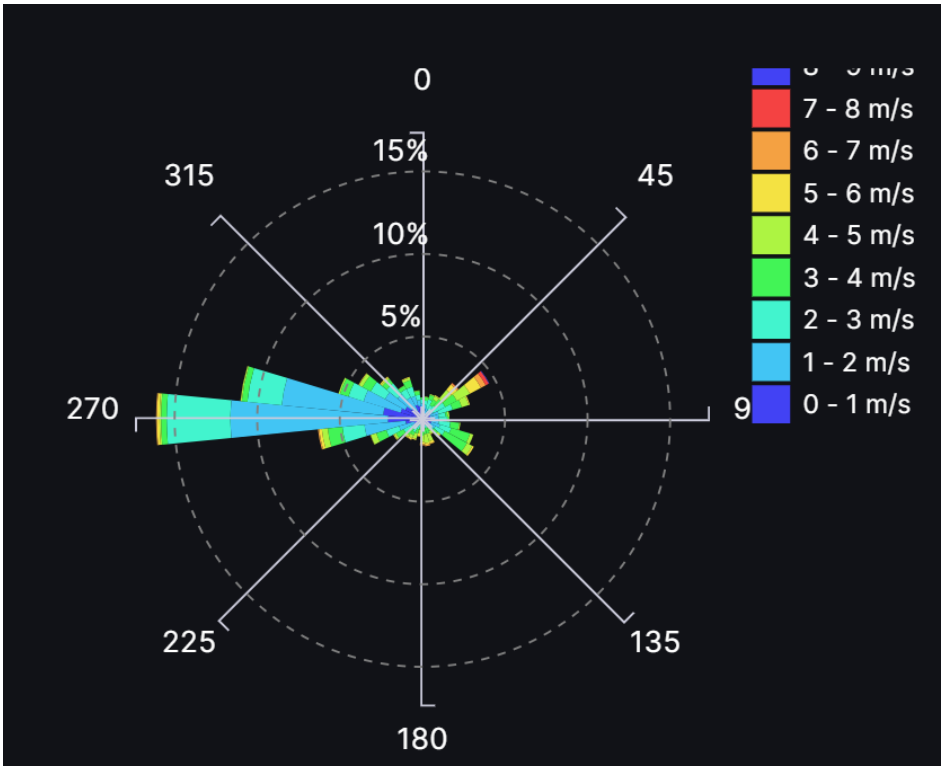


Figure 36 September 2023 Wind Rose

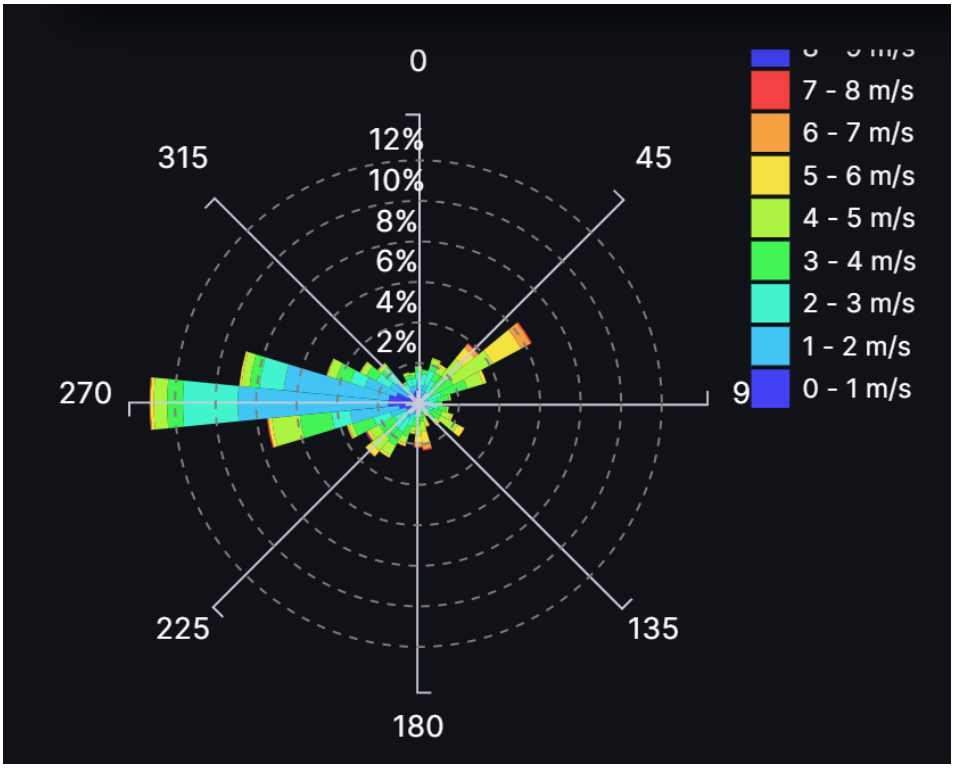


Figure 37 October 2023 Wind Rose

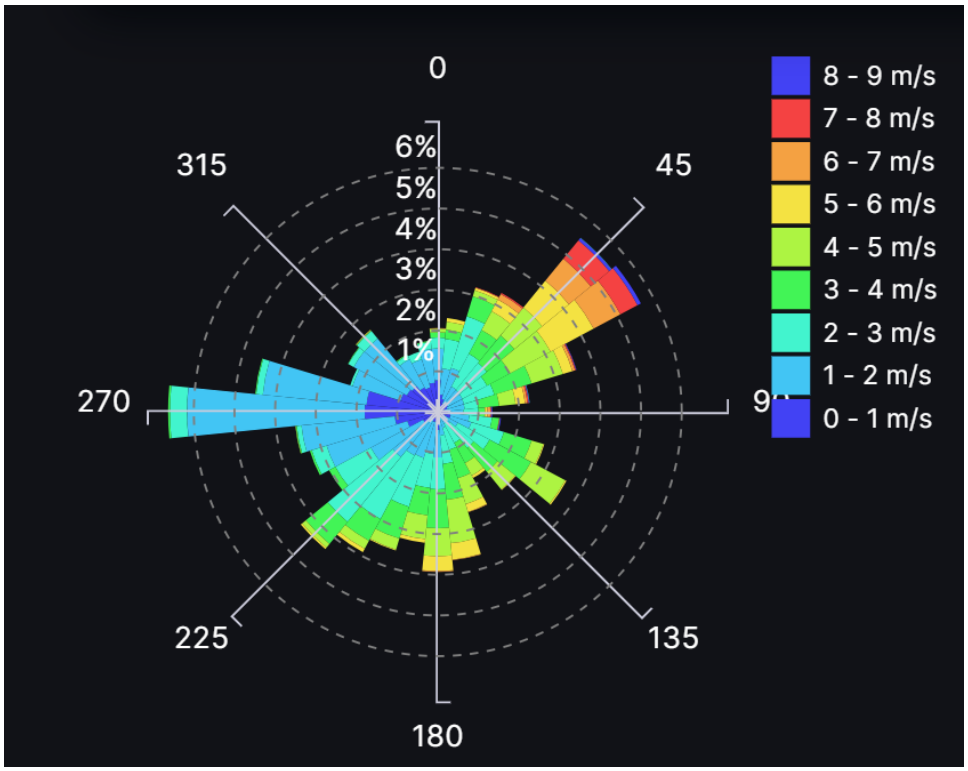


Figure 38 November 2023 Wind Rose

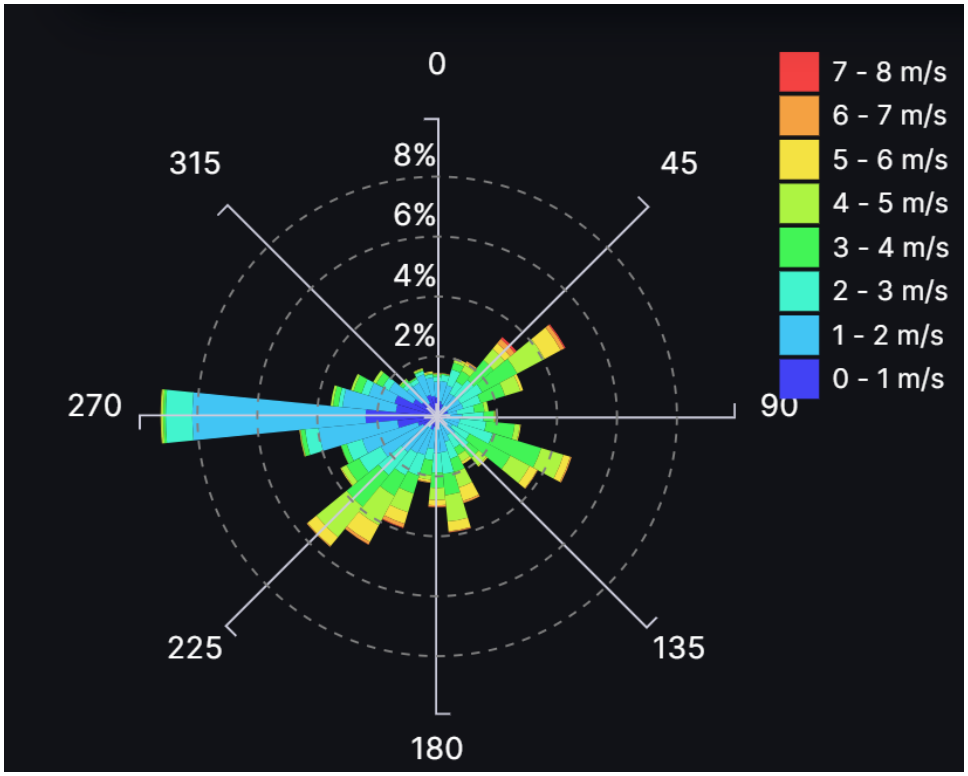


Figure 39 December 2023 Wind Rose

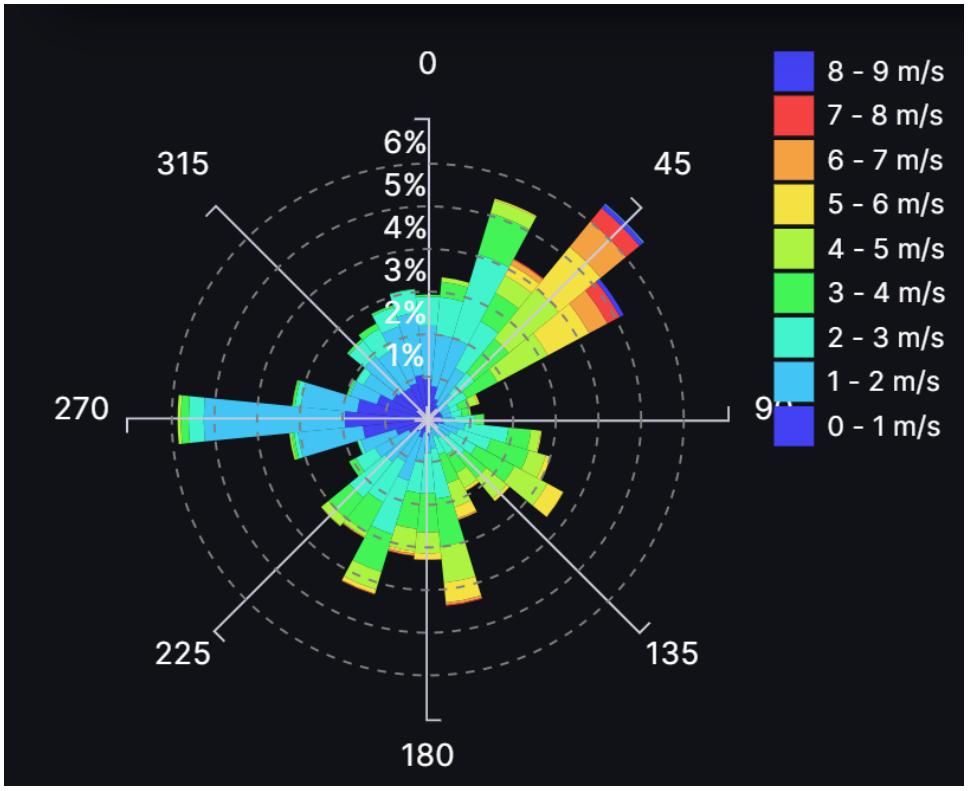


Figure 40 January 2024 Wind Rose

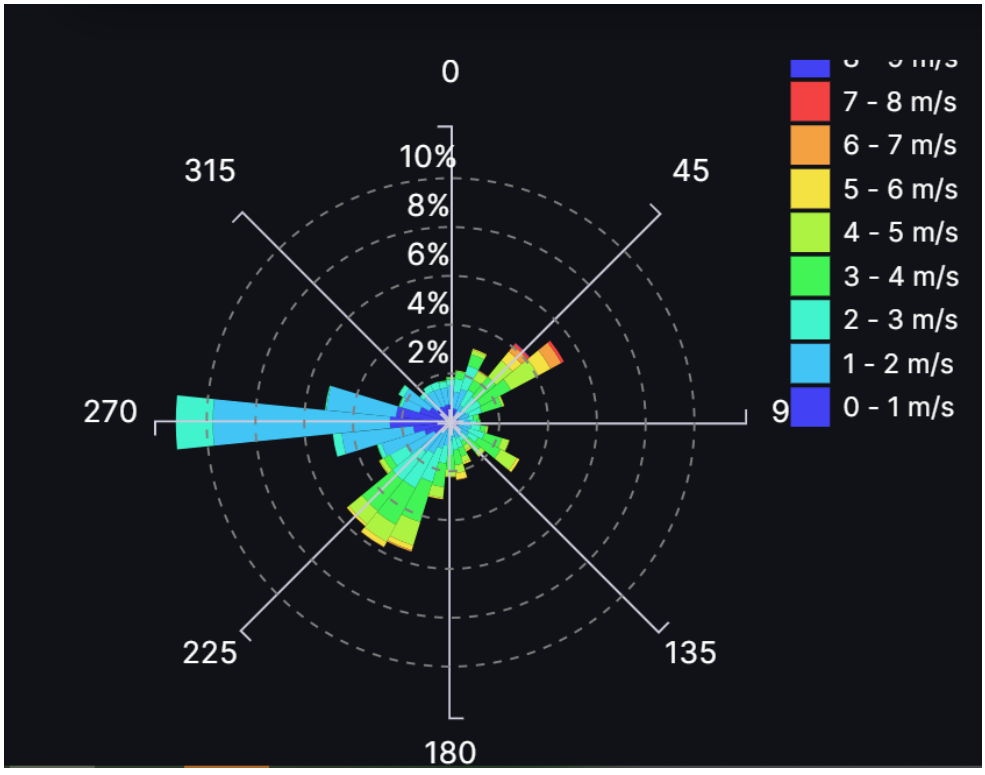


Figure 41 February 2024 Wind Rose

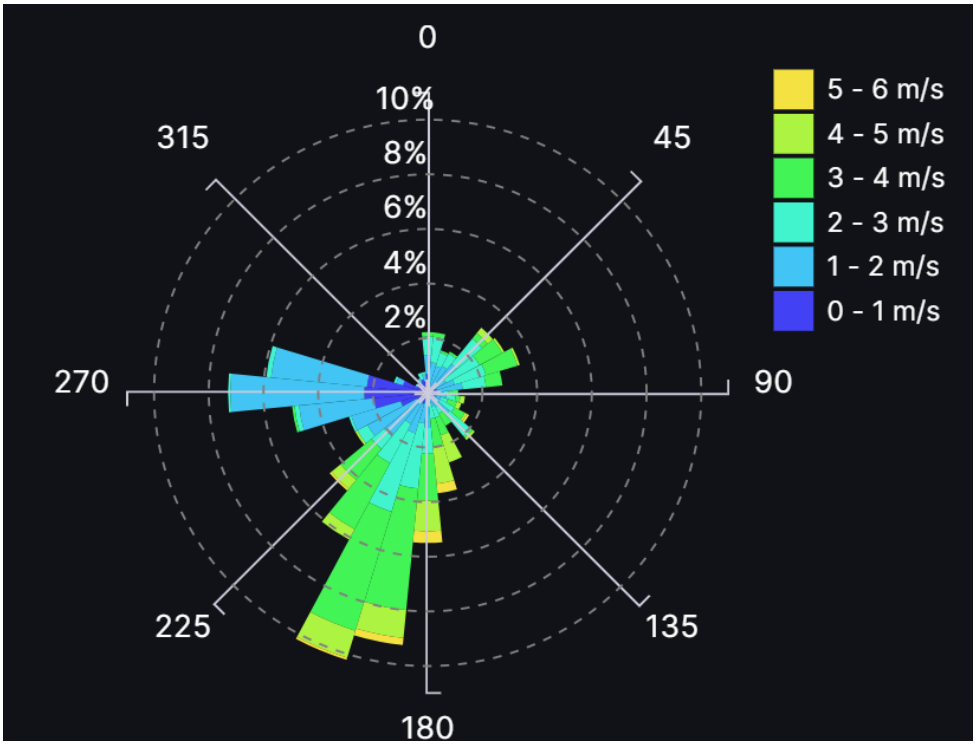


Figure 42 March 2024 Wind Rose

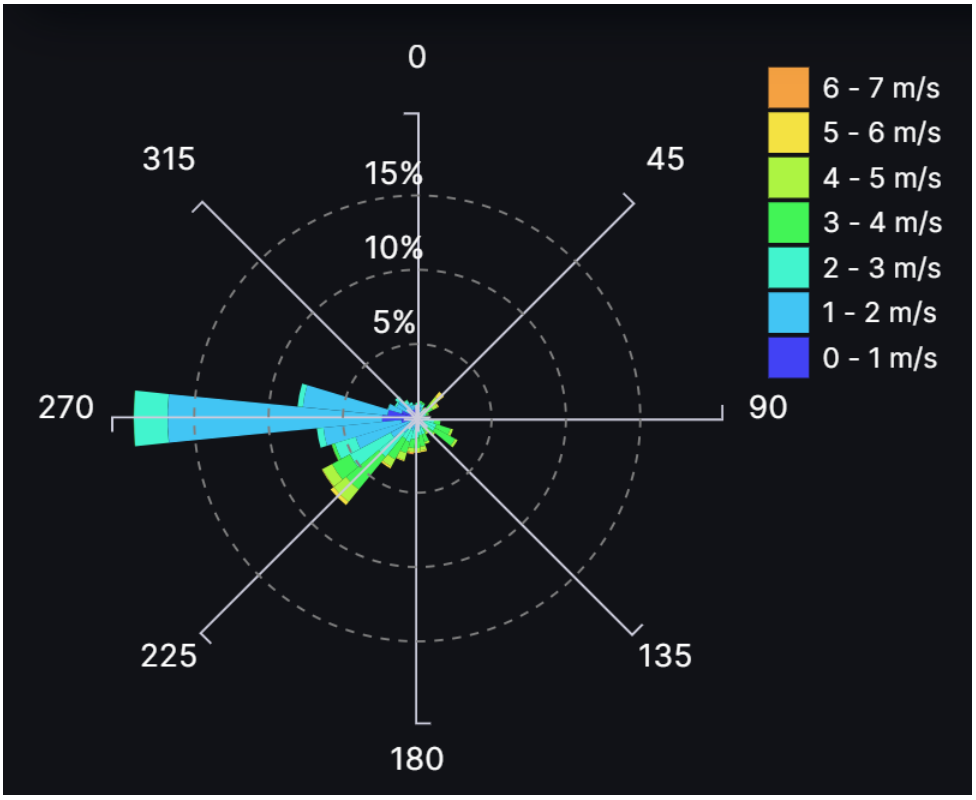


Figure 43 April 2024 Wind Rose

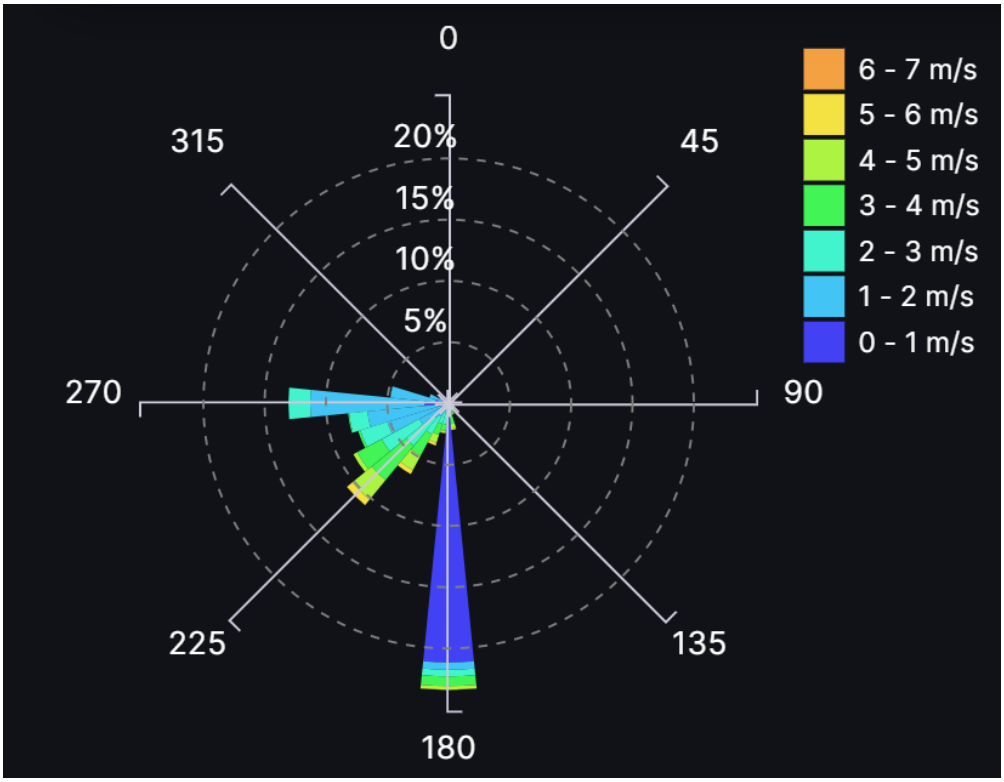


Figure 44 May 2024 Wind Rose

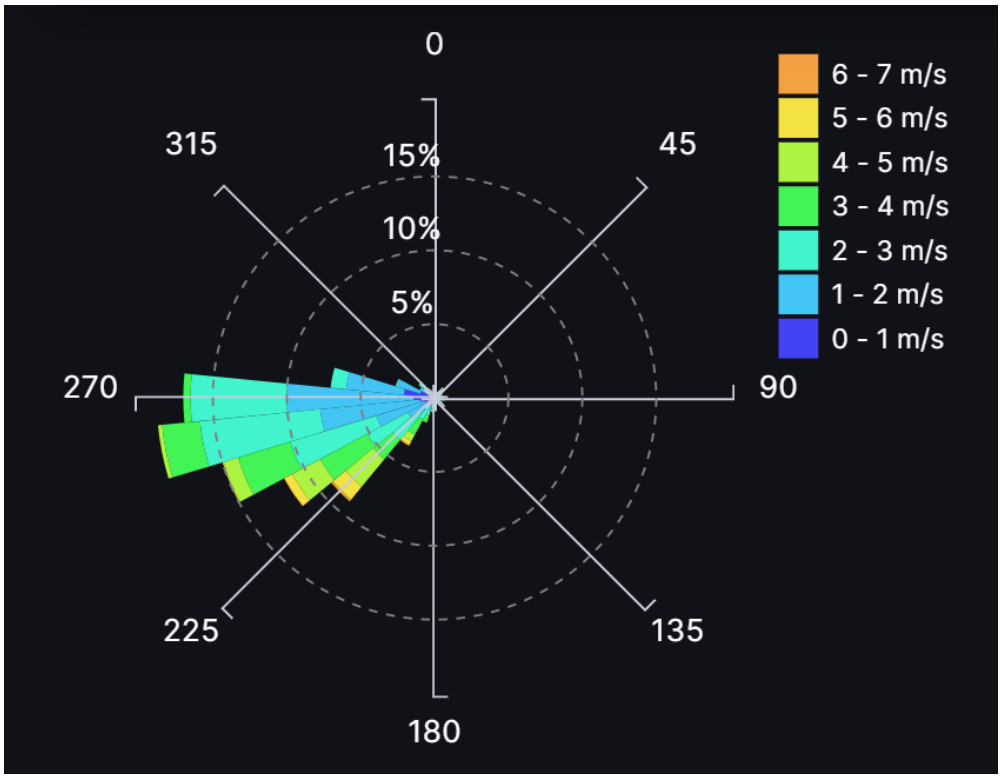


Figure 45 June 2024 Wind Rose

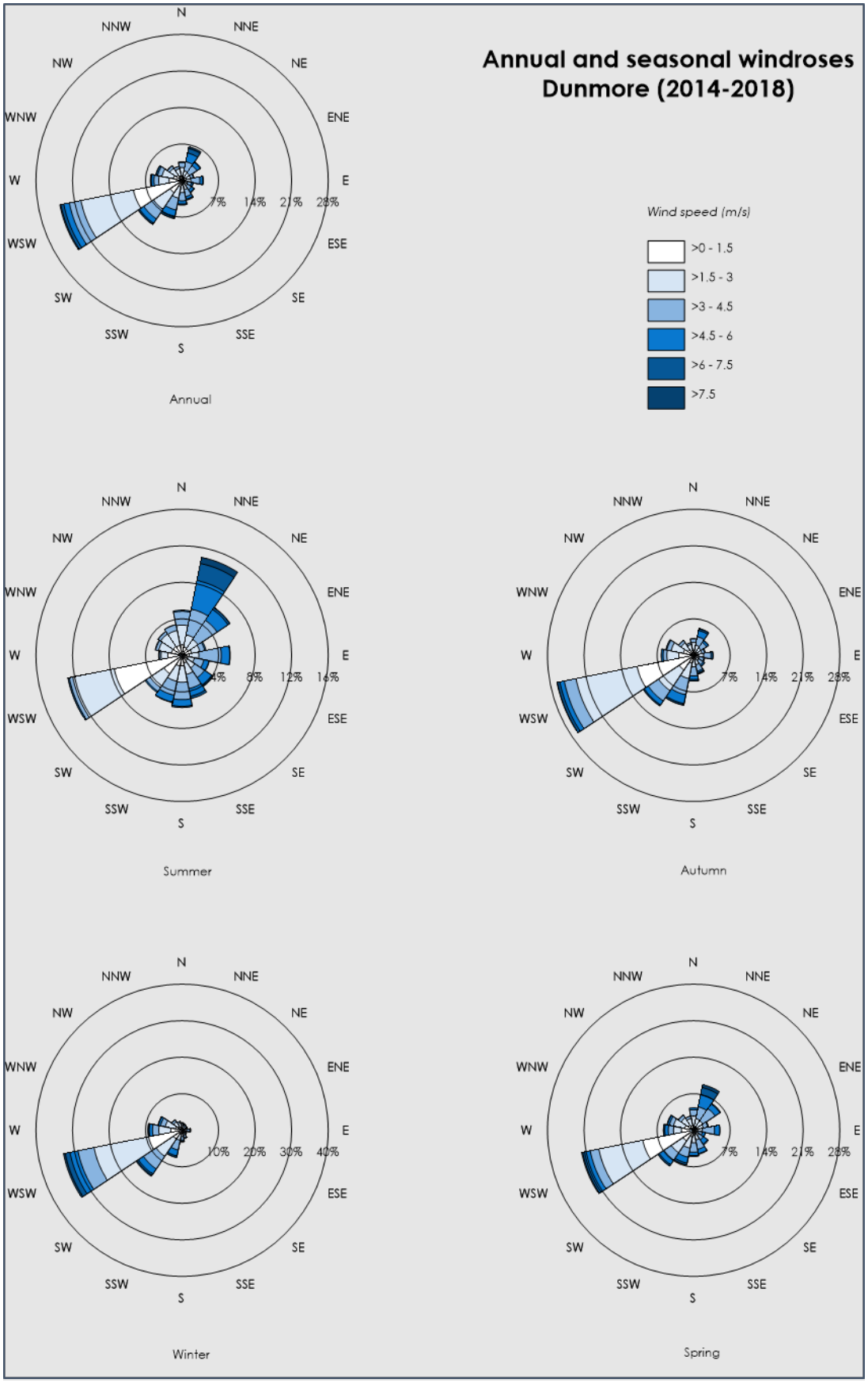


Figure 46 Dunmore Seasonal Wind Rose Data

10. Appendix B Air Quality Monitoring Additional Data and Graphs

Monthly breakdown of deposited dust monitoring is shown in Table 24. Dominant wind directions and production data are also shown within this table.

Table 24 Historical Deposited Dust Results

Month	DD2 grams/m²/month		DD5 grams/m²/month		DD6 grams/m²/month		DD7b/10 grams/m²/month		Deposited Dust Goal
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	
FY07 Average	3.68	1.9	3.3	2.1	5.75	3.36	3.9	1.92	4
FY08 Average	2.97	1.84	2.88	1.66	4.23	2.43	4.31	2.44	4
FY09 Average	3.07	1.98	3.79	1.94	3.83	2.87	5.55	3.17	4
FY10 Average	5.29	3.3	3.42	2.5	4.88	2.96	2.71	1.66	4
FY11 Average	6.16	3.68	3.42	1.99	3.92	2.47	3.15	2.33	4
FY12 Average	5.51	2.82	3.09	1.82	3.17	2.32	2.53	1.6	4
FY13 Average	4.19	2.19	3.26	1.84	3.7	2.48	2.75	1.81	4
FY14 Average	2.21	1.42	3.63	1.76	2.67	1.58	3.36	2.36	4
FY15 Average	3.57	1.77	2.55	1.46	3.94	2	3.2	2	4
FY16 Average	1.85	1.19	2.59	1.44	2.55	1.55	2.66	1.66	4
FY17 Average	2.28	1.56	2.67	1.77	3.31	1.68	2.01	1.30	4
FY18 Average	2.36	1.65	2.32	1.78	2.71	1.88	2.84	1.79	4
FY19 Average	3.66	1.87	3.1	1.9	3.03	1.94	2.81	1.59	4
FY20 Average	3.59	2.11	3.06	1.82	3.49	2.18	3.16	1.98	4
FY21 Average	1.94	1.12	2.44	1.34	2.00	1.08	1.85	1.11	4
FY22 Average	2.07	0.88	1.54	0.92	1.79	1.05	1.21	1.64	4
FY23 Average	2.39	1.39	1.86	1.19	1.69	1.12	1.32	0.90	4
FY24 Average	1.87	0.76	2.50	1.48	1.54	1.03	1.94	0.73	4
Jul-2023	0.92	0.53	1.16	0.23	1.14	0.6	0.62	0.47	4
Aug-2023	3.37	0.47	1.28	0.77	1.74	1.6	1.64	0.63	4
Sep-2023	2.47	1.84	2	1.48	1.61	1.23	2.42	1.07	4
Oct-2023	1.97	0.16	1.05	0.17	1.49	1.1	1.96	1.06	4
Nov-2023	1.78	0.96	3.02	0.47	0.75	0.4	0.81	0.33	4
Dec-2023	5.8	1.6	6.87	6.84	1.38	0.81	3.15	0.46	4
Jan-2024	1.12	1.05	4.62	4.57	3.49	2.18	1.38	1.17	4
Feb-2024	2.12	1.34	ND	ND	2.81	1.92	2.3	1.43	4
Mar-2024	0.88	0.61	2.06	1.26	0.72	0.62	2.88	1.25	4
Apr-2024	1.51	0.23	3.23	0.12	1.21	0.41	1.86	0.57	4
May-2024	0.20	0.09	1.52	0.27	1.86	1.17	3.59	0.02	4
Jun-2024	0.30	0.24	0.68	0.1	0.31	0.28	0.61	0.34	4
FY24 Average	1.87	0.76	2.50	1.48	1.54	1.03	1.94	0.73	4

A graph of the historical deposited dust values compared to production is shown in green for each deposited dust site in Figures 47 to 50.

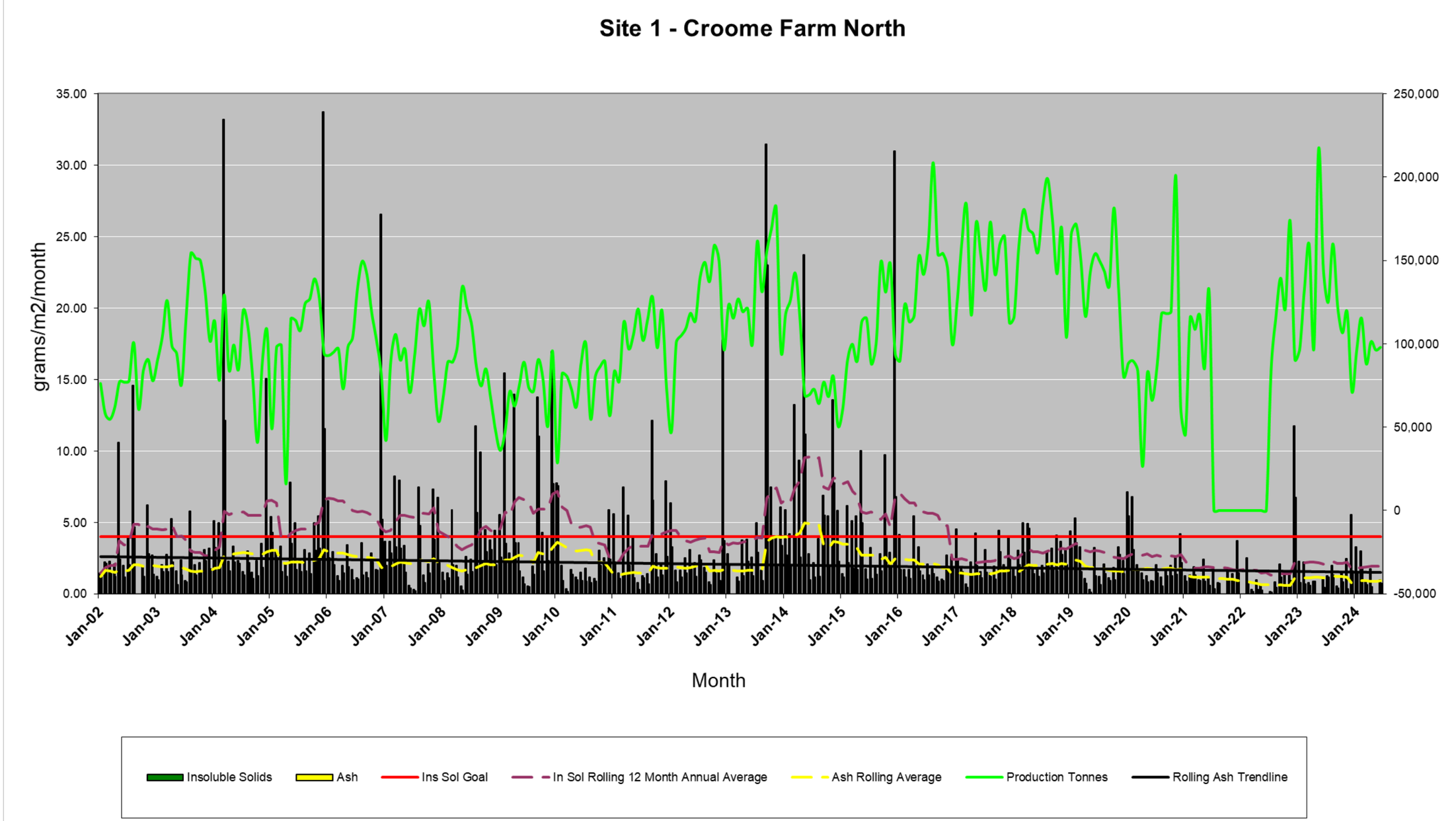


Figure 47 Historical Deposited Dust Values – DQ1

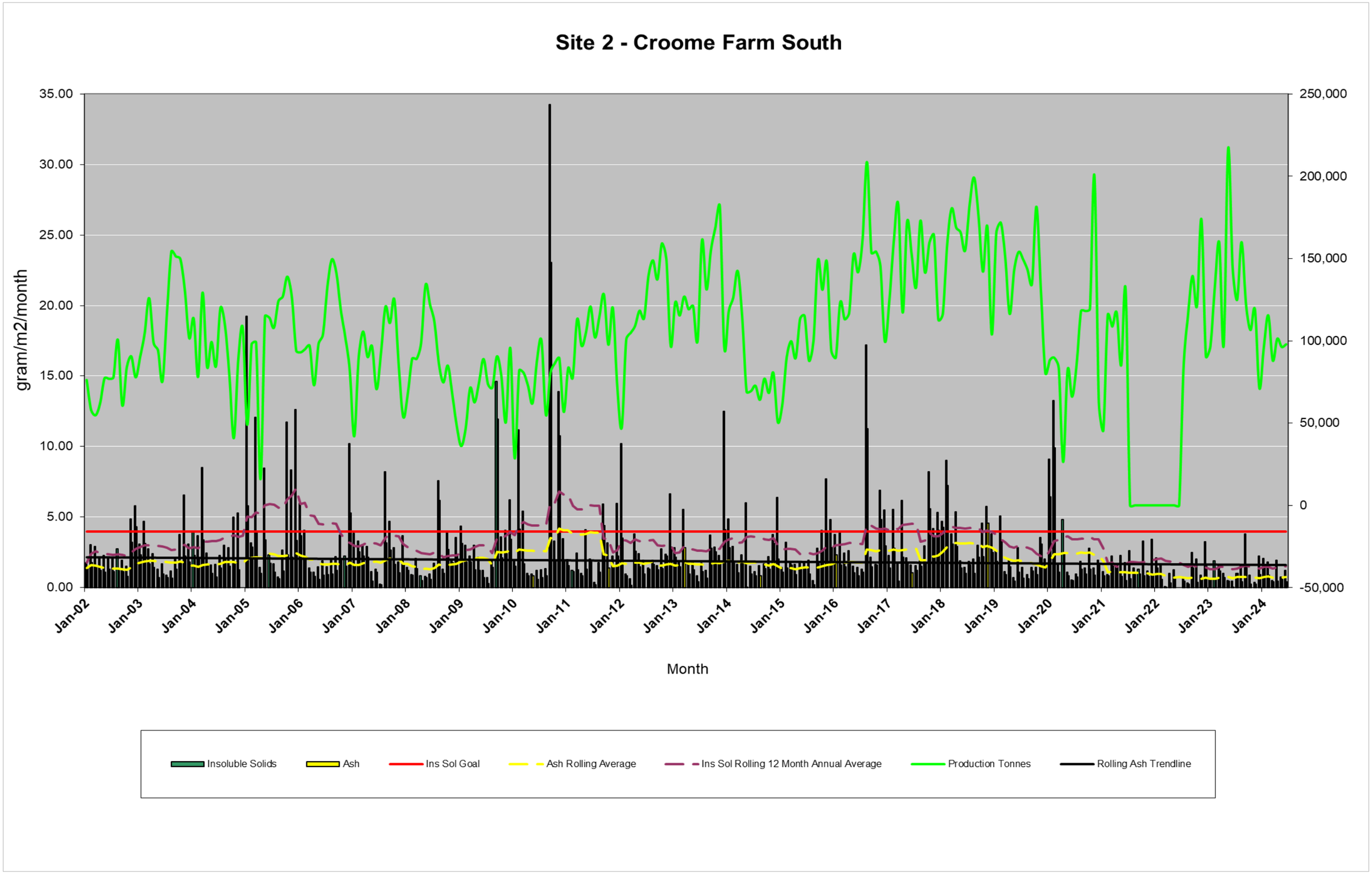


Figure 48 Historical Deposited Dust Values – DQ2

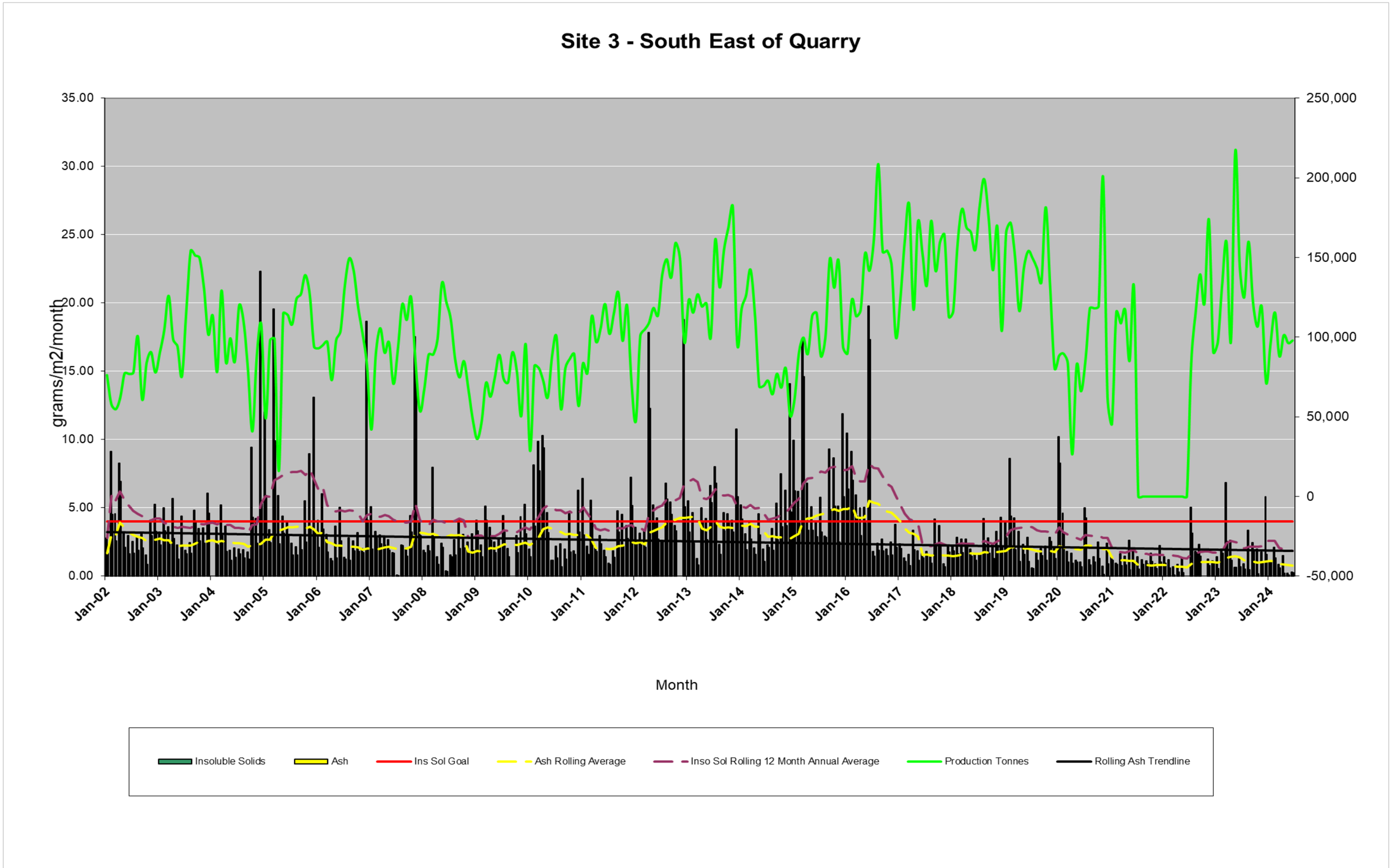


Figure 49 Historical Deposited Dust Values – DQ3

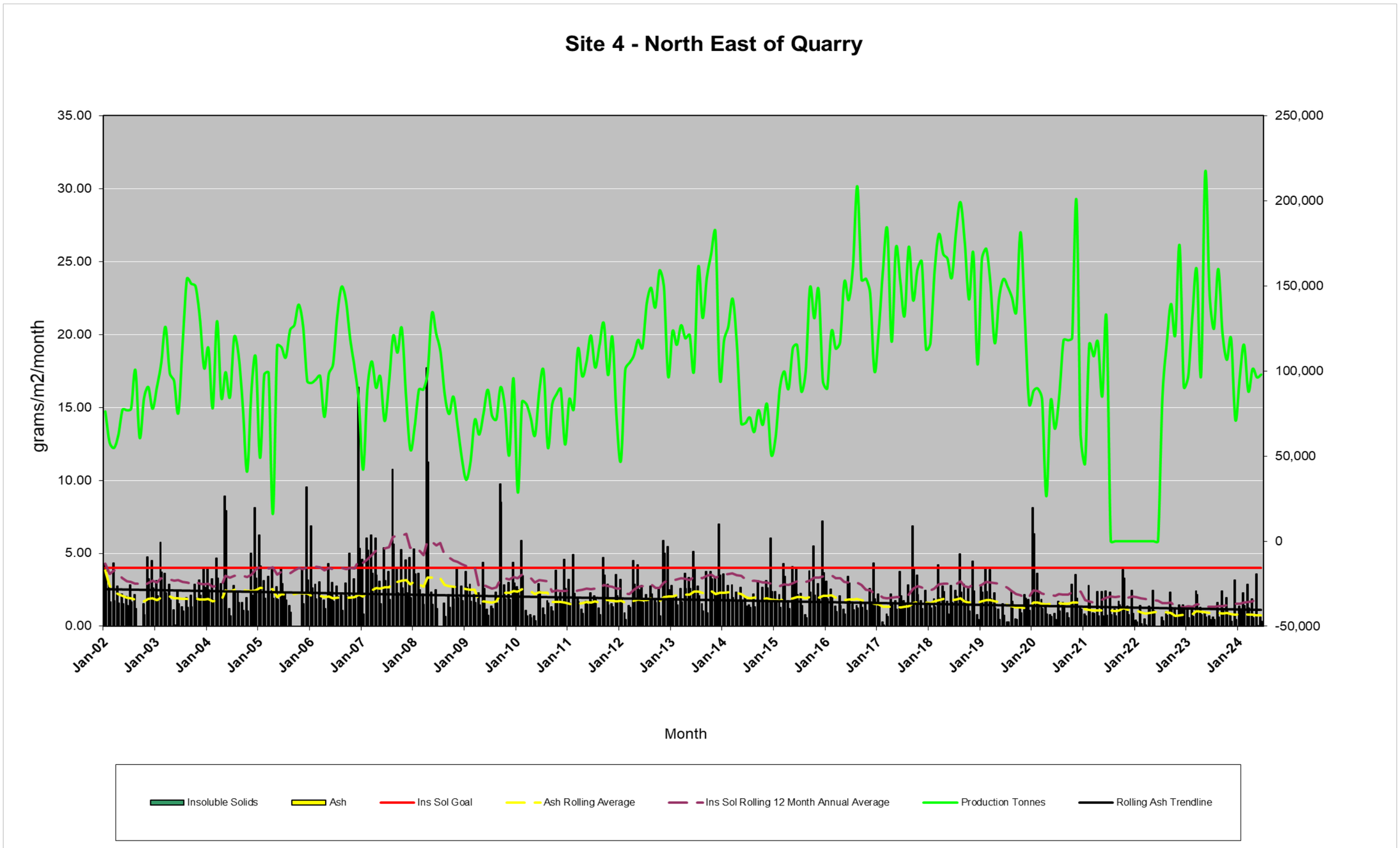


Figure 50 Historical Deposited Dust Values – DQ4

Table 25 Particulate Monitoring

Date	Sample Daily Average (µg/m$^{3)}$	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)
5/07/2023	0.76	50	30	7.19
11/07/2023	3.74	50	30	7.21
17/07/2023	7.66	50	30	7.34
23/07/2023	1.96	50	30	7.37
29/07/2023	3.62	50	30	7.30
4/08/2023	9.38	50	30	7.34
10/08/2023	4.87	50	30	7.42
16/08/2023	2.85	50	30	7.46
22/08/2023	6.24	50	30	7.56
28/08/2023	22.57	50	30	7.93
3/09/2023	1.43	50	30	7.82
9/09/2023	5.88	50	30	7.87
15/09/2023	26.31	50	30	8.15
21/09/2023	7.24	50	30	7.91
27/09/2023	17.02	50	30	8.11
3/10/2023	29.83	50	30	8.60
9/10/2023	15.86	50	30	8.85
15/10/2023	9.38	50	30	8.99
21/10/2023	11.52	50	30	9.62
27/10/2023	4.99	50	30	9.50
2/11/2023	10.69	50	30	9.42
8/11/2023	20.07	50	30	9.85
14/11/2023	22.86	50	30	10.12
20/11/2023	15.02	50	30	9.85
26/11/2023	4.58	50	30	9.92
2/12/2023	2.51	50	30	9.93
8/12/2023	32.42	50	30	9.71
14/12/2023	19.66	50	30	10.09
20/12/2023	2.02	50	30	9.87
26/12/2023	13.38	50	30	9.86
1/01/2024	6.79	50	30	9.89
7/01/2024	12.83	50	30	9.86
13/01/2024	13.45	50	30	9.77
19/01/2024	13.02	50	30	9.56
25/01/2024	7.53	50	30	9.50
31/01/2024	7.53	50	30	9.44
6/02/2024	6.1	50	30	9.12
12/02/2024	4.72	50	30	8.90
18/02/2024	5.57	50	30	8.88
24/02/2024	11.34	50	30	8.79
1/03/2024	8.67	50	30	8.85
7/03/2024	5.64	50	30	8.84
13/03/2024	13.95	50	30	8.95
19/03/2024	9.74	50	30	9.02
25/03/2024	2.71	50	30	8.91

Date	Sample Daily Average (µg/m$^{3)}$	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)
31/03/2024	2.23	50	30	8.85
6/04/2024	3.57	50	30	8.83
12/04/2024	1.38	50	30	8.78
18/04/2024	6.59	50	30	8.84
24/04/2024	4.96	50	30	8.89
30/04/2024	5.05	50	30	8.96
6/05/2024	5.45	50	30	8.92
12/05/2024	5.45	50	30	8.81
18/05/2024	3.21	50	30	8.79
24/05/2024	1.45	50	30	8.79
30/05/2024	1.95	50	30	8.78
5/06/2024	12.94	50	30	8.98
11/06/2024	3.17	50	30	9.02
17/06/2024	1.19	50	30	8.89
23/06/2024	4.99	50	30	8.82
29/06/2024	3.98	50	30	8.88

11. Appendix C MAC Noise Monitoring Annual Compliance Report

Annual Noise Monitoring Assessment 2023

Dunmore Quarry
Dunmore, NSW
July 2023

Prepared for: Boral Resources (NSW) Pty Ltd
July 2023
MAC180747-10RP1

Muller Acoustic Consulting

Document Information

Annual Noise Monitoring Assessment 2023

Dunmore Quarry

Dunmore, NSW

July 2023

Prepared for: Boral Resources (NSW) Pty Ltd

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MAC180747-10RP1	25 July 2023	Kristian Allen		Rod Linnett	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral Resources (NSW) Pty Ltd for Dunmore Quarry (the quarry), Tabbita Road, Dunmore, NSW.

The monitoring has been conducted in accordance with the Dunmore Quarry Noise Management Plan (NMP V4, December 2017) during July 2023 and forms the annual noise monitoring program to address conditions outlined in the Development Consent (Ref: 470-11-2003).

This report summarises the operator-attended noise monitoring results measured at five receivers in comparison to the relevant noise limits contained in the Development Consent and NMP.

The assessment has been conducted in general accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunmore Quarry Noise Management Plan V4 (NMP), 2017 (EMM Consulting);
- Discussion Paper - Validation of Inversion Strength Estimation Method (EPA) 2014;
- NSW Environment Protection Authority (EPA's), Approved Methods for the measurement and analysis of environmental noise in NSW, 2022; and
- Standards Australia AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

The Dunmore Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers surrounding the quarry and are presented in **Table 1**.

Table 1 Noise Limits

Description	Day (7am - 6pm)	Evening (6pm - 10pm)	Night (10pm - 7am)		Morning Shoulder (6am - 7am)	
	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{A1(1min)}$	dB $L_{Aeq(15min)}$	dB $L_{A1(1min)}$
Location K Stocker	49	44	38	48	47	55
Location O Dunmore Lakes	49	44	38	48	47	55
Location J Creagan	Negotiated Agreement in place					
Location AA	38	38	38	45	38	45
Location AB and T	36	36	36	45	36	45
Locations D, F, G and Z	40	40	40	45	40	45
Location S	37	37	37	45	37	45

Source: Table 2 of Dunmore Quarry NMP.

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3 Methodology

3.1 Locality

The quarry is located at Dunmore near Shellharbour, NSW. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Princes Highway situated to the east of the site. Highway traffic is a dominant noise source for those receivers east of the quarry along with rural noise. The representative noise monitoring locations identified in Table 4.1 of the NMP with respect to the quarry are presented in the locality plan in **Figure 1.** **Table 2** presents the noise limits for each receiver as per the EPL.

Table 2 Attended Monitoring Locations and EPL Noise Limits

ID	Description	Day[1]	Evening[1]	Night[1]		Morning Shoulder[1]	
		dB, $L_{Aeq(15min)}$	dB, $L_{Aeq(15min)}$	dB, $L_{Aeq(15min)}$	dB, $L_{A1(1min)}$	dB, $L_{Aeq(15min)}$	dB, $L_{A1(1min)}$
NM1	Location K Stocker 40 Swamp Road Dunmore	49	44	38	48	47	55
NM2	Location S 86 Croome Vale Road Croom	37	37	37	45	37	45
NM3	Location T 1338 Jamberoo Road Croom	36	36	36	45	36	45
NM4	Location G[2] 318 Croome Road Croom	40	40	40	45	40	45
NM5	Location F[3] 316 Croome Road Croom	40	40	40	45	40	45

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods and the morning shoulder period is from 6am to 7am.

Note 2: Representative location for western residences G, D, Z.

Note 3: Representative location for northwestern residences F, AA, AB.

3.2 Assessment Methodology

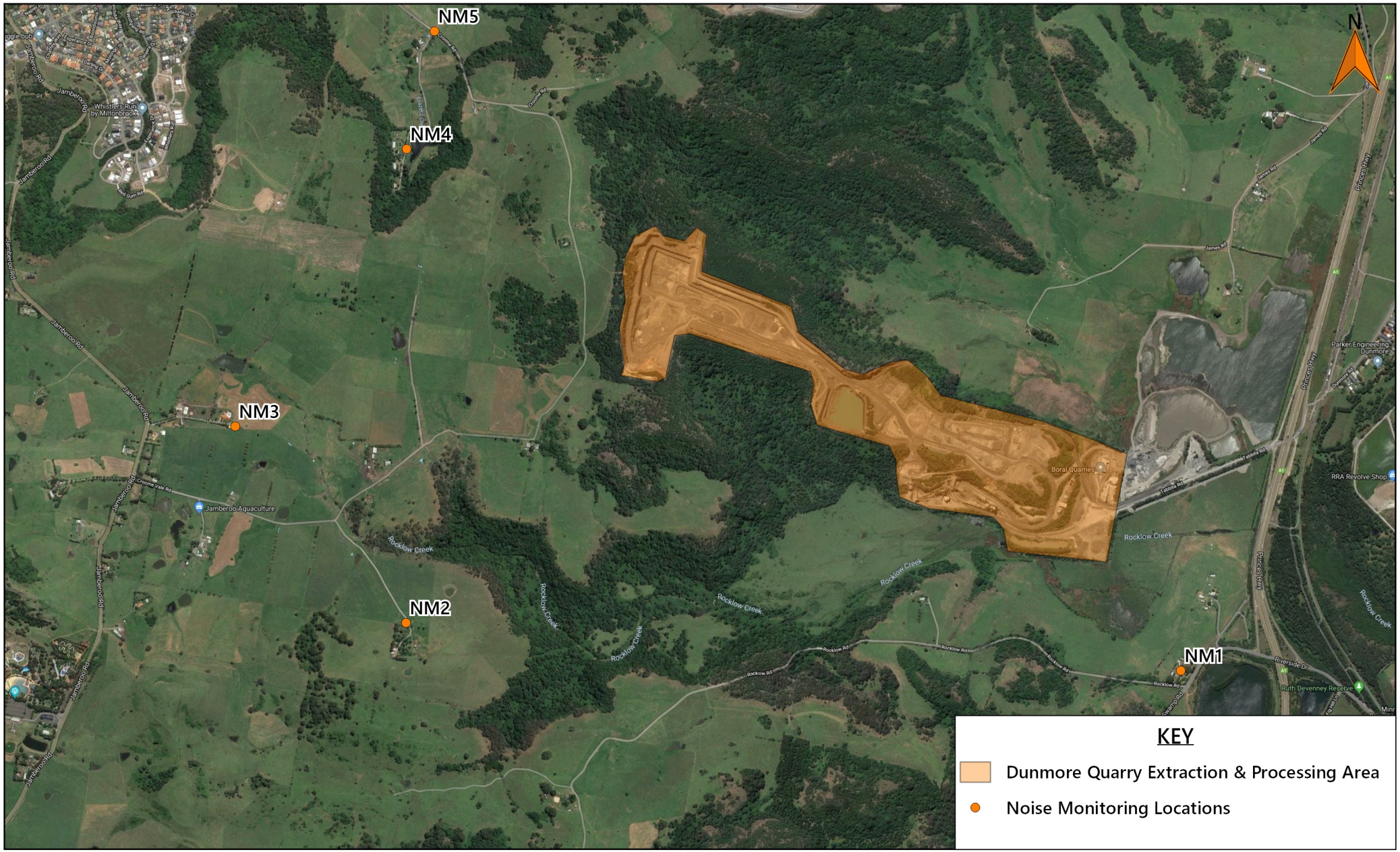
The attended noise measurements were conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Dunmore Quarry NMP. Noise measurements of 15-minutes in duration were conducted at five locations (NM1-NM5) using a Svantek Type 1, 971 noise analyser between Tuesday 11 July 2023 and Friday 14 July 2023 to satisfy the requirements of the NMP. All acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

To understand meteorological conditions during the evening period, direct measurement of temperature profile was undertaken at Trevethan Reserve, Minnamurra on Tuesday 11 July 2023 and Wednesday 12 July 2023 and at Croom Road, Croom (near NM4) on Friday 14 July 2023, at 2m above ground level and at 50m above ground level using a weather balloon.

The results of the temperature measurements were used to determine the temperature lapse rate in general accordance with the Validation of Inversion Strength Estimation Method (2014). These measurements, in combination with the onsite weather station provide a reference to validate the relevant meteorological conditions under which compliance is assessed.

Extraneous noise sources were excluded from the analysis to determine the dB $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet A4 of the NPI to determine the stability category present at the time of each attended measurement.

Where the quarry is inaudible, the contribution is estimated to be at least 10dBA below the ambient noise level.



MAC
Muller Acoustic Consulting

FIGURE 1

PROJECT LAYOUT

REF: MAC180747

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4 Results

A summary of the operator attended measurements at location NM1 to NM5 are presented **Table 3** to **Table 7** and provide the following information;

- Monitoring location.
- Date, time and assessment period.
- Observed Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 1.5m above the ground measured at the monitoring location.
- Measured Temperature (Temp) in °C at 2m and 50m above ground level at a representative location.
- Average Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 10m above ground level at the on-site weather station.
- Atmospheric stability class derived from the on-site weather station.
- Calculated temperature inversion strength.
- Ambient measured noise levels $LA_{eq(15min)}$ and $LA_{90(15min)}$ in dB re 20µPa.
- Quarry $LA_{eq(15min)}$ and $LA_{1(1min)}$ noise level contribution.
- Noise Limit $LA_{eq(15min)}$ and $LA_{1(1min)}$.

Results of the attended noise survey identified that the quarry was generally inaudible during the measurement periods, however extraneous sources such as traffic, insects, aircraft, birds, livestock, dogs barking, and local residential noise were audible during the survey period and dominated the results. Temperature data, from on-site measurements, indicated that inversion strengths during the morning shoulder and evening periods between Tuesday 11 July 2023 to Friday 14 July 2023 were generally outside the development consent conditions (ie higher than 6°C/100m).

Table 3 NM1 - Attended Noise Monitoring Summary													
Date & Period	Time (hrs)	1.5m WS WD Temp[3]	Descriptor		EPL Limits	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq\ (15min)}$/ $L_{A1\ (1min)}$	WS (m/s)[1]	WD[1]	2m Temp˚C	50m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
13/07/2023 (Morning Shoulder)	06:30	0.1m/s N 11˚	62	56	47/55	1.7	W	3˚	12˚	9˚	21˚	G	Traffic 54-79 Birds <50-69 Industrial Noise (DLSP) <50 Quarry Inaudible
Quarry Contribution													<45dB $L_{Aeq(15min)}$ <55dB $L_{A1(1min)}$
11/07/2023 (Day)	16:35	0.2m/s N 18˚	65	52	49	0.7	NNW	n/a	n/a	n/a	n/a	n/a	Traffic 49-82 Birds 49-56 Quarry Inaudible
Quarry Contribution													<45dB $L_{Aeq(15min)}$
11/07/2023 (Evening)	20:56	0.1m/s N 12˚	60	50	44	1.5	W	8˚	13˚	5˚	12˚	G	Traffic 47-85 Quarry Inaudible
Quarry Contribution													<40dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 50m temperature.

Note 3: At operator position as per AS1055.

Table 4 NM2 - Attended Noise Monitoring Summary													
Date & Period	Time (hrs)	1.5m WS WD Temp[3]	Descriptor		EPL Limits	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq\ (15min)}$/ $L_{A1\ (1min)}$	WS (m/s)[1]	WD[1]	2m Temp˚C	50m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
14/07/2023 (Morning Shoulder)	06:30	<0.5m/s NW 11˚	37	33	37/45	1.6	WNW	12˚	15˚	3˚	6˚	G	Insects 30-38 Agricultural Noise 31-45 Birds 30-54 Traffic 28-43 Livestock 30-43 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$ <45dB $L_{A1(1min)}$
11/07/2023 (Day)	17:38	0.1m/s W 18˚	42	38	37	2.2	W	n/a	n/a	n/a	n/a	n/a	Insects 36-41 Traffic 33-38 Dogs Barking 35-46 Aircraft 35-56 Quarry Inaudible
Quarry Contribution													<35dB $L_{Aeq(15min)}$
11/07/2023 (Evening)	20:37	<0.5m/s NW 10˚	38	34	37	1.5	W	8˚	13˚	5˚	11˚	G	Insects 31-42 Traffic 30-35 Dogs Barking 35-48 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 50m temperature.

Note 3: At operator position as per AS1055.

Table 5 NM3 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp[3]	Descriptor		EPL Limits	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq\ (15min)}$/ $L_{A1\ (1min)}$	WS (m/s)[1]	WD[1]	2m Temp˚C	50m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
14/07/2023 (Morning Shoulder)	06:05	0.1m/s NW 13˚	57	28	36/45	1.7	WNW	12˚	15˚	3˚	7˚	G	Traffic 25-75 Livestock 30-38 Insects <25-28 Birds 25-32 Quarry Inaudible
Quarry Contribution													<30dB LAeq(15min) <45dB LA1(1min)
12/07/2023 (Day)	07:30	0.1m/s NW 13˚	62	39	36	0.9	W	n/a	n/a	n/a	n/a	n/a	Birds 30-58 Traffic 29-82 Livestock 30-41 Quarry – Impacts <30 (<1min total duration)
Quarry Contribution													<35dB LAeq(15min)
11/07/2023 (Evening)	20:17	0.1m/s W 12˚	55	27	36	1.5	W	8˚	13˚	5˚	10˚	G	Insects 23-32 Traffic 25-755 Aircraft 30-41 Livestock 25-48 Quarry Inaudible
Quarry Contribution													<30dB LAeq(15min)

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 50m temperature.

Note 3: At operator position as per AS1055.

Table 6 NM4 - Attended Noise Monitoring Summary													
Date & Period	Time (hrs)	1.5m WS WD Temp[3]	Descriptor		EPL Limits	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq\ (15min)}$/ $L_{A1\ (1min)}$	WS (m/s)[1]	WD[1]	2m Temp˚C	50m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
14/07/2023 (Morning Shoulder)	06:04	0.1m/s N 8˚	54	36	40/45	1.7	WNW	12˚	15˚	3˚	7˚	G	Dogs Barking 34-61 Insects 32-34 Traffic 34-77 Birds 35-53 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$ <45dB $L_{A1(1min)}$
11/07/2023 (Day)	16:47	0.1m/s W 18˚	52	40	40	0.7	NW	n/a	n/a	n/a	n/a	n/a	Dogs Barking 40-58 Birds 30-64 Aircraft 40-48 Residential Noise 30-69 Quarry Inaudible
Quarry Contribution													<35dB $L_{Aeq(15min)}$
11/07/2023 (Evening)	19:26	0.1m/s W 13˚	52	35	40	0.5	N	8˚	13˚	5˚	10˚	G	Insects 30-35 Aircraft 35-53 Residential Noise 35-70 Dogs Barking 45-70 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 50m temperature.

Note 3: At operator position as per AS1055.

Table 7 NM5 - Attended Noise Monitoring Summary													
Date & Period	Time (hrs)	1.5m WS WD Temp[3]	Descriptor		EPL Limits	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq\ (15min)}$/ $L_{A1\ (1min)}$	WS (m/s)[1]	WD[1]	2m Temp˚C	50m Temp˚C	Delta Temp˚C	Lapse Rate ˚C/100m[2]	Stability Class[1]	
14/07/2022 (Morning Shoulder)	06:23	1.5m/s W 8˚	50	38	40/45	1.4	W	12˚	15˚	3˚	6˚	G	Birds 37-44 Traffic 36-77 Wind Gusts 34-42 Quarry Inaudible
Quarry Contribution													<35dB $L_{Aeq(15min)}$ <45dB $L_{A1(1min)}$
11/07/2023 (Day)	17:06	0.1m/s W 19˚	50	34	40	1.9	W	n/a	n/a	n/a	n/a	n/a	Traffic 31-38 Birds 30-48 Residential Noise 30-72 Dogs Barking 35-41 Aircraft 35-51 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$
11/07/2023 (Evening)	19:47	0.1m/s W 12˚	38	33	40	1.4	W	8˚	13˚	5˚	10˚	G	Traffic 30-43 Aircraft 35-48 Insects 25-33 Wildlife 40-48 Quarry Inaudible
Quarry Contribution													<30dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 50m temperature.

Note 3: At operator position as per AS1055.

5 Discussion and Compliance Assessment

The compliance assessment summary for each monitoring location is presented in **Table 8** for all assessment periods.

5.1 Discussion of Results - Location NM1

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the east. During the survey, quarry emissions were inaudible during all monitoring periods and quarry noise contributions were calculated (during short breaks in traffic) to be at or below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds, aircraft, and other industrial noise.

5.2 Discussion of Results - Location NM2

The noise monitoring survey identified that the acoustic environment at this location is dominated by natural sounds such as insects and bird noise, and agricultural noise such as livestock. Occasional local traffic on Jamberoo Road, approximately 350m to the west was audible for short periods. During the survey, quarry noise emissions were inaudible and quarry contributions were calculated to be below the relevant noise criteria for all periods.

5.3 Discussion of Results - Location NM3

Due to access restrictions at the NM3 location, measurements were conducted at the front fence line of the location approximately 300m to the west of the receiver. The noise monitoring survey identified that the acoustic environment at this location is dominated by natural sounds such as insects, and bird noise, and agricultural noise such as livestock. Traffic on Jamberoo Road, to the west was audible for short periods. During the survey, quarry noise emissions were barely audible for very short periods during daytime measurement period and inaudible during morning shoulder and evening measurement periods. Quarry contributions were calculated to be below the relevant noise criteria for all periods.

5.4 Discussion of Results - Location NM4

The noise monitoring survey identified that the acoustic environment at these locations is dominated by natural sounds such as insects, and bird noise and agricultural noise such as livestock. Occasional distant traffic on the East-West Link Road, approximately 2km to the north was audible for short periods. During the survey, quarry noise emissions were inaudible and quarry contributions were calculated to be below the relevant noise criteria for all periods.

5.5 Discussion of Results - Location NM5

The noise monitoring survey identified that the acoustic environment at these locations is dominated by natural sounds such as insects and bird noise and agricultural noise such as livestock. Occasional distant traffic on the East-West Link Road, approximately 2km to the north was audible for short periods. During the survey, quarry noise emissions were inaudible and quarry contributions were calculated to be below the relevant noise criteria for all periods.

Table 8 Noise Compliance Assessment Summary

Location	Estimated Quarry Noise Contribution[1]				Noise Limit[1]				Demonstrated Compliance			
	Day	Evening	Morning Shoulder		Day	Evening	Morning Shoulder		Day	Evening	Morning Shoulder	
			LAeq(15min)	LA1(1min)			LAeq(15min)	LA1(1min)			LAeq(15min)	LA1(1min)
NM1	<45	<40	<45	<55	49	44	47	55	Yes	Yes	Yes	Yes
NM2	<35	<30	<30	<45	37	37	37	45	Yes	Yes	Yes	Yes
NM3	<35	<30	<30	<45	36	36	36	45	Yes	Yes	Yes	Yes
NM4	<35	<30	<30	<45	40	40	40	45	Yes	Yes	Yes	Yes
NM5	<30	<30	<35	<45	40	40	40	45	Yes	Yes	Yes	Yes

Note 1: All levels are dBA.

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7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral Resources (NSW) Pty Ltd for Dunmore Quarry (the quarry), Tabbita Road, Dunmore, NSW.

Attended noise monitoring was undertaken between Tuesday 11 July 2023 and Friday 14 July 2023 at five representative monitoring locations. The assessment has identified that noise emissions generated by Dunmore Quarry were barely audible for very short periods on one occasion during the day period at NM3. The quarry was inaudible during the remaining periods. Quarry contributed noise emissions were below the relevant noise criteria at all locations during all measurement periods, thus satisfying the relevant noise limits.

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Appendix A - Glossary of Terms

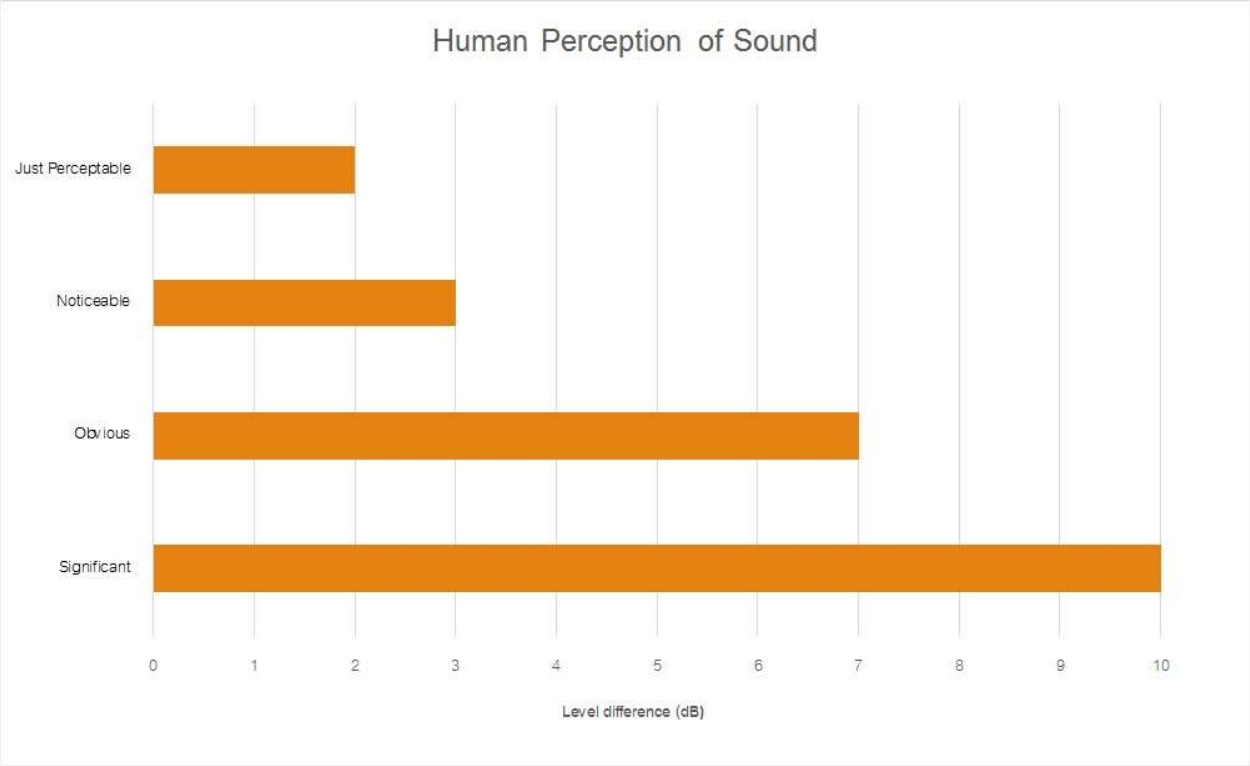
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
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 noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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12. Appendix D Blast Monitoring Tables

Table 26 Benny Residence FY23 Compliance Blast Monitoring Results

Date	Time	Airblast Overpressure *dB(Lin Peak)*	100% Airblast Limit *dB(Lin Peak)*	95% Annual Airblast Limit *dB(Lin Peak)*	Ground Vibration *(mm/s)*	95% Annual Vibration Limit *(mm/s)*
10/07/2023	3:02:00 PM	98	120	115	0.05	5
14/07/2023	12:39:00 PM	95	120	115	0.05	5
21/07/2023	2:00:00 PM	104.2	120	115	0.05	5
28/07/2023	12:23:00 PM	99.7	120	115	0.55	5
11/08/2023	9:57:00 AM	102.9	120	115	0.18	5
18/08/2023	2:32:00 PM	107	120	115	0.83	5
25/08/2023	12:28:00 PM	100.1	120	115	0.7	5
1/09/2023	1:16:00 PM	110.3	120	115	0.13	5
1/09/2023	1:34:00 PM	105.4	120	115	0.17	5
15/09/2023	1:40:00 PM	93.3	120	115	0.17	5
22/09/2023	1:34:00 PM	99.7	120	115	0.45	5
29/09/2023	3:52:00 PM	93.3	120	115	0.32	5
20/10/2023	1:47:00 PM	108.9	120	115	0.68	5
3/11/2023	1:46:00 PM	97.1	120	115	0.17	5
17/11/2023	1:15:00 PM	No Trigger	120	115	No Trigger	5
8/12/2023	1:04:00 PM	No Trigger	120	115	No Trigger	5
12/01/2024	3:38:00 PM	105	120	115	0.35	5
25/01/2024	12:04:00 PM	97.6	120	115	0.3	5
8/02/2024	3:59:00 PM	105.2	120	115	0.31	5
22/02/2024	12:27:00 PM	99.8	120	115	0.25	5
20/03/2024	12:58:00 PM	103.1	120	115	0.3	5
15/04/2024	1:49:00 PM	88.1	120	115	0.05	5
9/05/2024	3:09:00 PM	102.4	120	115	0.47	5
30/05/2024	1:56:00 PM	97.3	120	115	0.23	5
13/06/2024	1:56:00 PM	87.6	120	115	0.26	5

13. Appendix E EMM Ground Water Monitoring

2023-2024 Annual Groundwater Monitoring Report

Dunmore Quarry

Prepared for Boral Resources (NSW) Pty Ltd

August 2024

2023-2024 Annual Groundwater Monitoring Report

Dunmore Quarry

Boral Resources (NSW) Pty Ltd

J17314 RP7

August 2024

Version	Date	Prepared by	Reviewed by	Comments
1	30 August 2024	Q Bui	J Tait	Final

Approved by

Jonathon Tait
Associate Hydrogeologist
30 August 2024

Ground floor 20 Chandos Street
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Appendices

Tables

Figures

1 Introduction

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Dunmore Hard Rock Quarry (the quarry) at the end of Tabbita Road, in the Shellharbour local government area. The quarry is approximately 8 kilometres (km) north-west of Kiama (Figure 1.1). The quarry supplies construction hard rock materials to markets in the Illawarra, Southern Highlands and Sydney regions. Quarry operations, comprising hard rock extraction from the Bumbo Latite commenced in the early 20th century.

EMM Consulting Pty Limited (EMM) and International Environmental Consultants (IEC) were engaged by Boral to complete groundwater monitoring for the quarry. Routine groundwater monitoring is completed to detect any potential impacts to groundwater resources from quarry operations.

This annual groundwater monitoring report has been prepared as per the *Groundwater Monitoring Program for Dunmore Hard Rock Quarry* (GMP) (EMM 2016) in compliance with condition 44 (c) of the quarry's approved Development Consent (DA 470-11-2003). The GMP is required to investigate and report on baseline local and regional groundwater levels and quality, groundwater impact assessment criteria, and groundwater inflows for the monitoring period (July 2023 to June 2024).

1.1 Site operations

The quarry comprises one elongated open cut pit with an approved disturbance area of approximately 100 hectares (ha) (Figure 1.1). The extraction area contains four pits; the Original Dunmore Quarry, Rail Infrastructure Corporation (RIC) Pit, Croome Farm Pit and Croome West Pit. Site infrastructure includes a crushing and screening plant, product stockpiles, workshop and site offices located to the east of the pit. East of the pit is the Processing plant, the Dunmore Concrete Batching Plant (CBP), and the Dunmore Sand and Soil Quarry (DSS quarry). The Blending plant is located between the Processing plant and CBP.

Water management at the quarry comprises of a series of dams to control surface water runoff. Captured runoff is directed into dedicated water management dams for storage and subsequent treatment. Stored water is utilised for site operations such as dust suppression. Excess water within the excavated quarry pits is pumped to the Middle Dam, which has a holding capacity of 120 to 150 megalitres (ML) (EMM 2020).

1.2 Approvals history

The quarry is currently under Development Consent DA 470-11-2003. In 2017, approval was granted to expand extractive activities within the Croome West Pit. Due to a lower than expected resource volume, a modification was proposed to extend the life of the quarry and maintain operations. The proposed modification (MOD 13) to the Development Consent includes:

- increasing the approved extraction area by approximately 7.8 ha – the RIC Pit extension
- increasing the depth of approved extraction area
- increasing the approved period for quarry operations from 2034 to 2043.

1.3 Scope of works

The monitoring program includes analysis and interpretation of groundwater quality and level data from the groundwater monitoring network. The monitoring network consists of seven groundwater monitoring bores. Four monitoring bores (GW1–GW4) are installed up gradient within the Bumbo Latite and three are installed down gradient within alluvium (DG-12, DG-21, DG-37).

The scope of works as defined in the GMP are to:

- complete a six-monthly groundwater sampling events at the Bumbo Latite monitoring bores and alluvial monitoring bores
- analyse and interpret groundwater level and water quality data collected.

This report also includes a review of the current monitoring network design and provides any recommendations for ongoing monitoring.

KEY

- Dunmore Quarry site boundary
- Approved extraction area
- Croome West pit extension
- Rail line
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- Cadastral boundary
- Croome West monitoring bore

Dunmore Sand and Soil monitoring bores

- Active
- Decomissioned

Source: EMM (2020); Nearmap (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2017\117314 - Boral Quarry Dunmore groundwater monitoring\GIS\Maps\G001_MonitoringBores_20220720_03.mxd 20/07/2022

Site location and monitoring bores

Boral Dunmore Quarry
Annual groundwater monitoring report
Figure 1.1

EMM
creating opportunities

2 Environmental setting

2.1 Site setting

The project area (Figure 1.1) is surrounded by small agricultural plots, with cattle and horse grazing, and rural residential properties. Historically the area has been used for dairy farming. Remnant native vegetation lines the top of the prominent ridge line and persists in isolated pockets in the lower lying areas.

The quarry is set on a north south-west trending range. The peak is named Locking Hill and is partially incised by the existing pit. The ridge extends along the current western quarry highwall and has an elevation of approximately 164 metres Australian Height Datum (mAHD). The elevation of the south-east processing area is 10 mAHD. The DSS quarry and the CBP are east of the quarry. Quaternary alluvial sediments associated with the Minnamurra River system are extracted and processed at the DSS quarry.

Other quarries are located near the project. Approximately 1.5 km to the north is the Cleary Bros Bombo Pty Ltd (Cleary Bros) Albion Park Quarry. The Cleary Bros quarry is approved to produce 900,000 tonnes per annum and has extracted and processed hard rock from the Bumbo Latite since the 1950s (MMJ 2013). Holcim Australia Pty Ltd (Holcim) operates the Readymix Albion Park Quarry immediately west of the Cleary Bros Albion Park Quarry. This quarry also extracts a hard rock resource from the Bumbo Latite.

2.2 Climate

The project area is part of the Illawarra region, which is characterised by a mild and temperate climate described as warm and humid. Rainfall and climate data was downloaded from the SILO Long Paddock database for Albion Park weather station (Bureau of Meteorology (BoM): 068241), which is situated approximately 10 km north of the quarry. Rainfall data has been collected at this monitoring station since 1999. Evaporation data at this site has been interpolated by SILO from nearby weather stations. Climate statistics are summarised in Table 2.1.

The average annual rainfall is 1,012 millimetres (mm) (BoM 068241) with the most significant rainfall events generally experienced in autumn (February and March) and the lowest rainfall in winter and spring (August and September).

The average annual evaporation is 1,480.4 mm (BoM 068241) and exceeds rainfall throughout most of the year. Evaporation follows a seasonal trend with the highest rates of evaporation occurring during the hotter months between October to February.

Table 2.1 Average monthly rainfall and evaporation statistics

Time period (month)	Rainfall (mm)			Evaporation (mm)
	Min	Mean	Max	Mean
January	2.6	85.2	178.4	198.9
February	9.8	150.3	356	151.6
March	4.2	142.0	670.6	133.0
April	2.2	76.7	261.2	94.2
May	4.8	63.3	398.6	70.3
June	0	90.0	340.4	53.2
July	1.4	79.6	550.6	61.3
August	1.2	57.7	281.8	86.6

Table 2.1 Average monthly rainfall and evaporation statistics

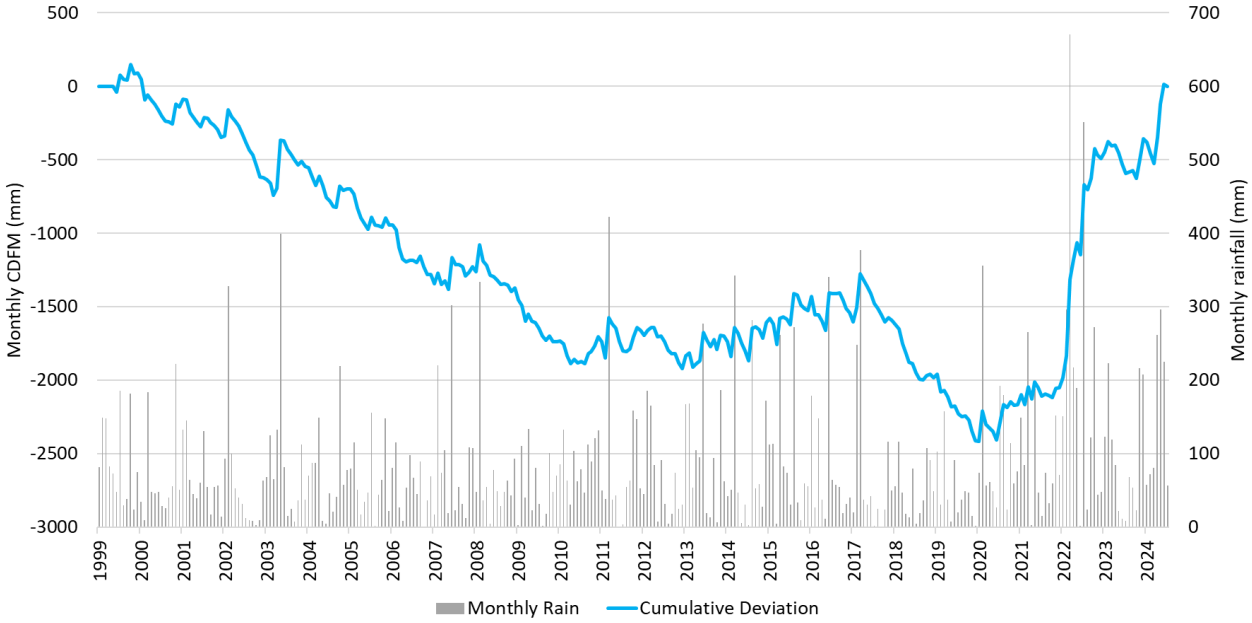
Time period (month)	Rainfall (mm)			Evaporation (mm)
	Min	Mean	Max	Mean
September	0	45.5	122	119.1
October	0.2	76.8	272.2	149.6
November	9.6	80.9	222.0	167.3
December	1.6	64.0	171.8	195.3

Source: Data sourced from SILO at BoM station 068241 (Albion Park – Shellharbour Airport)

The cumulative deviation of monthly rainfall from the mean (CDFM) from 1999 to mid-2024 is presented in Figure 2.1. The long-term CDFM is generated by subtracting the long-term average monthly rainfall for the recorded period from the actual monthly rainfall and then accumulating these residuals over the assessment period. Periods of below average rainfall are represented as downward trending slopes while periods of above average rainfall are represented as upward trending slopes.

The cumulative deviation plot for Albion Park shows a period of predominantly below average or average rainfall from 1999 until 2010, followed by a period of above average rainfall to 2017. Between 2017 and 2020, rainfall was generally below average. From July 2020 to the current reporting period (June 2024) rainfall has been above the long-term average.

The monthly rainfall over the 2023-2024 monitoring period is presented in Figure 2.2. Monthly rainfall was generally around average to below average in most months with exception of November and December 2023 and April to June 2024 where significantly higher monthly rainfalls were recorded. During the reporting period 1,567 mm of rain was recorded compared to the annual average of 1,012 mm.



Source: Data sourced from SILO at BoM station 068241 (Albion Park – Shellharbour Airport)

Figure 2.1 Cumulative deviation from long-term monthly mean rainfall

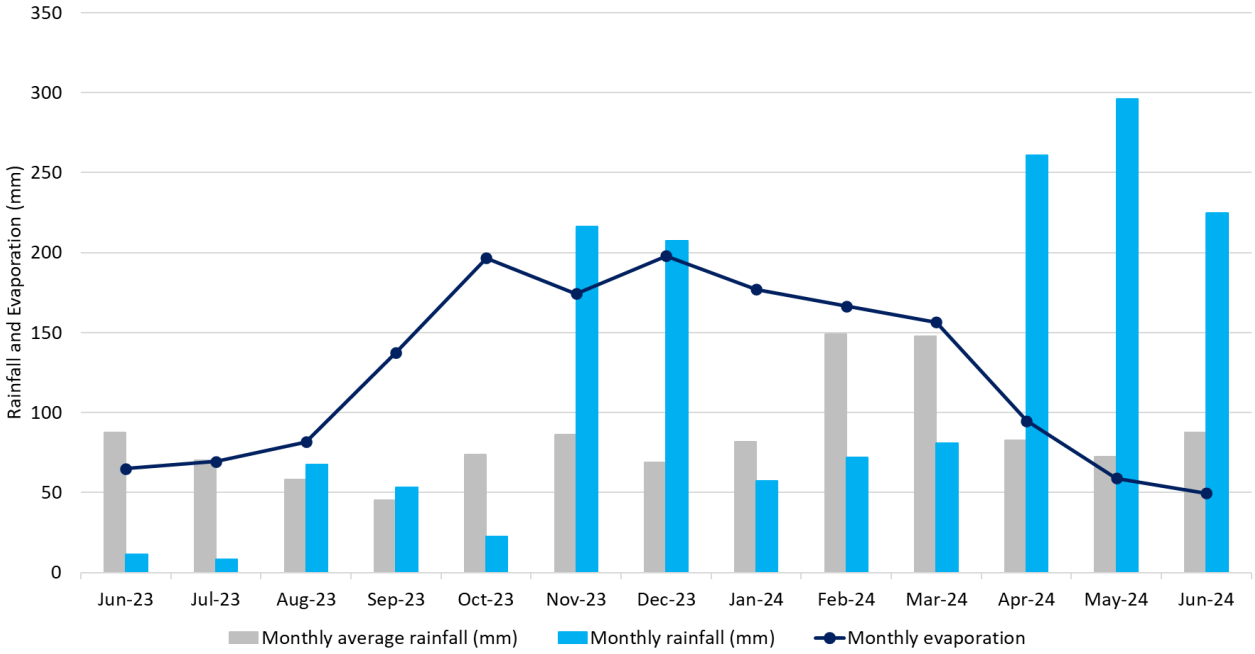


Figure 2.2 Monthly rainfall for June 2023 to July 2024 compared to average

2.3 Surface water

The quarry is located within the Rocklow Creek catchment area, which forms part of the Minnamurra River Catchment. Rocklow Creek is located to the south of the quarry, flowing to the east and draining to the Minnamurra River. The Minnamurra River discharges into the Pacific Ocean approximately 8 km south-east of the project area.

The Rocklow Creek catchment has an area of 21 km^2 and originates in the Illawarra Range, approximately 3 km west of the project area (Arcadis 2016). All clean water runoff from the project area flows into Rocklow Creek. Boral have a current surface water access licence (WAL 25152) to extract up to 227 megalitres (ML) per year of water from Rocklow Creek.

To the north of the project area is the Frasers Creek catchment area which drains to Lake Illawarra. Frasers Creek is an ephemeral system and forms disconnected pools during dry periods.

2.4 Geology

The project area is situated in the south-eastern corner of the Permo-Triassic Sydney Basin. The Sydney Basin predominantly comprises Permian and Triassic aged sedimentary rocks. Near the quarry, the Triassic and Late Permian sedimentary rocks have been eroded exposing the older early Permian aged Gerringong Volcanics of the Shoalhaven Group (Geology of the Wollongong, Kiama and Robertson 1:50,000 Sheet, Department of Mines 1974). The surface geology across the project area is presented on Figure 2.3.

Volcanic activity in the area has produced a series of flat lying lava flows interspersed with volcaniclastic sandstone members and breccias. The thickness of each successive flow decreases with distance from the volcanic origin, assumed to be off the current coastline to the south (Cohen 2006). At the quarry all geological units exhibit a gentle dip in an easterly direction (Evans and Peck 2006; MMJ 2013).

The Gerringong Volcanics facies comprise nine latite members and three volcanic sandstones or tuff members. The Gerringong Volcanics were deposited in a shallow marine environment, which was then uplifted above sea level. The area has since been eroded via river action to form the present landscape (Cohen 2006).

The Bumbo Latite is the areas greatest and most persistent lava flow and is the predominant geological unit at the quarry and has a maximum thickness of 150 m. The Bumbo Latite Member is divided into three flows: upper, middle, and lower. The Bumbo Latite is a grey to dark grey, very hard dense rock with light coloured phenocrysts of feldspar (Cohen 2006). Weathered latite is generally softer with a brownish, yellow colour. The latite can be jointed and fractured, with the dominant jointing close to vertical, however jointing is not widespread (MMJ 2013). The Bumbo Latite Member overlies the Kiama Sandstone Member which outcrops to the west of the quarry.

A breccia layer was deposited between the middle and lower Bumbo Latite Member flows. This breccia layer, also comprising volcanic material, ranges in thickness between 5 to 22 m (Cohen 2006). It comprises a softer layer of fragmental, angular materials cemented in a fine grained matrix (Department of Mines 1974).

Further east, the low-lying floodplain area is dominated by Quaternary Alluvium, deposited during flooding events associated with the Minnamurra River and its tributaries. This alluvium comprises unconsolidated to loosely consolidated gravels, sands, silts and clays.

2.5 Hydrogeology

2.5.1 Overview

The regional groundwater system, within the Kiama Sandstone aquifer, flows south-east, controlled by the dip of the strata and topography (Cohen 2006). Recharge to the Kiama Sandstone is by rainfall where it outcrops and subcrops and by leakage from overlying sedimentary units to the west of the project area. The Kiama Sandstone aquifer discharges to the Pacific Ocean (Cohen 2006).

Local groundwater systems are present within the Bumbo Latite along the elevated ridgeline (Walker *et al* 2003). These systems are isolated and have limited connection to the regional flow system. The Bumbo Latite is characterised as 'tight' with a low primary and low to moderate secondary porosity (Cohen 2006) controlling groundwater flow. Groundwater flow within the Bumbo Latite is minimal, predominantly occurring along fractures and at contacts between volcanic rock and the underlying sandstone (MMJ 2013).

The local groundwater systems are recharged by rainfall with infiltration higher in areas where the Bumbo Latite outcrops on the ridgelines and hilltops of the landscape (i.e. areas with limited soil profile). Discharge from the local groundwater system occurs in the valleys and includes ephemeral springs.

There is no history of dewatering at the quarry and there is no visual evidence of groundwater seepages to the Croome Farm pit with the rockface remaining dry throughout the year (Arcadis 2016). Cohen (2006) and Clearly Bros (2019) reports that there is no active mine dewatering at the two Albion Park quarries which also intersect the Bumbo Latite.

Information from Boral suggests that the breccia layer is partially saturated and more permeable than the surrounding Bumbo Latite. Breccia generally exhibits a variable porosity with areas of higher permeability common however they are generally limited in their extent.

The Quaternary alluvial sediments associated with the surface water courses form unconfined groundwater systems of varying storage. These systems are recharged by leakage from surface water courses during wet periods. The alluvial systems are depleted during dry periods and are not recharged by underlying porous and fractured rocks (Cohen 2006).

2.5.2 Conceptual hydrogeological model

i Groundwater flows

Groundwater within the Bumbo Latite flows from areas of high relief towards the valleys and low lying plains where it discharges to the alluvium and surface watercourses. The bulk rock mass has a low primary permeability with groundwater flow occurring primarily through fractures and along the contacts between the latite flows and breccia. Hydraulic testing results indicate an average hydraulic conductivity of $5.5x10^{-7}$ metres per day (m/day) (EMM 2014) which is comparable to the reported hydraulic conductivity in fractured igneous rocks: $8x10^{-9}$ to $3x10^{-4}$ m/day (Domenico & Schwartz 1990).

In the vicinity of the quarry, groundwater flow is generally towards the south-east, discharging to Rocklow Creek and the Minnamurra estuary system. To the north of the quarry the landscape gives way to steep valleys that shed surface water and provide limited potential for groundwater recharge.

The deep groundwater system associated with the Kiama Sandstone typically flow along bedding planes towards the east and are coincident with the dip of the strata.

ii Recharge and discharge

The local groundwater systems within the Bumbo Latite are recharged by rainfall with infiltration in higher areas where the Bumbo Latite outcrops on the ridgelines and hilltops of the landscape (i.e. areas with limited soil profile).

The regional groundwater system is recharged by infiltration from overlying sedimentary units west of the project area and losses from surface watercourses. The steep relief increases runoff with a smaller percentage of rainfall infiltration in this steeper terrain.

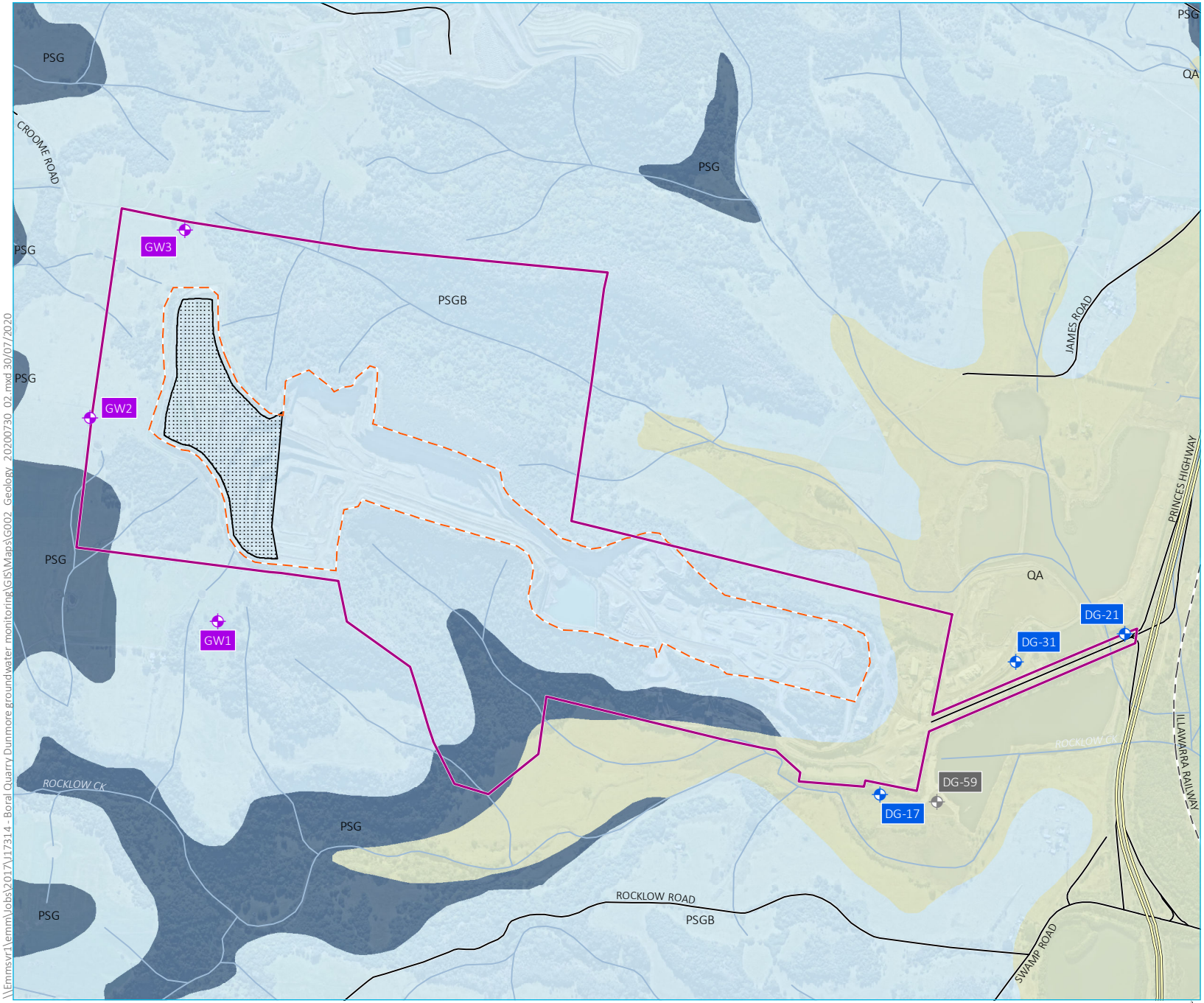
Groundwater from the shallow latite is largely thought to discharge to the Minnamurra River and Rocklow Creek, which form the main drainage systems in the vicinity of the quarry.

iii Groundwater-surface water connection

The surface watercourses in the elevated parts of the landscape are ephemeral in nature with the upper reaches drying out during periods of low rainfall. This ephemeral nature indicates that the surface watercourses are losing streams and are not fed by the underlying fractured rock groundwater systems.

The surface water systems to the east of the quarry in the lower parts of the landscape (Illawarra River, Minnamurra River and Rocklow Creek) are connected to shallow, marginal groundwater systems within surficial alluvial systems. Direct rainfall and surface water runoff recharges these shallow systems during wet periods which rapidly deplete during the drier periods, providing an important temporary source of baseflow for the surface watercourses.

Although groundwater within the shallow Bumbo Latite flows through to the alluvium in the east, the volume of this flux is likely to be insignificant in comparison to the recharge from the overlying rivers, restricted by the groundwater flow properties of the 'tight' rock matrix.



KEY

- Dunmore Quarry site boundary
- Approved extraction area
- Croome West pit extension
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Croome West monitoring bore

Dunmore Sand and Soil monitoring bores

- Active
- Decomissioned

Lithology

- Quaternary Alluvium (Qa)
- Shoalhaven Group, Bumbo Latite (Psgb)
- Shoalhaven Group, undifferentiated siltstone (Psg)

\\Emmsvr1\emm\Jobs\2017\17314 - Boral Quarry Dunmore groundwater monitoring\GIS\Maps\G002_Geology_20200730_02.mxd 30/07/2020

Source: EMM (2020); Nearmap (2020); DFSI (2017); DPE (1996)

0 250 500 m

GDA 1994 MGA Zone 56

N

Surface geology

Boral Dunmore Quarry
Annual groundwater monitoring report
Figure 2.3

EMM creating opportunities

3 Groundwater monitoring program

3.1 Monitoring network design

The groundwater monitoring network comprises seven monitoring bores installed at different times since 2014. The groundwater monitoring network has been designed to satisfy the requirements of Condition 40, Schedule 4 of the approved Development Consent. Four groundwater monitoring bores are installed into the fractured rock outside the quarry area, with a further three bores are installed into the alluvium outside the DSS dredge pond (refer Figure 1.1 and Table 3.1). In summary:

- GW4 was installed in February 2022 as part of the proposed northern extension into the RIC area. GW4 is screened across the base of the latite and up gradient of current quarrying activities
- three deep monitoring bores (GW1, GW2 and GW3) targeting the Bumbo Latite (EMM 2014), were installed in July 2014. GW1 is screened across latite and the top of the underlying sandstone, GW2 is screened across latite, and GW3 is screened across latite and breccia. These bores are located up hydraulic gradient from current quarrying activities
- DSS installed and monitor bores as part of their operations. Three shallow monitoring bores (DG-17, DG-31 and DG-21) are screened in the alluvium overlying the regional fractured rock groundwater system
- DG-59, which was part of the 2018/2019 monitoring program, was demolished in August 2019 due to further expansion of the DSS dredge pond. DG-21 has been added to the network as a replacement to DG-59.

Table 3.1 Groundwater monitoring bore construction details

Bore ID	Total depth (mbgl)[1]	Ground level (mAHD)[2]	Total depth (mAHD)[2]	Screened interval (mbgl)[1]	Screened interval (mAHD)[2]	Screened formation	Monitoring duration
GW1	78.0	131.44	53.440	72.0–78.0	59.44–53.44	Bumbo Latite and Kiama Sandstone	July 2014 - present
GW2	86.0	135.69	49.690	79.0–85.0	56.69–48.69	Bumbo Latite	July 2014 - present
GW3	80.0	147.25	67.250	68.0–80.0	79.25–67.25	Bumbo Latite and Breccia	July 2014 - present
GW4	29.0	57	28	20–26	21–27	Bumbo Latite	February 2022 - present
DG-17	6.0	3.49	-2.510	2.8–6.0	0.69–2.51	Alluvium	November 2018 - present
DG-31S	5.5	3.05	-2.450	2.5–5.5	0.55–2.45	Alluvium	May 2016 - present
BH-F (decommissioned)	5.2	2.23	3.0	2.1–5.2	0.1–3.0	Alluvium	July 2014 - March 2018
DG-59 (decommissioned)	8.69	1.763	-6.927	unknown	unknown	Alluvium	February 2017 - August 2019
DG-21	5.0	2.12	-2.880	2.0–5.0	0.12–2.88	Alluvium	November 2018 - present

Notes: 1. mbgl = metres below ground level; 2. mAHD = metre Australian Height Datum

3.2 Groundwater quality

In accordance with the GMP, groundwater sampling events were completed as described in Table 3.2.

Table 3.2 Groundwater quality monitoring program

Monitoring bores	Monitoring events (during the 2023/2024 monitoring year)	Monitored by
GW1, GW2, GW3, GW4	December 2023 and June 2024	EMM
DG-17, DG-31S, DG-21, GW4	August 2023, November 2023, February 2024 and May 2024	IEC

3.3 Sampling methodology

Due to the low permeability of the Bumbo Latite a grab sample was collected (using a decontaminated stainless steel double-check bailer) within the screened interval of monitoring bores GW1 to GW4.

Physicochemical parameters (pH, electrical conductivity (EC), temperature, total dissolved solids (TDS), dissolved oxygen (DO) and oxidation reduction potential (ORP)) were measured for the sampled water using a calibrated hand-held water quality meter.

3.4 Chemical analysis

Water quality samples were analysed for a broad chemical suite. The suite allows groundwater systems to be differentiated by chemical signatures and allows any potential quality impacts from quarry operations to be identified. The analytical suite is provided in Table 3.3.

Table 3.3 Water quality suite of analysis

Grouping	Parameter
Physicochemical parameters (field)	EC, pH, DO, Temperature, TDS, ORP
Major ions	Calcium[1], Magnesium, Sodium, Potassium, Chloride, Total alkalinity, Sulphate[1], Silica[1]
Dissolved metals	Aluminium[1], Arsenic[1], Cadmium[1], Chromium[1], Copper[1], Iron, Manganese[1], Nickel[1], Zinc[1]
Nutrients	Ammonia, Nitrate, Nitrite, Total nitrogen, Total phosphorus

Note: 1. Not analysed in the shallow monitoring bores (DG-17, DG-31 and DG-21).

The samples collected by EMM from GW1, GW2, GW3 and GW4 were analysed by Australian Laboratory Services Limited (ALS). The samples collected from the alluvial bores by IEC were analysed by Sydney Analytical Laboratories in Seven Hills. All laboratories used for analysis are NATA accredited.

All samples were collected in bottles provided by the laboratory, with appropriate preservation where required. Samples undergoing dissolved metal analysis were field filtered using 0.45 micron (µm) filters.

3.4.1 Quality assurance and quality control (QA/QC)

Field sampling procedures conformed to EMM's QA/QC protocols to prevent cross-contamination and preserve sample integrity. The following QA/QC procedures were applied:

- samples were collected in clearly labelled bottles with appropriate preservation solutions
- samples were delivered to the laboratories within the specified holding times

- unstable parameters were analysed in the field (physiochemical parameters).

3.4.2 Laboratory QA/QC

The laboratories conduct their own internal QA/QC program to assess the repeatability of the analytical procedures and instrument accuracy. These programs include analysis of laboratory sample duplicates, spike samples, certified reference standards, surrogate standards/spikes and laboratory blanks. In addition, a duplicate sample is collected in the field for every ten samples collected to assess sampling and laboratory analysis accuracy. A duplicate sample at GW2 was taken during the December 2023 monitoring round and at GW4 in the June 2024 monitoring round.

3.5 Groundwater levels

Following completion of GW1, GW2, GW3 and GW4, pressure transducers (level loggers) were installed to record a groundwater level every six hours. During monitoring events, groundwater levels were also gauged using an electronic dip meter. Groundwater level data for the alluvial bores was supplied to EMM by IEC.

Level loggers were installed by Environmental Earth Sciences (EES) in monitoring bores DG-31, DG-21 and DG-17. These level loggers were programmed to record water levels every hour.

4 Groundwater levels

Hydrographs showing groundwater levels and rainfall from the start of monitoring until June 2024 are presented in Figure 4.1 and Figure 4.2 for the alluvium and latite bores respectively. Individual hydrographs for the latite monitoring bores are included in Appendix A.

During the 2020/2021 monitoring period, GW1 and GW2 level loggers malfunctioned from December 2020 and June 2020, respectively. Level loggers were replaced in June 2021. The manual groundwater level measurements confirmed no significant changes to long-term groundwater levels at GW1 or GW2.

Since December 2023, the manual dips recorded at GW2 have not matched level logger data. There is evidence of significant logger drift and the malfunctioning logger should be replaced.

4.1 Alluvium

Groundwater level trends in the alluvium (DG-17, DG-31 and DG-21) are comparable to the previous monitoring period (Figure 4.1). All shallow alluvial monitoring bores shows a direct and immediate response to rainfall events with DG-21 and DG-31 showing the most pronounced responses. The maximum groundwater level rise in these bores is 1.5 m (at DG-31). There is an overall slightly increasing trend from November 2023 into the current period which corresponds to the above average rainfall during this period.

4.2 Bumbo Latite

During the 2023/24 reporting period, there were no observable groundwater impacts in the fractured rock monitoring bores from quarrying activities.

Groundwater elevations in the latite monitoring bores at GW1, GW2 and GW3 ranged between 100 and 130 mAHD (Figure 4.2). Groundwater elevations at GW4, screened at the base of the latite, are lower and ranged between 50 and 55 mAHD (ignoring the sampling spikes). Monitoring bore GW4 is also located further down hydraulic gradient compared to the other fractured rock monitoring bores GW1 GW3.

The groundwater levels in monitoring bores GW2, GW3 and GW4 show a more muted response to rainfall recharge compared to GW1. The groundwater level at GW1 has historically responded to rainfall recharge during periods of above average rainfall with correlation to the CDFM. GW1 is partially screened within the Kiama Sandstone member which responds well to recharge via rainfall and leakage from overlying sedimentary units. GW2, GW3 and GW4 are screened in the Bumbo Latite member which has a more muted response to recharge due the steep valley slopes shedding surface water and the latite member being fracture dominated with limited connectivity to the regional system.

A summary of the groundwater levels during the monitoring period are as follows:

- GW1 recorded a water level decline between May to October 2023 (about 10 m) corresponding to a period of below average monthly rainfall. Groundwater levels recovered (approximately 10 m) during the wetter conditions from November 2023 back to previous levels.
- GW2 groundwater level declines observed in the logger data does not align with the manual measurement. Manual measurements show the groundwater level is stable and indicates the logger is malfunctioning and experiencing significant logger drift. The logger should be replaced.
- GW3 groundwater levels are generally stable recording a subdued trend corresponding to prevailing rainfall conditions.

- GW4 groundwater levels trended upwards during the monitoring period. The periodic drawdown at GW4 is a result of purging prior to groundwater quality sampling by IEC and is not representative of natural groundwater conditions. Groundwater samples collected at monitoring bores GW1-GW3 (Section 2.5) do not show periodic drawdowns, indicating their higher hydraulic conductivity.

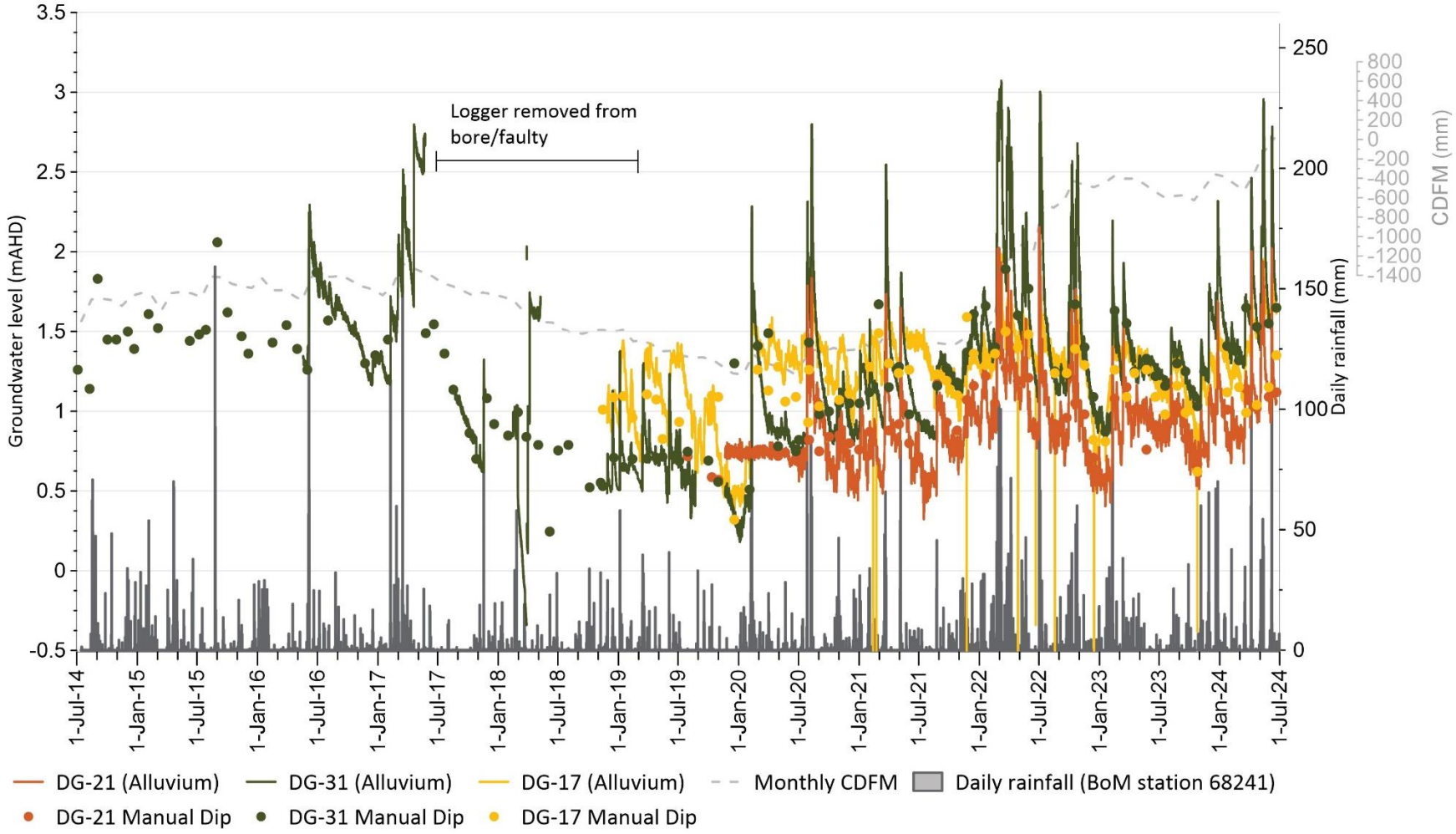


Figure 4.1 **Groundwater levels in the alluvium**

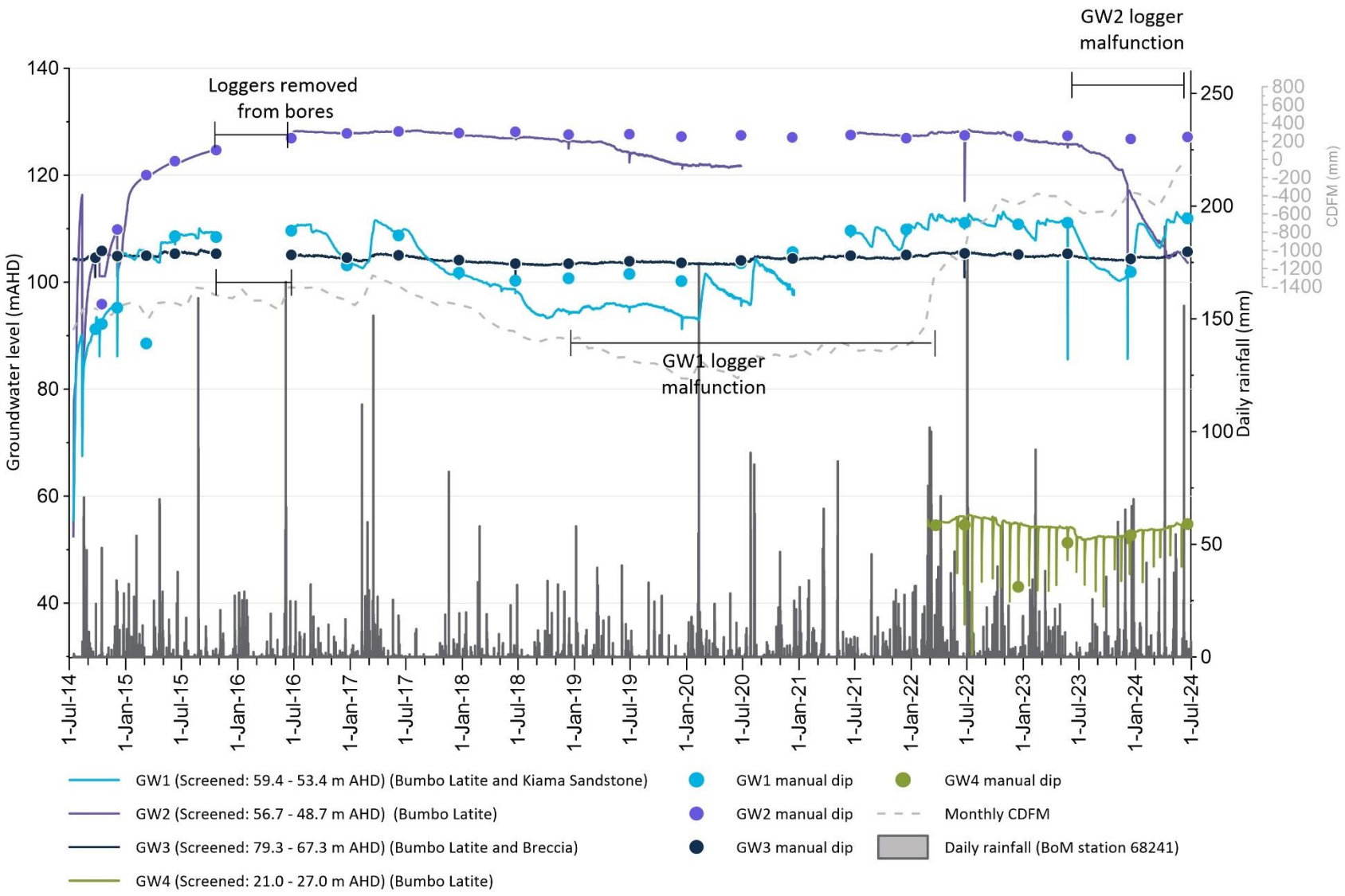


Figure 4.2 **Groundwater levels in the Bumbo Latite**

5 Groundwater quality

Water quality results for the 2023/2024 monitoring year are summarised below. The full water quality results for the GMP monitoring sites are presented in Appendix B, with laboratory quality control reports provided in Appendix C. The water quality timeseries for metals for the Croome west monitoring bores (GW1 to GW4) are presented in Appendix D.

5.1 Field parameters

Groundwater Electrical conductivity (EC) and pH from the Bumbo latite bores, GW1 to GW4 and in the alluvium at DG-17, DG-21, DG-31 were overall comparable to previous monitoring year. Time series of field EC and pH are presented in Figure 5.1 and Figure 5.2. The mean groundwater EC and pH for the monitoring period is summarised in Table 5.1.

Table 5.1 Mean measured field parameters for monitoring period

Bore	Mean electrical conductivity (µS/cm)	Mean pH (pH units)
GW1	1,179	7.08
GW2	1,269	7.67
GW3	615	6.75
GW4	1000	7.32
DG-17	2076	7.03
DG-21	1078	6.53
DG-31	625	6.89

EC in the Bumbo Latite was varied and has generally declined from initial values in 2014 when monitoring commenced and was generally stable during the monitoring period. EC at GW1 has historically recorded large fluctuation ranging from 834 to 4,187 µS/cm but has been generally stable since 2022 around 1,200 µS/cm. GW3 has consistently recorded lower EC compared to the other latite bores. The pH at the latite bores range between slightly acidic to slightly alkaline during the monitoring period.

Alluvial groundwater EC is highly variable and large fluctuations are recorded during the monitoring period. DG-17 consistently records the highest EC for the alluvial bores with values ranging from 834 to 3,236 µS/cm during the monitoring period. The high salinity can be attributed to its proximity to Rocklow creek which is tidally influenced. The pH in the alluvium was generally slightly acidic during the monitoring period. There was a spike of higher pH (more alkaline) across all three alluvial bores in July 2023 however this is likely a result of physico-chemical water quality metre inaccuracy.

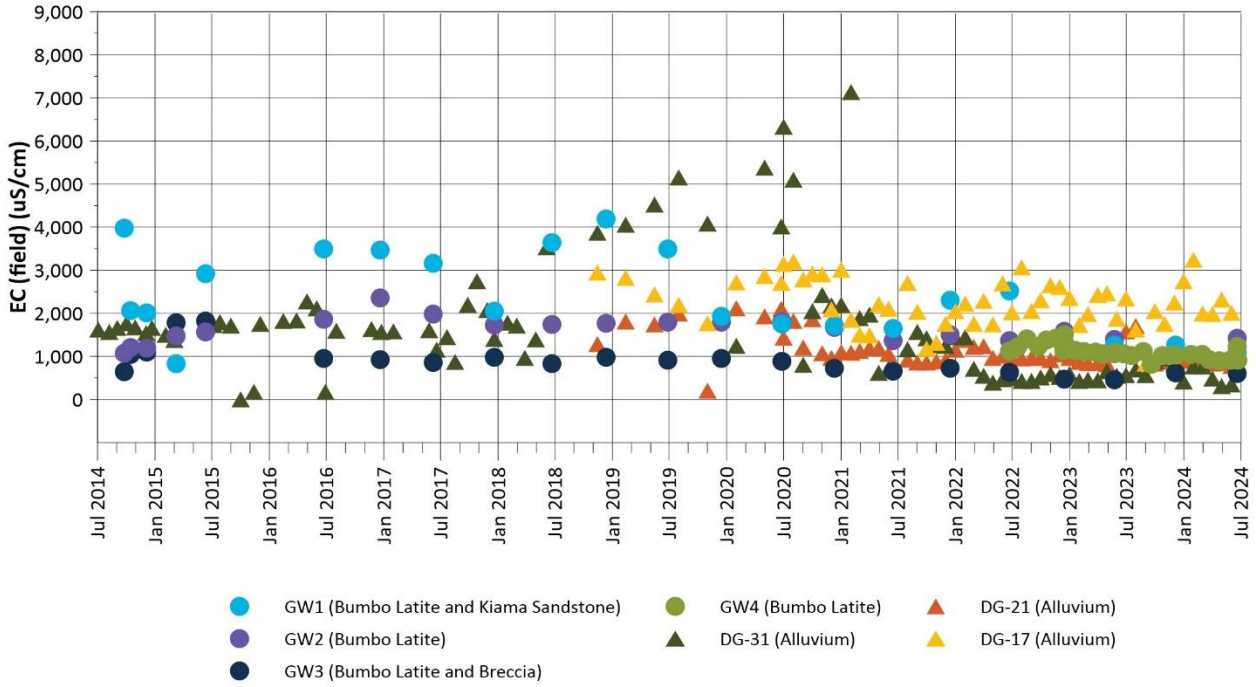


Figure 5.1 EC timeseries for all monitoring bores

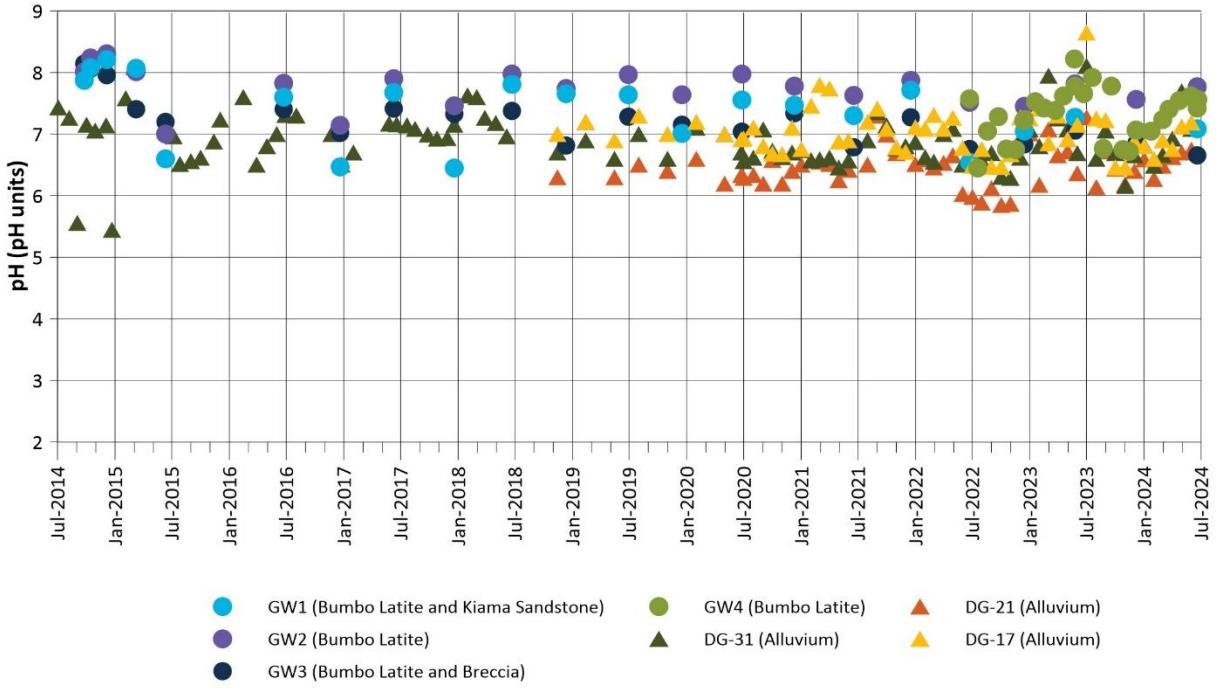


Figure 5.2 pH timeseries for all monitoring bores

5.2 Major ions

The major ion characteristics of groundwater samples for the monitoring sites for the 2023/24 monitoring year are shown in a piper diagram in Figure 5.3. A piper diagram is a graphical representation of the relative concentrations of major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, HCO_3^{-}, CO_3^{2-} and SO_4^{2-}).

Groundwater chemistry from GW1 to GW4 (latite bores) shows some minor variation in water type. All four bores are bicarbonate dominant. GW1, GW2 and GW4 are sodium dominant while GW3 is more calcium and magnesium dominant. Major ion concentrations measured at GW1 to GW4 are comparable to previous monitoring year.

Groundwater chemistry from DG-17, DG-21 and DG-31S (alluvial monitoring site) are bicarbonate dominant which is comparable to the previous year. There is no dominant cation type, DG-31S tends towards a calcium type while DG-17 and DG-21 tends towards a sodium type. The sodium type at DG-17 and DG-17 may be attributed to the tidal infleunces at nearby Rocklow creek.

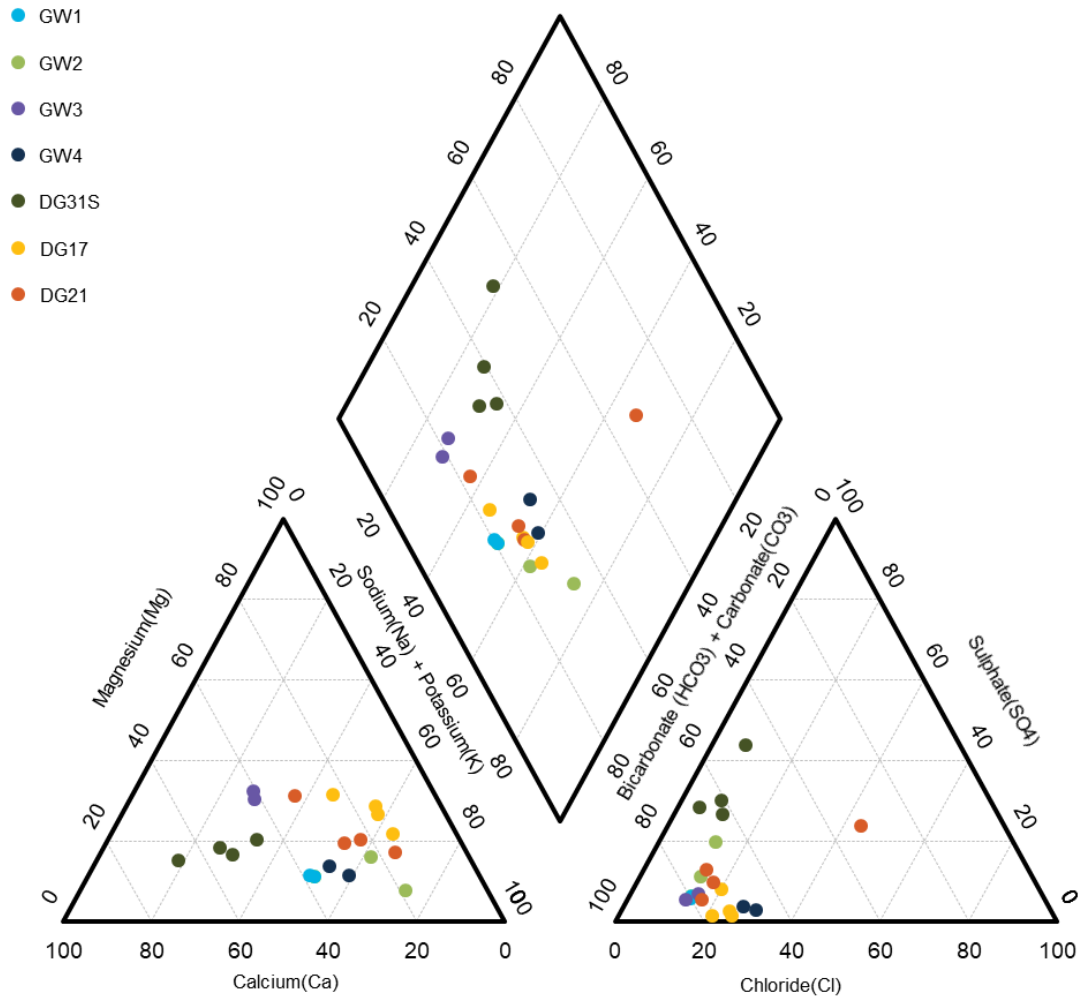


Figure 5.3 Piper plot for all monitoring bores (2023/2024 monitoring year)

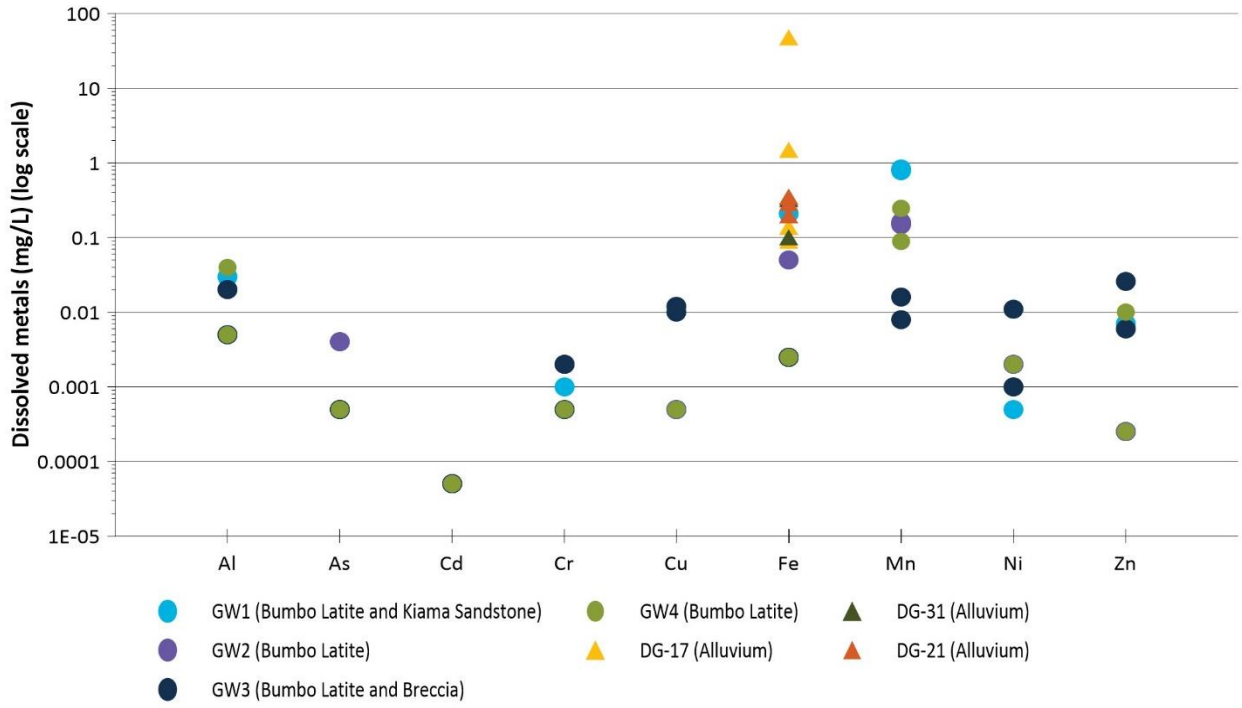
5.3 Dissolved metals

Concentrations of dissolved metals from the groundwater samples collected during the 2023/24 monitoring year are presented in Figure 5.4.

A full suite of metals was analysed for the GW1 to GW4 monitoring sites, with timeseries shown in Appendix D. The metals suite for the alluvial monitoring sites (DG-17, DG-21 and DG-31) was only analysed for dissolved iron.

The main findings for dissolved metals are as follows:

- Dissolved metals at GW1 to GW4 show concentrations within the same order of magnitude as the previous years.
- Iron was detected at all the alluvial monitoring sites (DG-17, DG-21 and DG-31) above the laboratory limits of reporting (LOR). A large spike in iron concentrations were detected at DG-17 and DG-21 in November 2023 but returned to historical levels the following sampling event.
- Aluminium at GW1 to GW4 which had been below the LOR (0.01 mg/L) since 2020 measured a spike in June 2024 with highest concentrations recorded at GW3 (0.06 mg/L).
- Arsenic at GW2 has been steadily decreasing. At the other bores concentrations are close to or below the LOR (0.001 mg/L).
- Cadmium concentrations were below the LOR at all sites
- Chromium concentrations were stable close to or below the LOR (0.001 mg/L) at all sites.
- Copper concentrations were stable close to or below the LOR (0.001 mg/L) at GW1, GW2 and GW4, and stable with concentrations around 0.010 mg/L at GW3.
- Iron concentrations continue to be below the LOR (0.05 mg/L) at GW2, GW3 and GW4. GW1 which had historically recorded concentrations below the LOR since 2021, recorded a spike in June 2024 (0.21 mg/L).
- Manganese concentrations are increasing at GW1, stable at GW2 and GW3 and decreasing at GW4. Concentrations were an order of magnitude lower at GW3 compared with the other latite groundwater monitoring sites (i.e. GW1, GW2 and GW4).
- Nickel concentrations were stable close to or below the LOR (0.001 mg/L) except for a single spike at GW3 (0.011 mg/L) in December 2023.
- Zinc concentrations showed large fluctuations but were within historical limits.



Note: Concentrations below the Estimated Quantitation Limit (EQL) are presented as half the EQL

Figure 5.4 Dissolved metal concentrations for the 2023/2024 monitoring year

5.4 Nutrients

Time series of nitrate, total phosphorus and ammonia concentrations are presented in Figure 5.5, Figure 5.6, and Figure 5.7, respectively. Generally, nutrient concentrations were comparable to the previous monitoring year Observations for nutrients in the monitoring period are as follows:

- Nitrate measurements at GW3 were typically an order of magnitude higher than all the other bores (both the Latite and alluvial bores) and continue to fluctuate.
- Total phosphorus concentrations displayed a slightly increasing trend in the monitoring period. A spiked increase was observed at GW4 (1.11 mg/L) in June 2024 but was still within historical limits. The total phosphorous concentrations at DG-17 continues to be an order of magnitude higher when compared with DG-21 and DG-31. The elevated concentration at DG-17 may be attributed to water management processes at the nearby Middle dam.
- Ammonia concentrations at GW1 and GW2 remains an order of magnitude higher than at all the other monitoring bores. GW3 remains close to or below the LOR. GW4 measured significant fluctuations from concentrations below LOR to a historic high of 0.53 mg/L in February 2024. At the alluvial bores concentrations are generally close to or below the LOR with occasional spikes.

The elevated and variable nutrient concentrations are not unexpected as these bores are located on or adjacent to farmlands and the groundwater chemistry is likely to be influenced by land use practices.

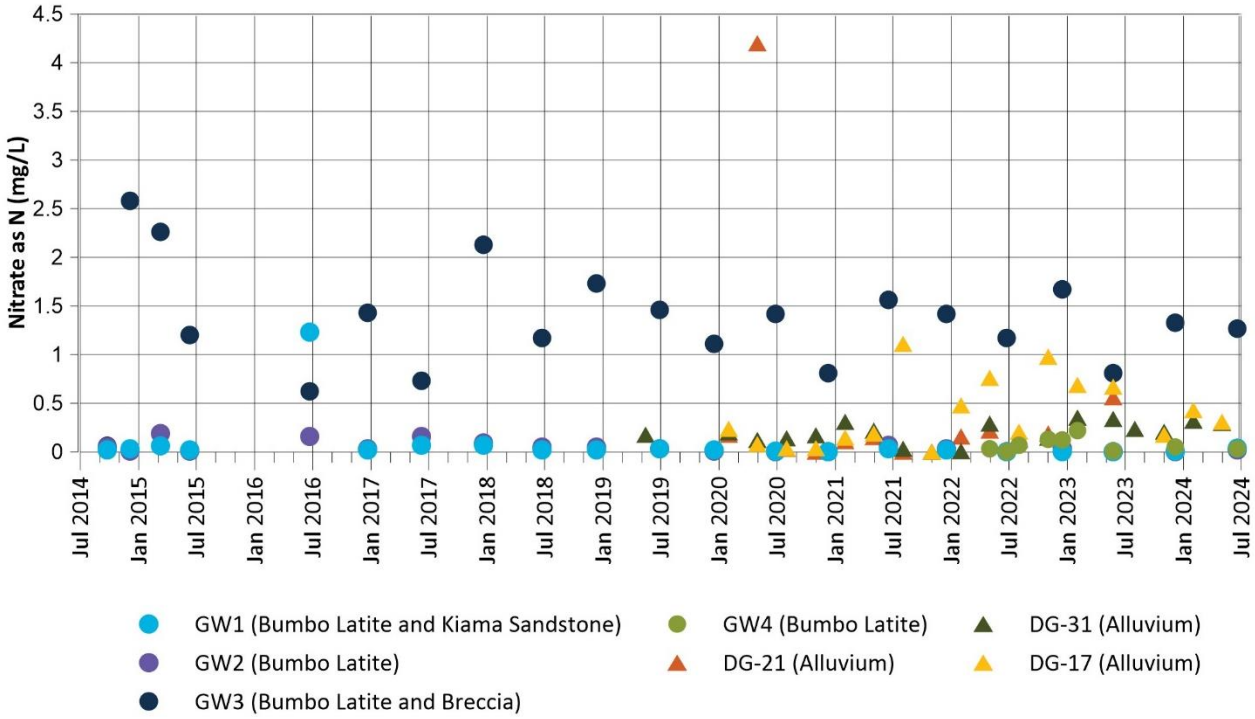
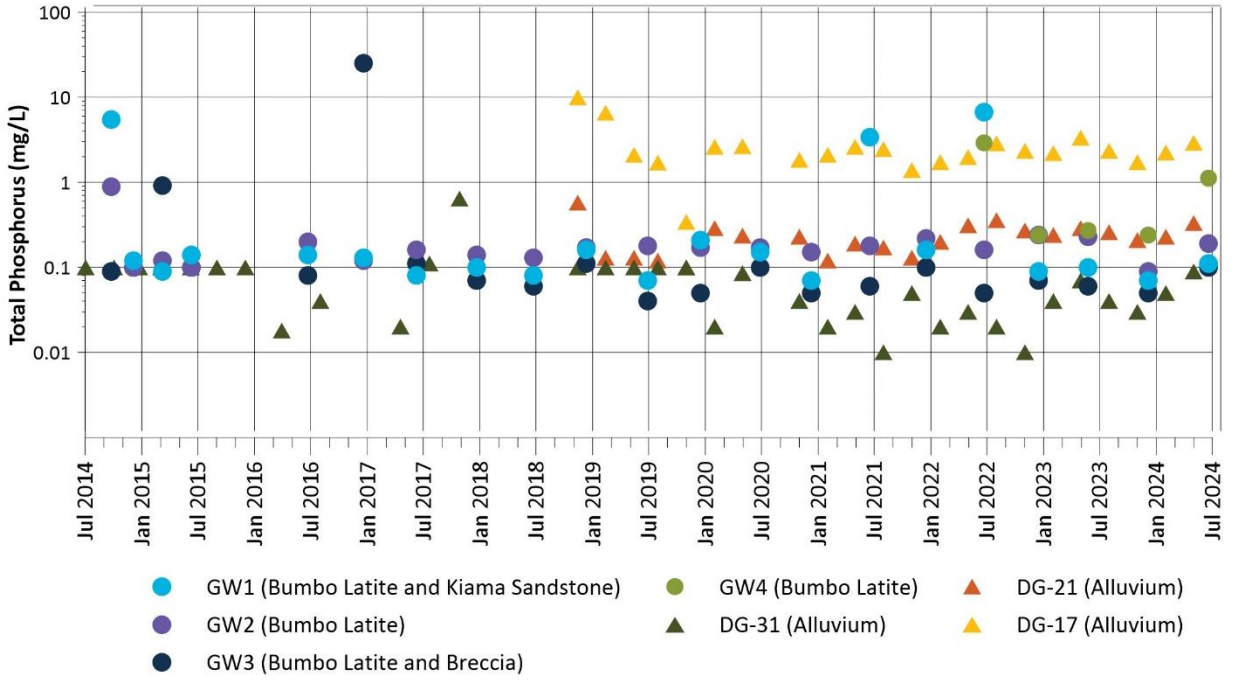


Figure 5.5 **Nitrate concentration time series**



Note: The figure presents total phosphorus for the alluvium bores and total phosphate as P for the Bumbo Latite bores

Figure 5.6 **Total phosphorus concentration time series**

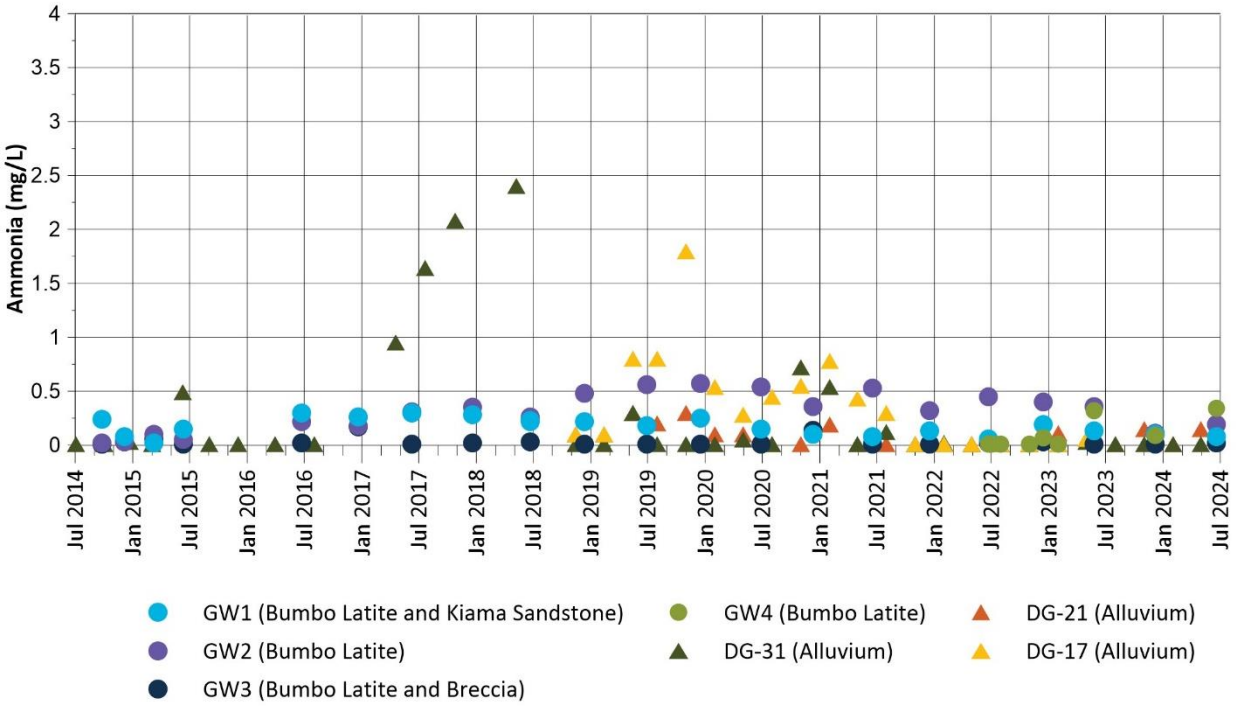


Figure 5.7 **Ammonia concentration time series**

6 Conclusions and recommendations

The main findings for the 2023/24 monitoring year regarding groundwater levels are:

- no observable groundwater level impacts from quarrying activities associated with groundwater depressurisation were identified at the monitoring bores
- groundwater levels in the alluvium and Kiama Sandstone show a response to rainfall recharge, while the Bumbo Latite shows a more muted rainfall recharge response.

The main findings for the 2023/24 monitoring year regarding groundwater quality are:

- groundwater quality at the monitoring sites was generally consistent with historical data, except for a spike in aluminium at the Bumbo latite bores (GW1 to GW4), and a slight increase pH trend across all bores towards neutral to slightly alkaline conditions.
- the variable nutrient concentrations are not unexpected as these bores are located on or adjacent to farmlands with livestock and the groundwater chemistry has possibly been altered by land use practices.

The results for the 2023/24 monitoring year are consistent with the hydrogeological conceptual model for the project. There were no changes to groundwater levels or water quality observed in the groundwater monitoring bores during the reporting period that could be associated with the Croome West pit extension activities.

6.1 Recommendations

The Development Consent conditions, issued on 11 March 2019, note: *on the provision of two years of monitoring data that shows negligible impact on the regional groundwater network the Secretary may agree to suspend monitoring of regional groundwater levels and/or quality*. The four year groundwater monitoring period has shown negligible impact to the monitored groundwater system. However, in the interest of minimising potential impact whilst Boral is extracting in the Croome West pit, it is proposed that monitoring should continue.

Groundwater level monitoring should continue via dataloggers set at six-hourly intervals and groundwater quality monitoring should continue at the six-monthly frequency at GW1, GW2, GW3 and GW4, and at approximately quarterly intervals at DG-17, DG-21 and DG-31 in accordance with the GMP.

The groundwater logger at GW2 logger is malfunctioning and experiencing significant logger drift. It is recommended the logger be replaced. Hydrasleeve's are also recommended to be installed at GW1 to GW4.

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Department of Mine 1974, *Geology of the Wollongong, Kiama and Robertson 1:50,000 Sheets*.

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MMJ Wollongong (MMJ) 2013*, Environmental Assessment, Modification of Development Consent 10639 of 2005 Albion Park Quarry.*

Walker G., Gilfedder M., Evans R., Dyson P., Stauffacher M. 2003*, Groundwater Flow Systems Framework – Essential Tools for Planning Salinity Management*, Murray Darling Basin Commission and CSIRO Land and Water.

Appendix A
Groundwater hydrographs

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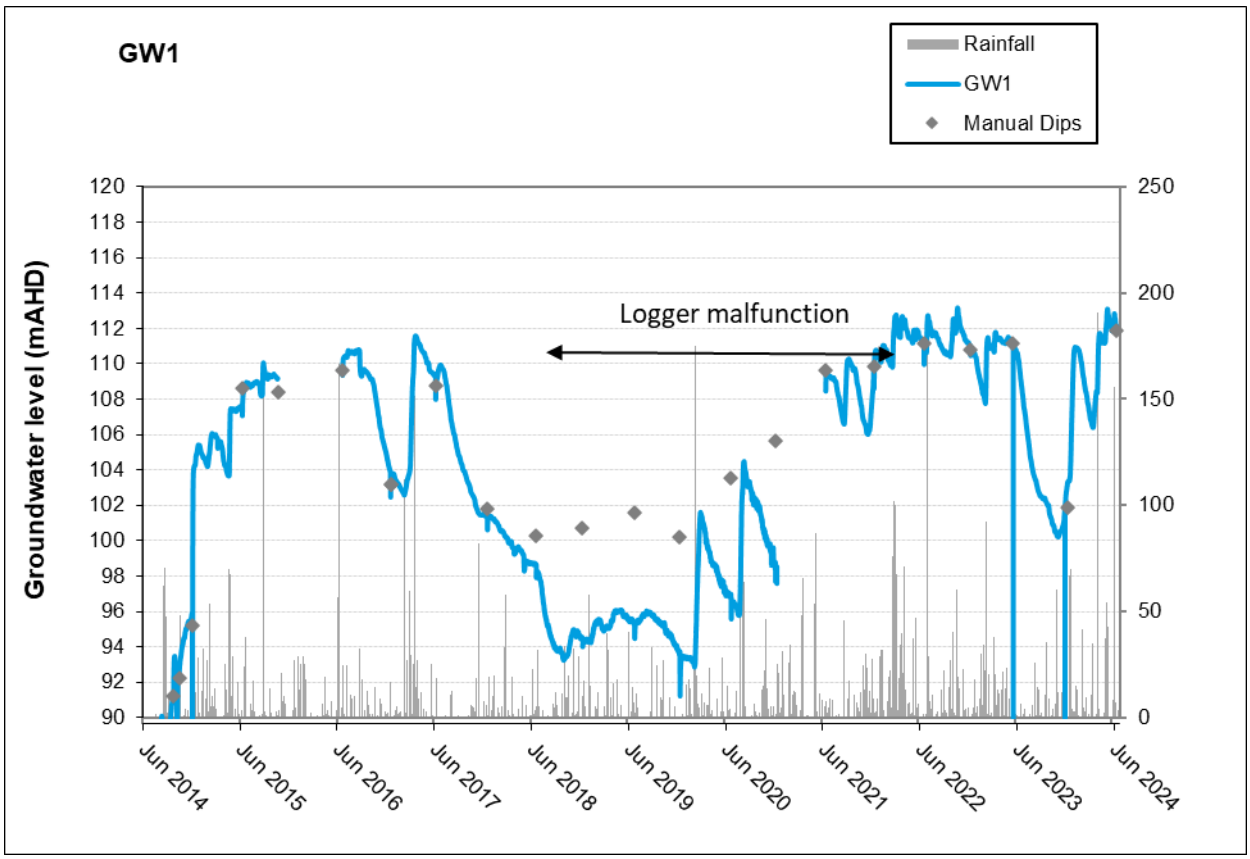
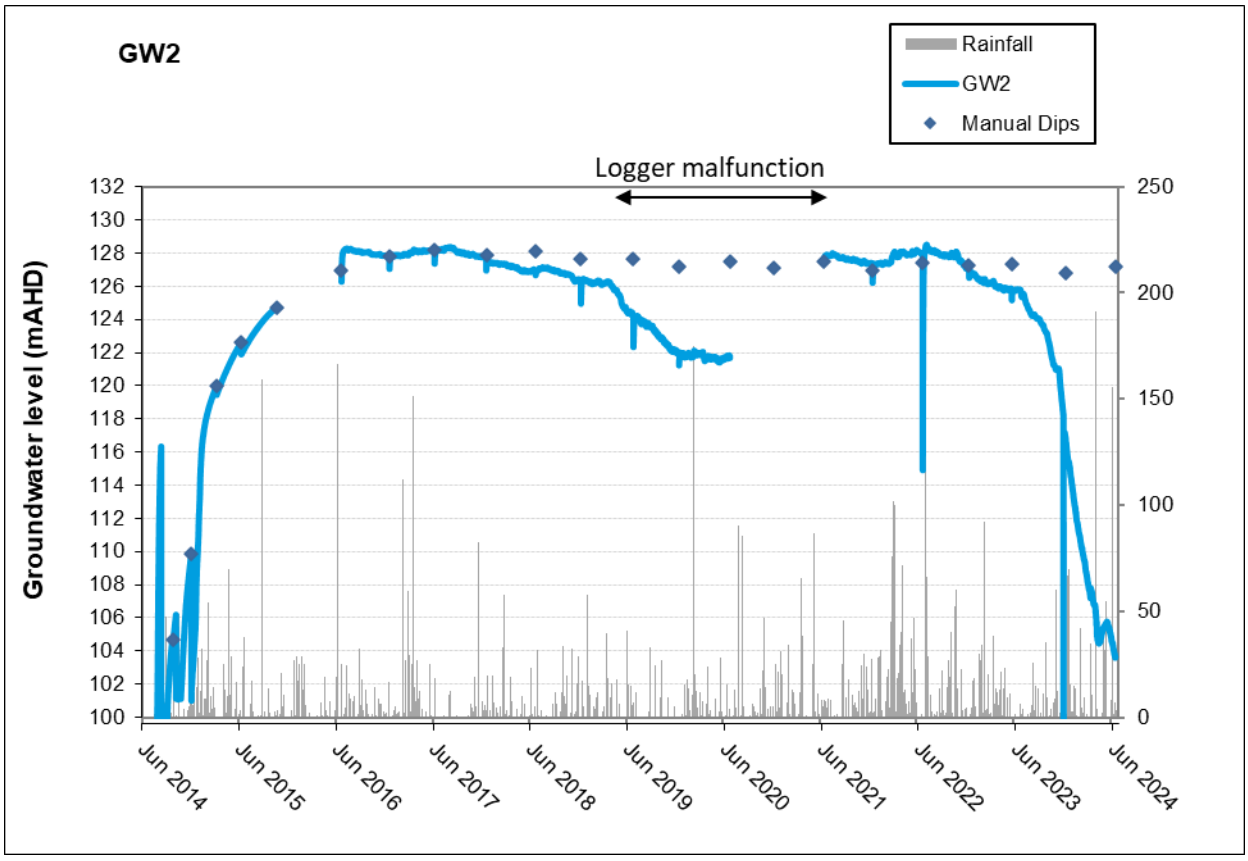
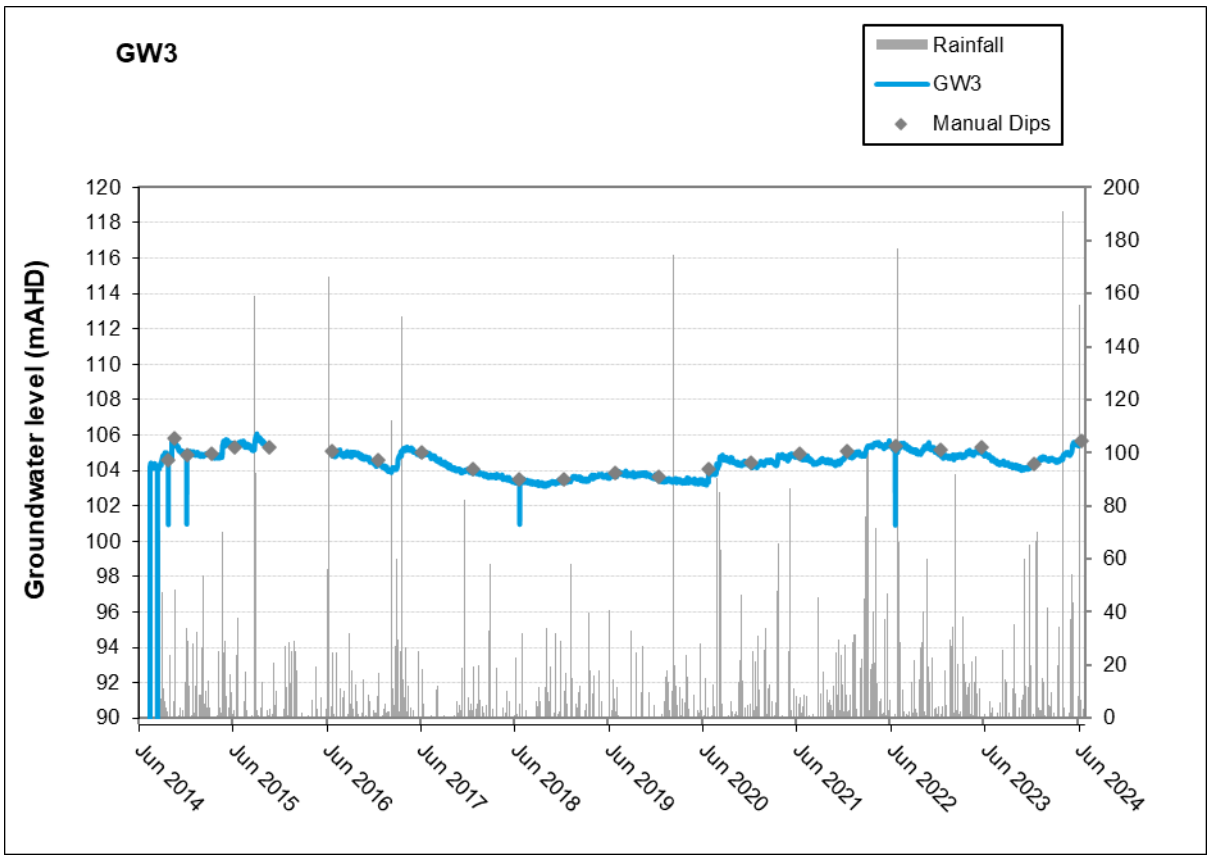
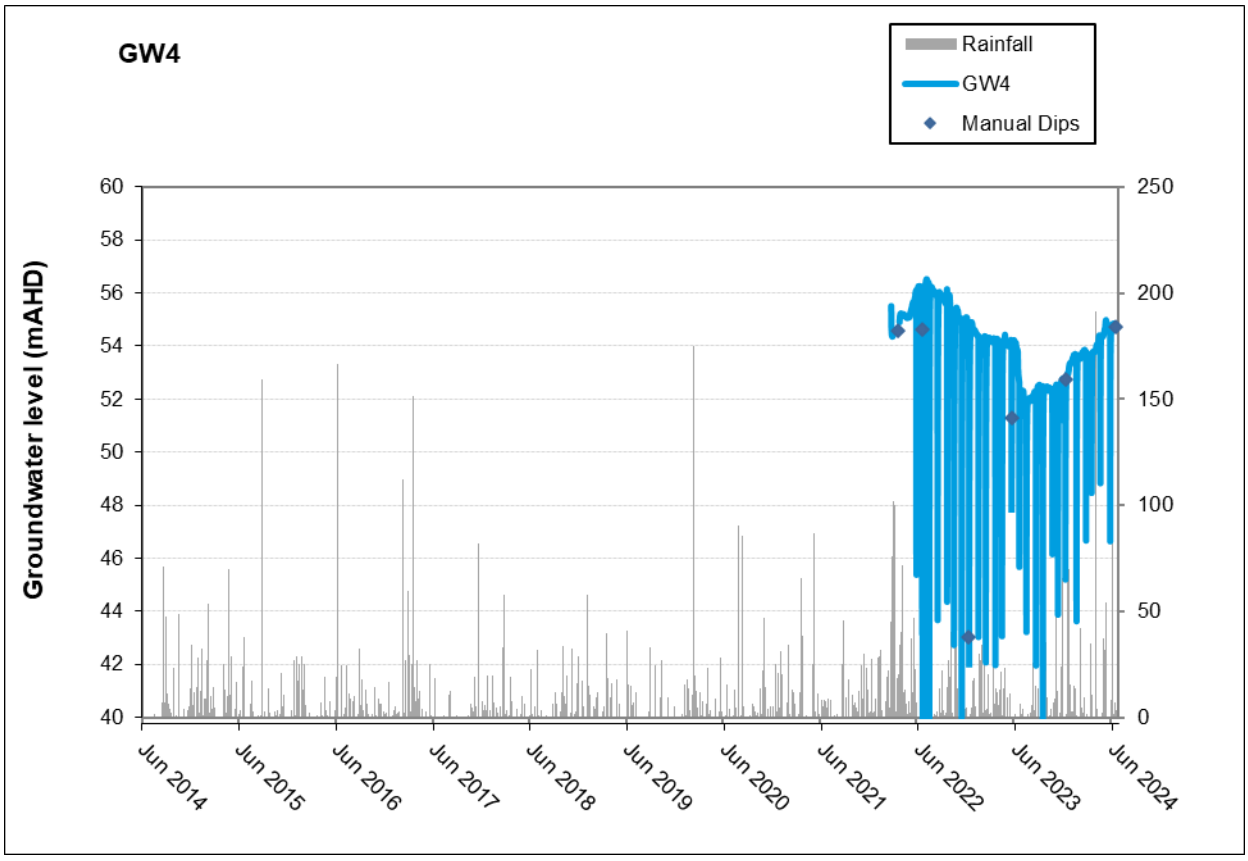
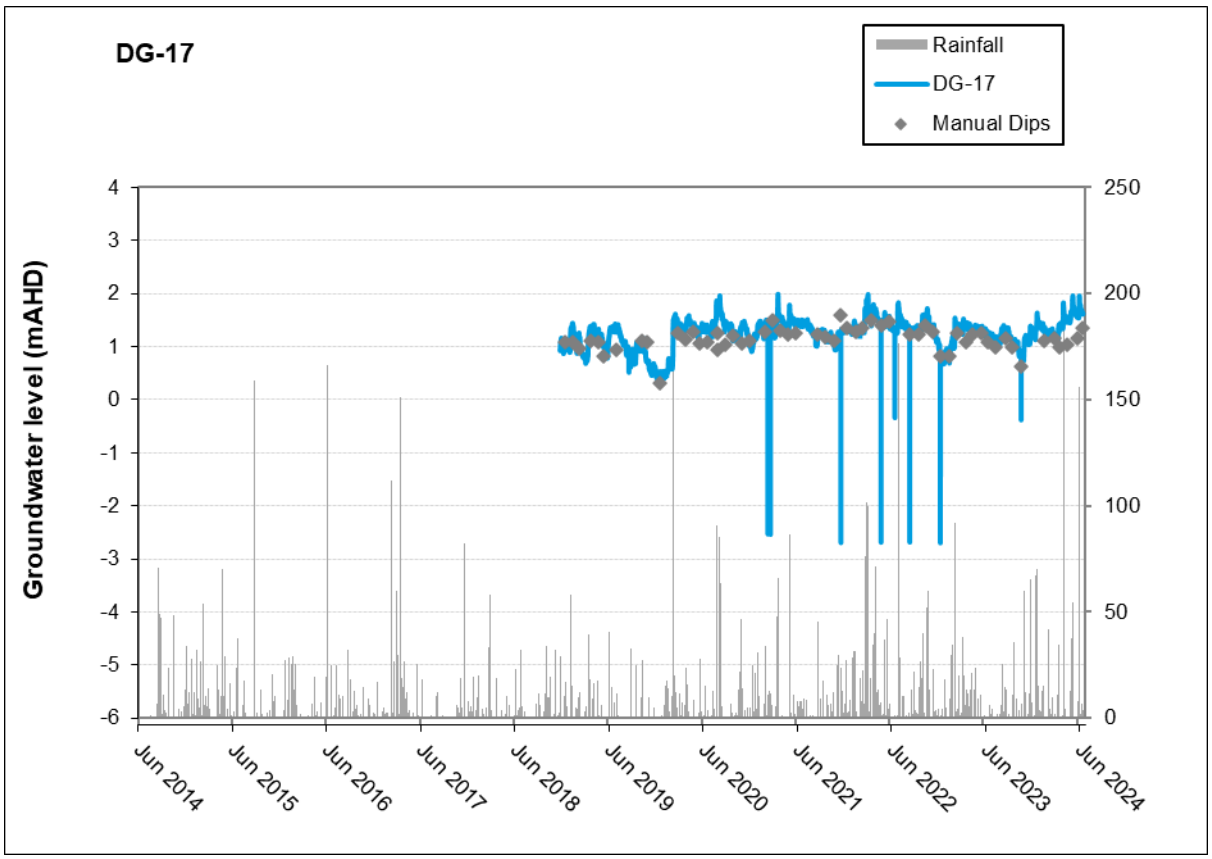
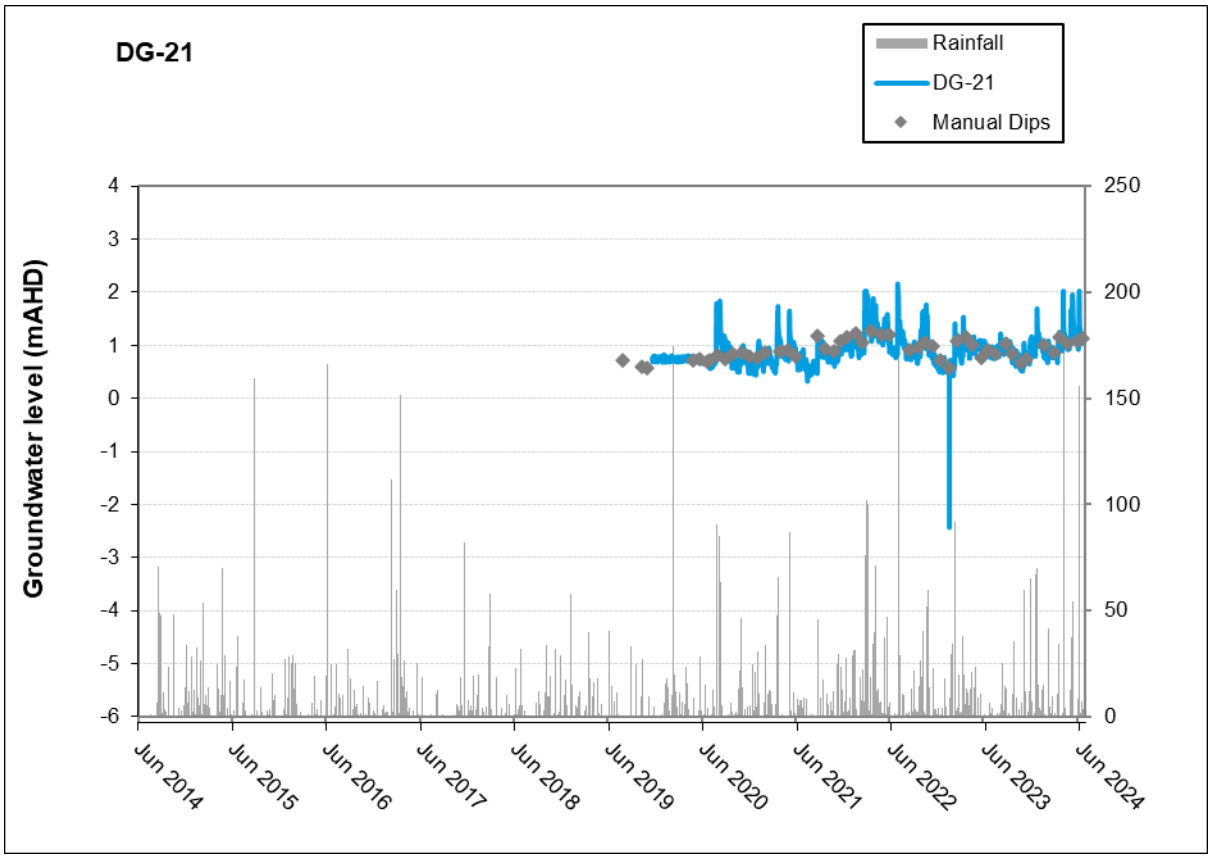

GW1
Rainfall
GW1
Manual Dips
Logger malfunction
Groundwater level (mAHD)
120
118
116
114
112
110
108
106
104
102
100
98
96
94
92
90
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024

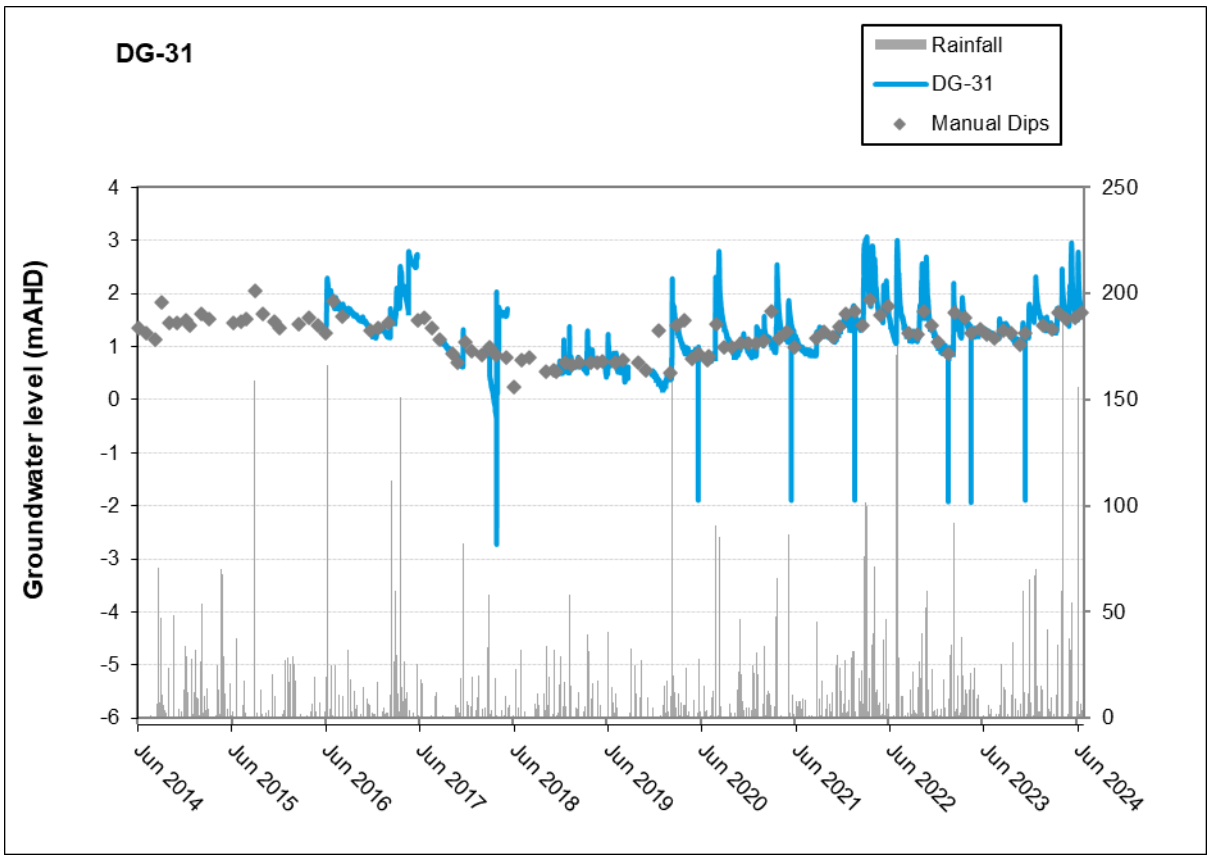

GW2
Rainfall
GW2
Manual Dips
Logger malfunction
Groundwater level (mAHD)
132
130
128
126
124
122
120
118
116
114
112
110
108
106
104
102
100
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024


GW3
Rainfall
GW3
Manual Dips
Groundwater level (mAHD)
120
118
116
114
112
110
108
106
104
102
100
98
96
94
92
90
200
180
160
140
120
100
80
60
40
20
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024


GW4
Rainfall
GW4
Manual Dips
Groundwater level (mAHD)
60
58
56
54
52
50
48
46
44
42
40
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024


DG-17
Rainfall
DG-17
Manual Dips
Groundwater level (mAHD)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024


DG-21
Rainfall
DG-21
Manual Dips
Groundwater level (mAHD)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024


DG-31
Rainfall
DG-31
Manual Dips
Groundwater level (mAHD)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
250
200
150
100
50
0
Jun 2014
Jun 2015
Jun 2016
Jun 2017
Jun 2018
Jun 2019
Jun 2020
Jun 2021
Jun 2022
Jun 2023
Jun 2024

Appendix B
Water quality summary tables

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			Project ID	J17314	J17314	J17314	J17314	J17314	J17314	J17314	J17314
			Site ID	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry	Dunmore Quarry
			Location Code	GW1	GW1	GW2	GW2	GW3	GW3	GW4	GW4
			Date	06 Dec 2023	19 Jun 2024	06 Dec 2023	19 Jun 2024	06 Dec 2023	19 Jun 2024	06 Dec 2023	19 Jun 2024
	Unit	EQL									
Analytical results – alkalinity											
Alkalinity (Bicarbonate as $CaCO_3$)	mg/L	1	405	388	312	371	213	202	248	342
Alkalinity (Carbonate as $CaCO_3$)	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1
Alkalinity (Hydroxide) as $CaCO_3$	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1
Alkalinity (total) as $CaCO_3$	mg/L	1	405	388	312	371	213	202	248	342
Inorganics										
Calcium (filtered)	mg/L	1	95	96	51	57	54	54	63	78
Chloride	mg/L	1	104	99	82	102	61	48	162	192
Silicon as SiO2 (filtered)	mg/L	0.1	37.3	39.4	53.0	38.8	34.4	33.6	48.5	47.2
Sodium (filtered)	mg/L	1	150	144	163	260	41	42	118	180
Magnesium (filtered)	mg/L	1	17	17	22	14	26	24	16	18
Potassium (filtered)	mg/L	1	1	1	1	2	<1	<1	1	2
Anions Total	meq/L	0.01	12.2	11.6	10.4	14.6	6.70	5.91	9.94	13.0
Ionic Balance	%	0.01	1.75	3.44	4.90	2.46	0.66	4.72	1.65	1.05
Cations Total	meq/L	0.01	12.7	12.5	11.5	15.4	6.62	6.50	9.62	13.2
Sulfate as SO_4 - Turbidimetric (filtered)	mg/L	1	59	53	89	208	35	25	20	35
Metals										
Aluminium (filtered)	mg/L	0.01	<0.01	0.02	<0.01	0.02	<0.01	0.06	<0.01	0.04
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001	0.004	0.004	<0.001	<0.001	<0.001	<0.001
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (III+VI) (filtered)	mg/L	0.001	0.001	<0.001	0.002	0.002	0.002	<0.001	<0.001	<0.001
Copper (filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.012	0.010	<0.001	<0.001
Iron (filtered)	mg/L	0.05	<0.05	0.21	<0.05	0.05	<0.05	<0.05	<0.05	<0.05
Manganese (filtered)	mg/L	0.001	0.788	0.828	0.149	0.160	0.016	0.008	0.247	0.089
Nickel (filtered)	mg/L	0.001	0.001	<0.001	0.002	0.002	0.011	0.001	0.002	0.002
Zinc (filtered)	mg/L	0.005	<0.005	0.007	<0.005	<0.005	0.026	0.006	0.010	<0.005
Analytical results – nutrients										
Ammonia as N	mg/L	0.01	0.10	0.08	0.11	0.19	<0.01	0.02	0.09	0.34
Nitrite + Nitrate as N	mg/L	0.01	0.01	0.04	<0.01	0.02	1.33	1.27	0.05	0.03
Kjeldahl Nitrogen Total	mg/L	0.1	0.3	0.4	0.4	0.7	0.3	0.3	0.2	1.4
Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	0.01	0.04	<0.01	0.02	1.33	1.27	0.05	0.03
Nitrogen (Total)	mg/L	0.1	0.3	0.4	0.4	0.7	1.6	1.6	0.2	1.4
NA										
Phosphate total (as P)	MG/L	0.01	0.07	0.11	0.09	0.19	0.05	0.10	0.24	1.11

Appendix C
Laboratory quality control reports

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QUALITY CONTROL REPORT

Work Order	: **ES2342343**	Page	: 1 of 7
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Quan Bui	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9493 9582	Telephone	: +61 2 8784 8555
Project	: Dunmore	Date Samples Received	: 06-Dec-2023
Order number	: J17314	Date Analysis Commenced	: 08-Dec-2023
C-O-C number	: ----	Issue Date	: 14-Dec-2023
Sampler	: Quan Bui		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC
* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 5484149)									
ES2342228-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	76	76	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	76	76	0.0	0% - 20%
ES2342422-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	153	153	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	153	153	0.0	0% - 20%
ED040F: Dissolved Major Anions (QC Lot: 5478860)									
ES2342343-001	GW1	ED040F: Silicon as SiO2	14464-46-1	0.1	mg/L	37.3	37.4	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 5478859)									
ES2342343-001	GW1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	59	58	0.0	0% - 20%
EW2305481-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	19	19	0.0	0% - 50%
ED045G: Chloride by Discrete Analyser (QC Lot: 5478858)									
ES2342343-001	GW1	ED045G: Chloride	16887-00-6	1	mg/L	104	110	6.2	0% - 20%
EW2305481-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	57	54	4.2	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 5484822)									
ES2342343-001	GW1	ED093F: Calcium	7440-70-2	1	mg/L	95	95	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	17	17	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	150	150	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED093F: Dissolved Major Cations (QC Lot: 5484822) - continued									
ES2342343-001	GW1	ED093F: Potassium	7440-09-7	1	mg/L	1	1	0.0	No Limit
ES2342423-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	34	35	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	11	11	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	4	4	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5484823)									
ES2342343-001	GW1	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.788	0.783	0.5	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
ES2342423-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.180	0.180	0.0	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.049	0.048	2.1	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.040	0.039	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.253	0.246	2.6	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.07	0.07	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.22	0.23	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5481932)									
ES2342130-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01 (0.10)*	mg/L	14.8	15.4	3.7	0% - 20%
ES2342345-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 5478857)									
ES2342516-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2342343-001	GW1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 5481931)									
ES2341997-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	42.4	43.0	1.5	0% - 20%
ES2342345-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 5481925)									
ES2341997-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (1.0)*	mg/L	6.6	6.6	0.0	No Limit
ES2342345-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (1.0)*	mg/L	5.9	6.4	8.6	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5481926)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5481926) - continued									
ES2341997-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.10	0.14	30.7	0% - 50%
ES2342345-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.02	0.02	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED037P: Alkalinity by PC Titrator (QCLot: 5484149)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.3	81.0	115
				----	50 mg/L	116	80.0	120
ED040F: Dissolved Major Anions (QCLot: 5478860)								
ED040F: Silicon as SiO2	14464-46-1	0.1	mg/L	<0.1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5478859)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	82.0	122
				<1	500 mg/L	99.6	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 5478858)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	102	80.9	127
				<1	1000 mg/L	95.3	80.9	127
ED093F: Dissolved Major Cations (QCLot: 5484822)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	99.8	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	96.9	85.0	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 5484823)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.9	80.0	116
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	102	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.9	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.3	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.2	81.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.1	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.1	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	100	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.0	82.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5481932)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	97.4	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5478857)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	96.8	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5481931)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5481931) - continued								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	100	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5481925)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	93.5	69.0	101
				<0.1	1 mg/L	96.9	70.0	118
				<0.1	5 mg/L	86.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5481926)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	96.0	71.3	126
				<0.01	0.442 mg/L	94.4	71.3	126
				<0.01	1 mg/L	98.9	70.0	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5478859)							
ES2342343-001	GW1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 5478858)							
ES2342343-001	GW1	ED045G: Chloride	16887-00-6	250 mg/L	84.1	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5484823)							
ES2342343-002	GW2	EG020A-F: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	100	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	99.3	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	109	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	102	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	104	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	102	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5481932)							
ES2342130-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5478857)							
ES2342343-001	GW1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	99.9	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5481931)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5481931) - continued							
ES2341997-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5481925)							
ES2341998-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	100 mg/L	88.8	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5481926)							
ES2341998-001	Anonymous	EK067G: Total Phosphorus as P	----	20 mg/L	94.8	70.0	130

QUALITY CONTROL REPORT

Work Order	: **ES2420143**	Page	: 1 of 7
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Quan Bui	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9493 9582	Telephone	: +61 2 8784 8555
Project	: J17314	Date Samples Received	: 19-Jun-2024
Order number	: ----	Date Analysis Commenced	: 21-Jun-2024
C-O-C number	: ----	Issue Date	: 26-Jun-2024
Sampler	: J DEBOER		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC
* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED037P: Alkalinity by PC Titrator (QC Lot: 5875887)									
ES2419856-012	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	179	180	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	179	180	0.0	0% - 20%
ES2419856-013	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	218	219	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	218	219	0.0	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 5875888)									
ES2420143-002	GW2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	371	370	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	371	370	0.0	0% - 20%
ES2420238-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	78	79	1.4	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	78	79	1.4	0% - 20%
ED040F: Dissolved Major Anions (QC Lot: 5872614)									
ES2420143-001	GW1	ED040F: Silicon as SiO2	14464-46-1	0.1	mg/L	39.4	39.1	1.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 5872612)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 5872612) - continued									
ES2419630-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	22	22	0.0	0% - 20%
ES2420264-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	26	25	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 5872613)									
ES2420143-001	GW1	ED045G: Chloride	16887-00-6	1	mg/L	99	100	1.2	0% - 20%
ES2420264-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	81	82	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 5872739)									
ES2420121-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	13	13	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	1	1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	4	4	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EW2402857-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	26	26	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	9	9	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	32	32	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	1	1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 5872738)									
ME2401008-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	1.51	1.51	0.2	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.126	0.124	1.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.012	0.012	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
ES2419853-008	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0020	0.0021	0.0	0% - 20%
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.048	0.048	0.0	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.070	0.072	3.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.039	0.039	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.432	0.440	1.9	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.27	0.27	0.0	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	1.48	1.52	2.7	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 5876344)									
ES2420031-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.04	0.0	No Limit
ES2420572-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.38	0.40	4.5	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 5872615)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 5872615) - continued									
ES2420354-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2420143-001	GW1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 5876343)									
ES2420031-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01 (0.05)*	mg/L	1.58	1.54	2.2	0% - 20%
ES2420572-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.22	2.16	2.9	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 5876349)									
ES2420040-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (5.0)*	mg/L	268	282	5.0	0% - 20%
ES2420572-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1 (5.0)*	mg/L	845	836	1.1	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 5876348)									
EN2405594-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01 (1.00)*	mg/L	236	240	1.7	0% - 20%
ES2420040-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01 (0.20)*	mg/L	74.6	78.0	4.4	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED037P: Alkalinity by PC Titrator (QCLot: 5875887)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	103	81.0	115
				----	50 mg/L	101	80.0	120
ED037P: Alkalinity by PC Titrator (QCLot: 5875888)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.9	81.0	115
				----	50 mg/L	98.7	80.0	120
ED040F: Dissolved Major Anions (QCLot: 5872614)								
ED040F: Silicon as SiO2	14464-46-1	0.1	mg/L	<0.1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5872612)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.5	82.0	122
				<1	500 mg/L	97.9	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 5872613)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	106	80.9	127
				<1	1000 mg/L	99.3	80.9	127
ED093F: Dissolved Major Cations (QCLot: 5872739)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	110	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	104	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	101	85.0	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 5872738)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	92.7	80.0	116
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	94.0	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	93.7	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.3	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.4	81.0	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	94.5	82.0	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.5	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	95.6	81.0	117
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	89.2	82.0	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5876344)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	108	90.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5872615)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	99.9	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5876343)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5876349)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	97.3	69.0	123
				<0.1	1 mg/L	108	70.0	123
				<0.1	5 mg/L	108	70.0	123
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5876348)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	94.5	71.3	126
				<0.01	0.442 mg/L	101	71.3	126
				<0.01	1 mg/L	108	70.0	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 5872612)							
ES2419630-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	93.4	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 5872613)							
ES2420143-001	GW1	ED045G: Chloride	16887-00-6	250 mg/L	93.6	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 5872738)							
ES2420142-001	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	94.6	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	96.6	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	96.3	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	96.2	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	99.0	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	94.3	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 5876344)							
ES2420031-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.5 mg/L	109	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 5872615)							
ES2420143-001	GW1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	109	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5876343)							

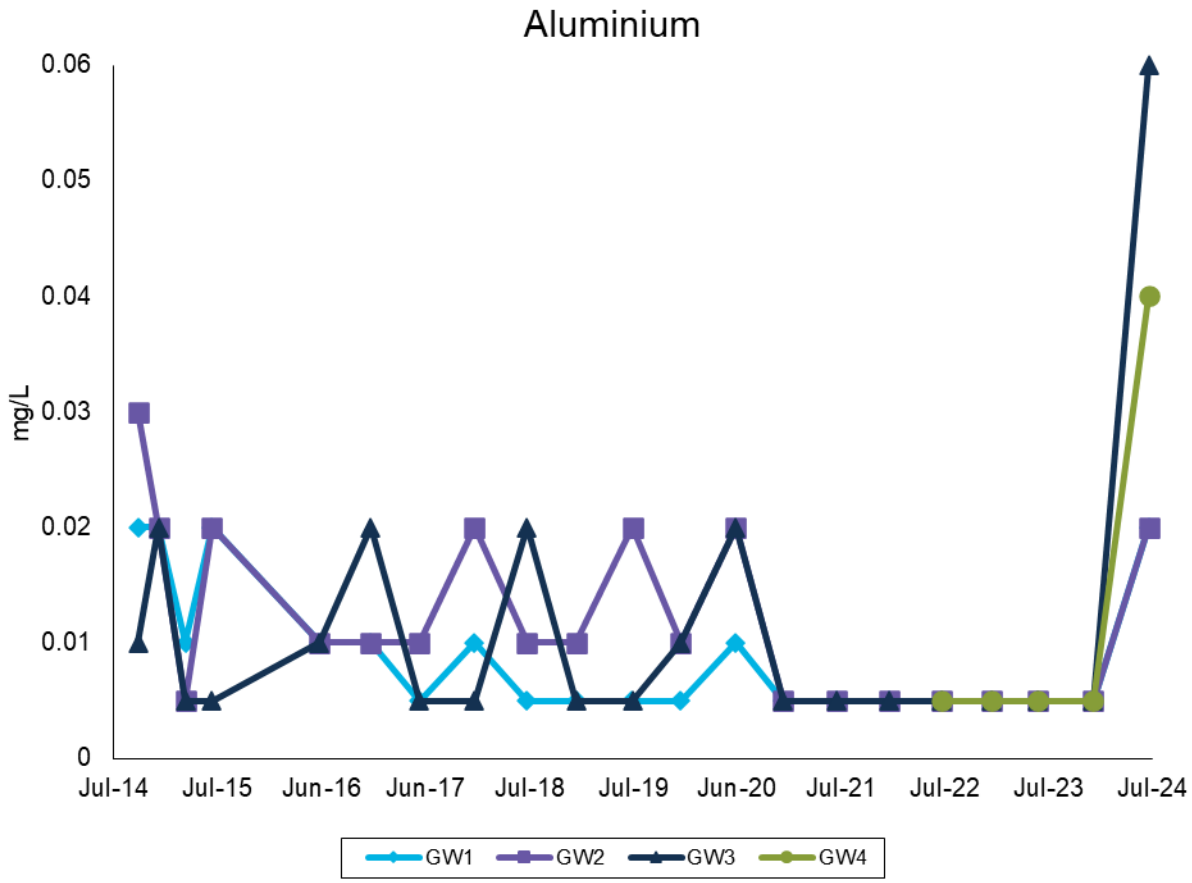
Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 5876343) - continued							
ES2420031-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	2.5 mg/L	97.5	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 5876349)							
ES2420020-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	95.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 5876348)							
ES2420020-002	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	111	70.0	130

Appendix D

Croome west – metals time series charts

EMM
creating opportunities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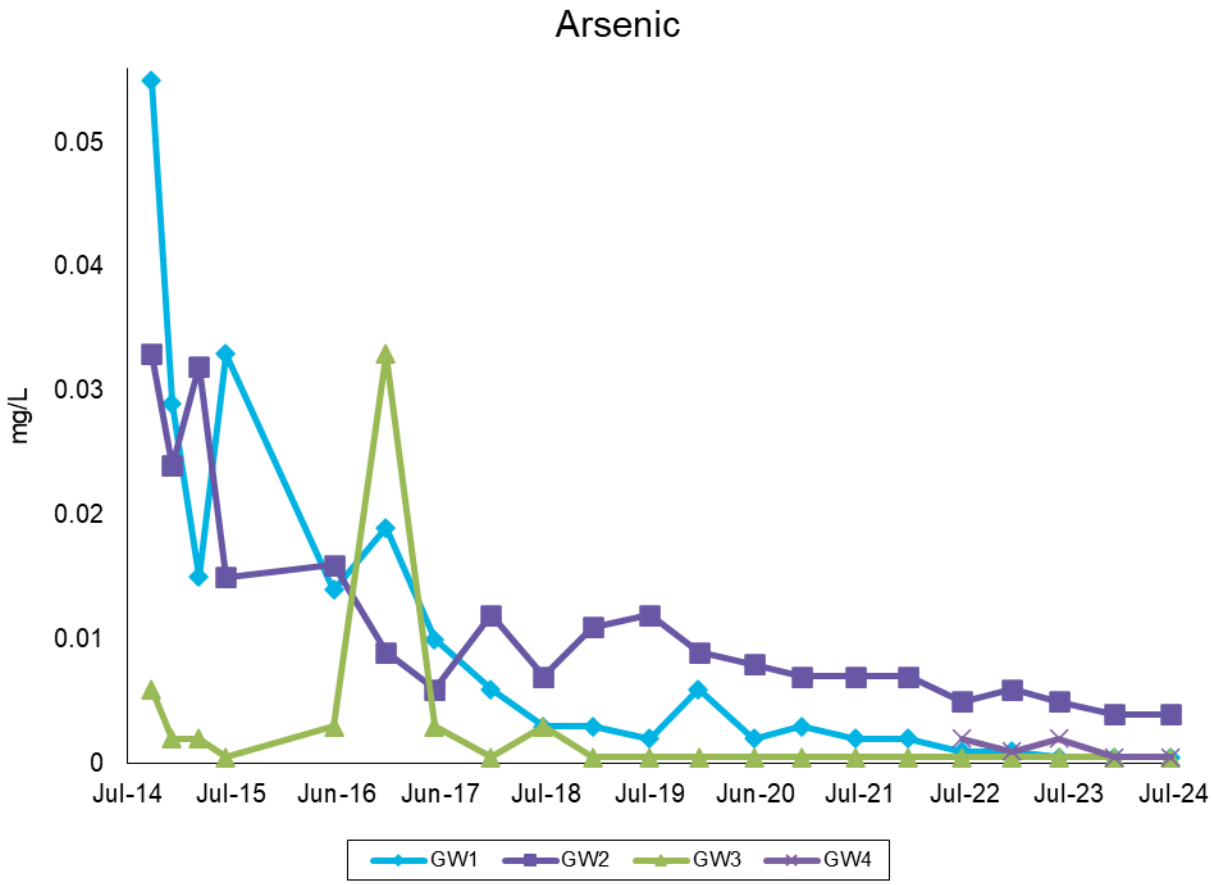
0.03
0.02
0.01
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4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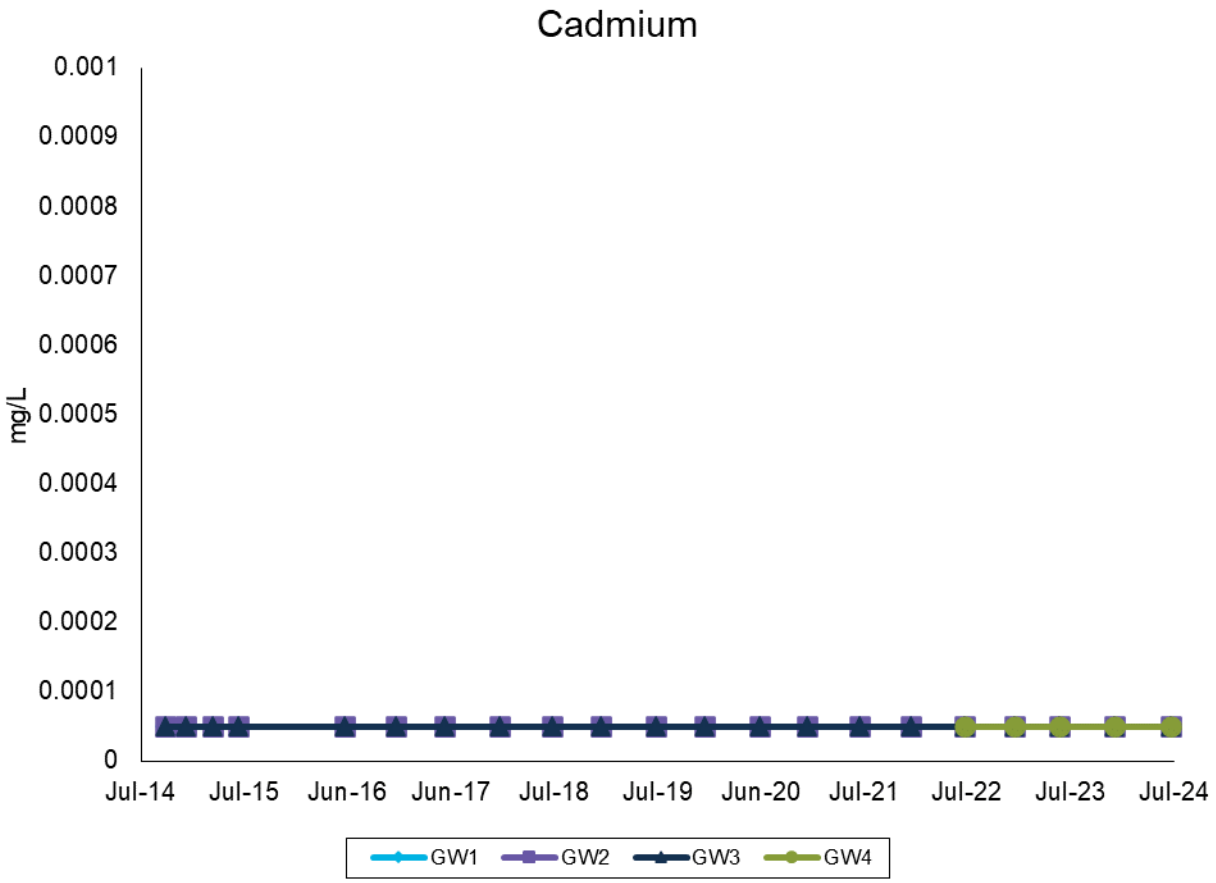
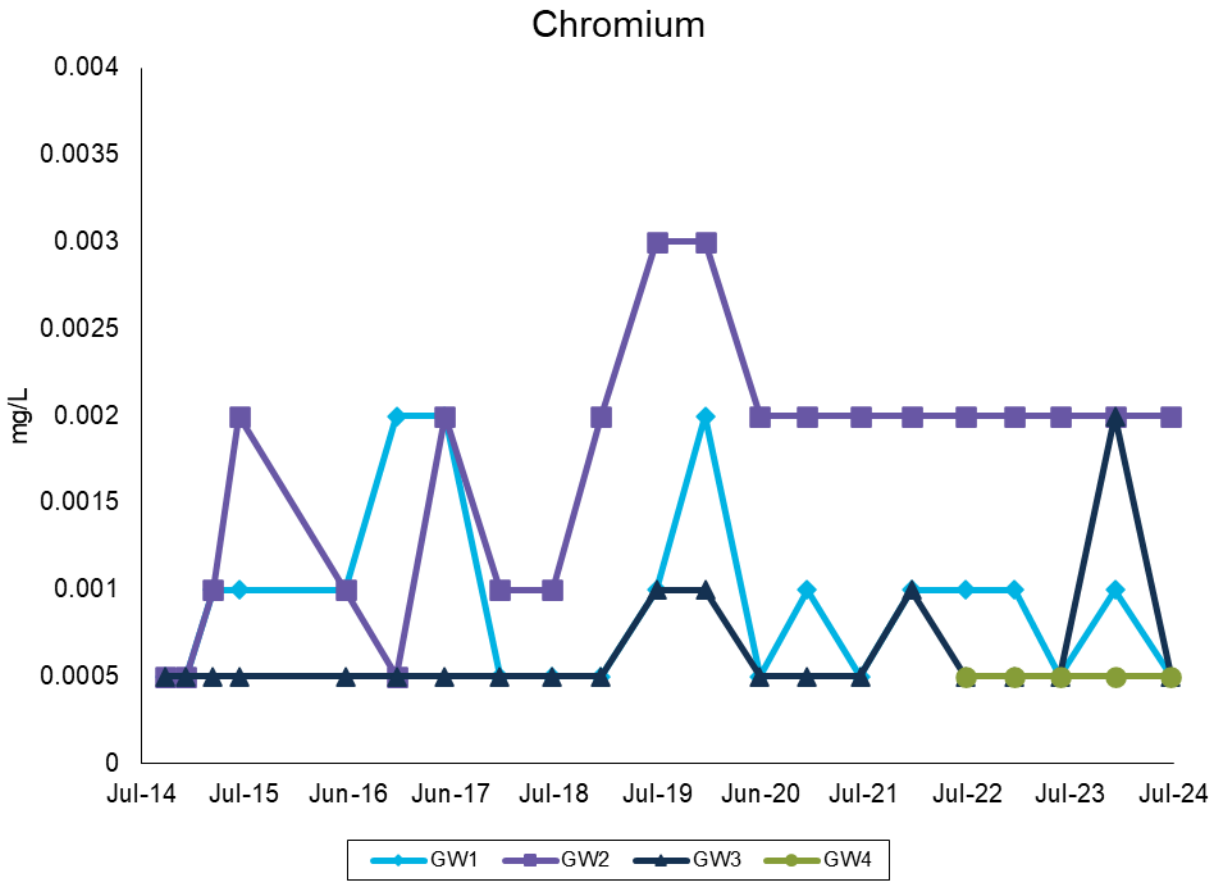
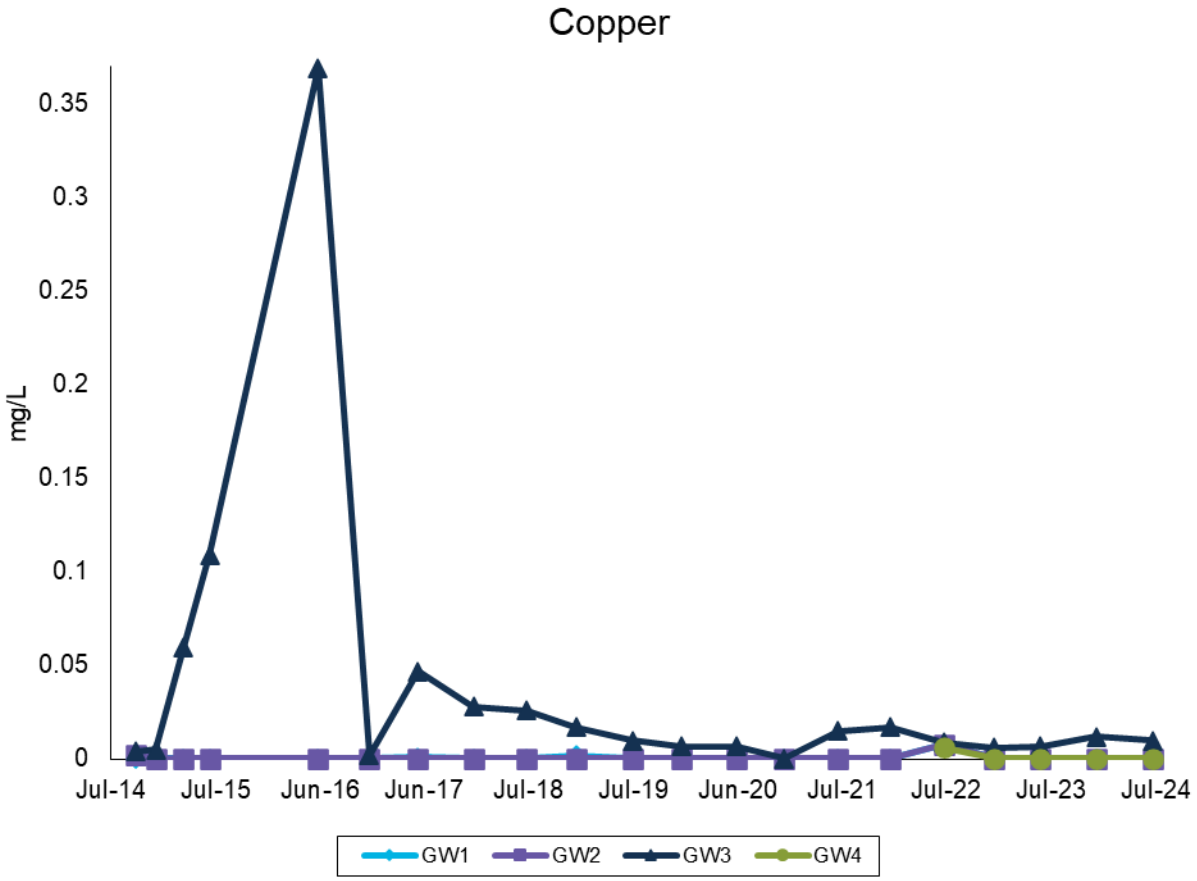
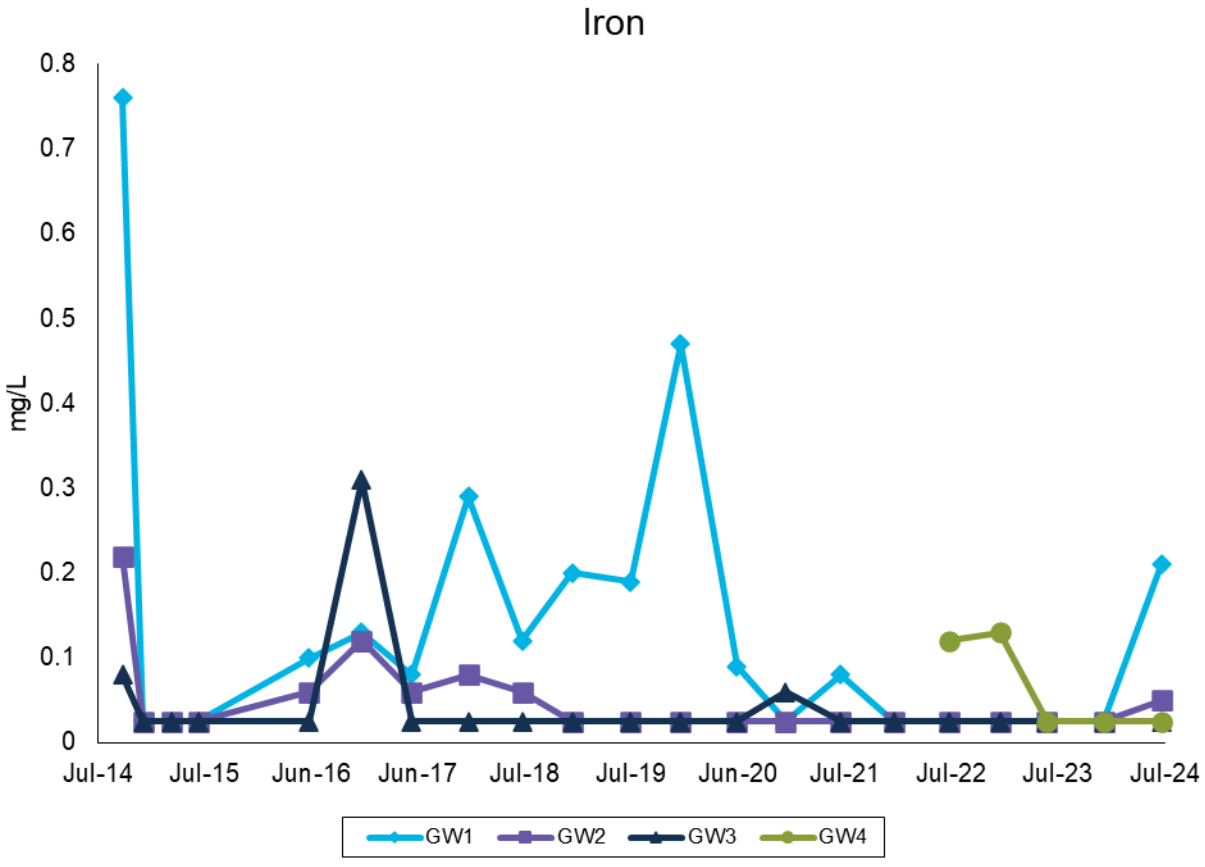
0.04
0.03
0.02
0.01
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Cadmium
0.001
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Chromium
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Copper
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Iron
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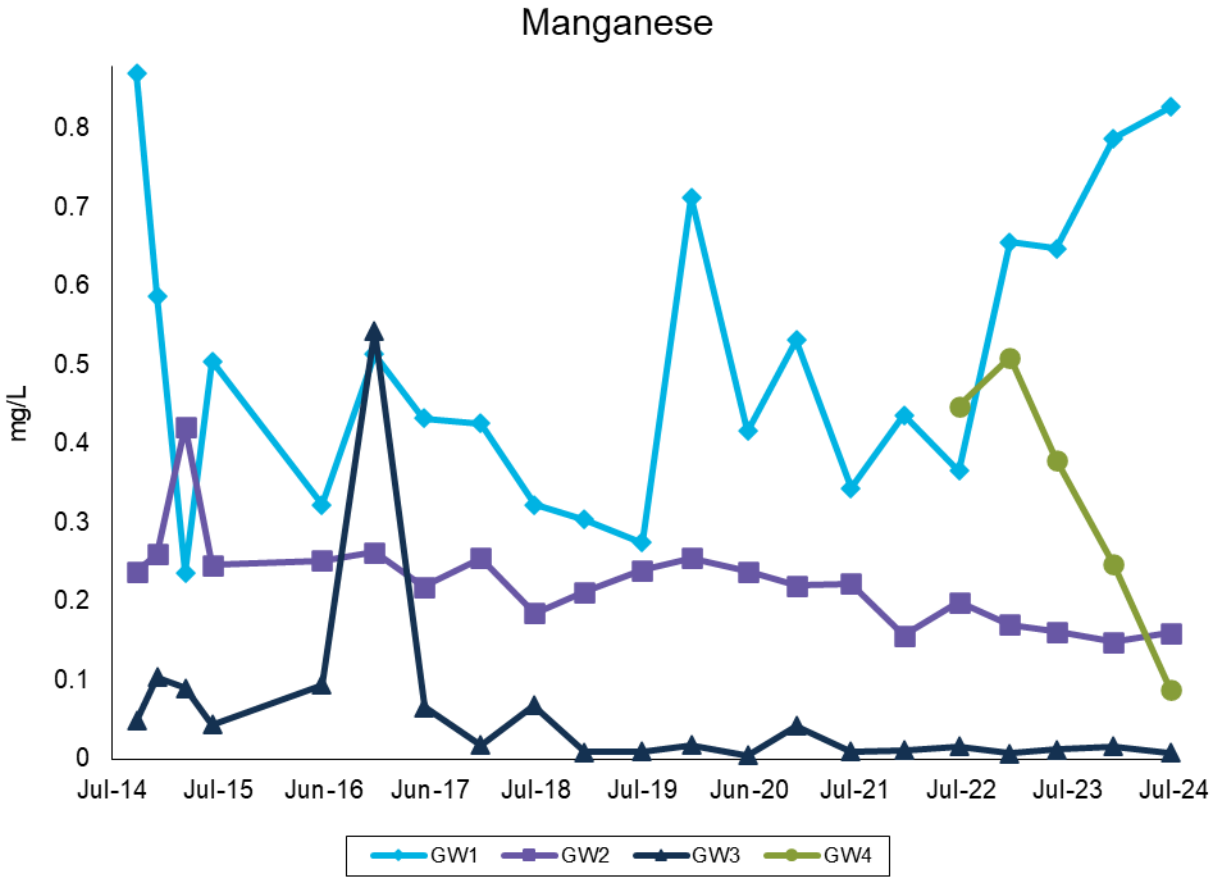
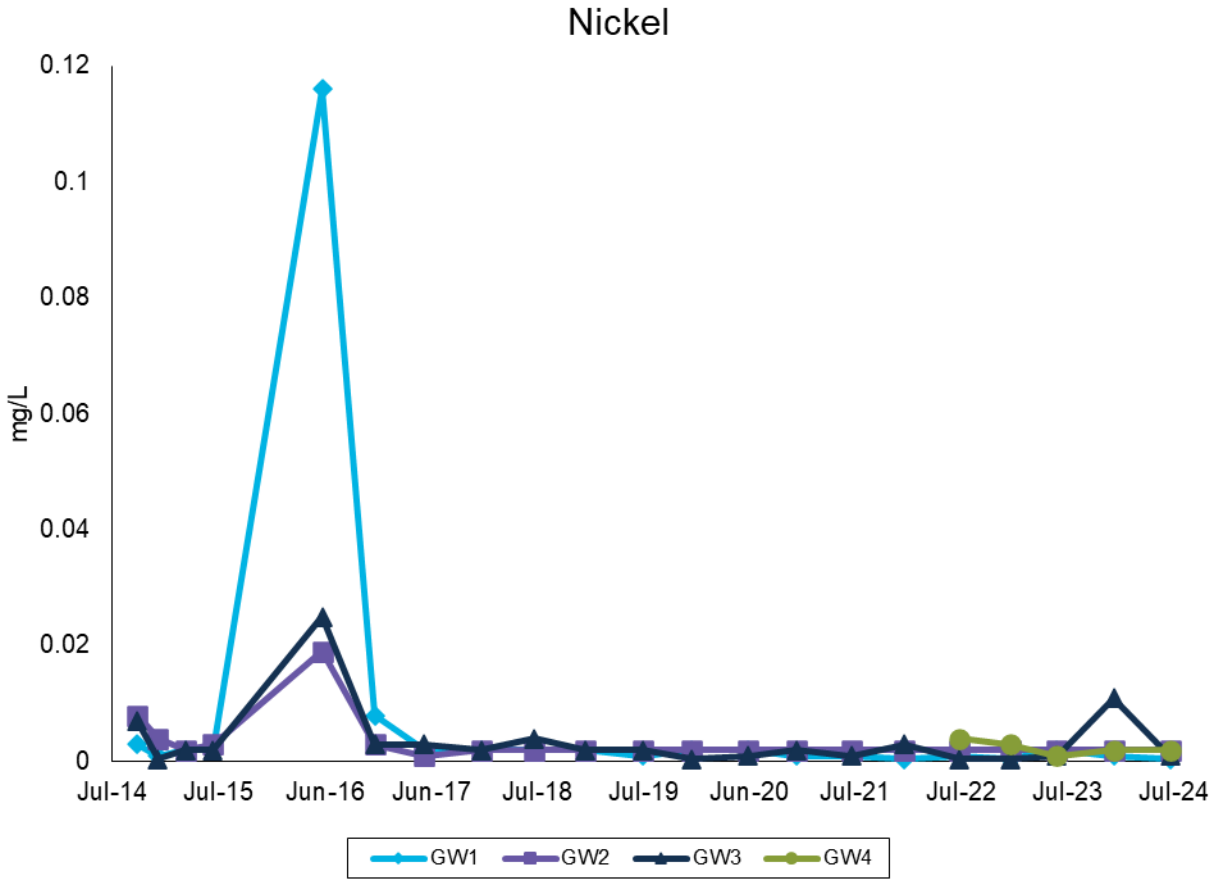
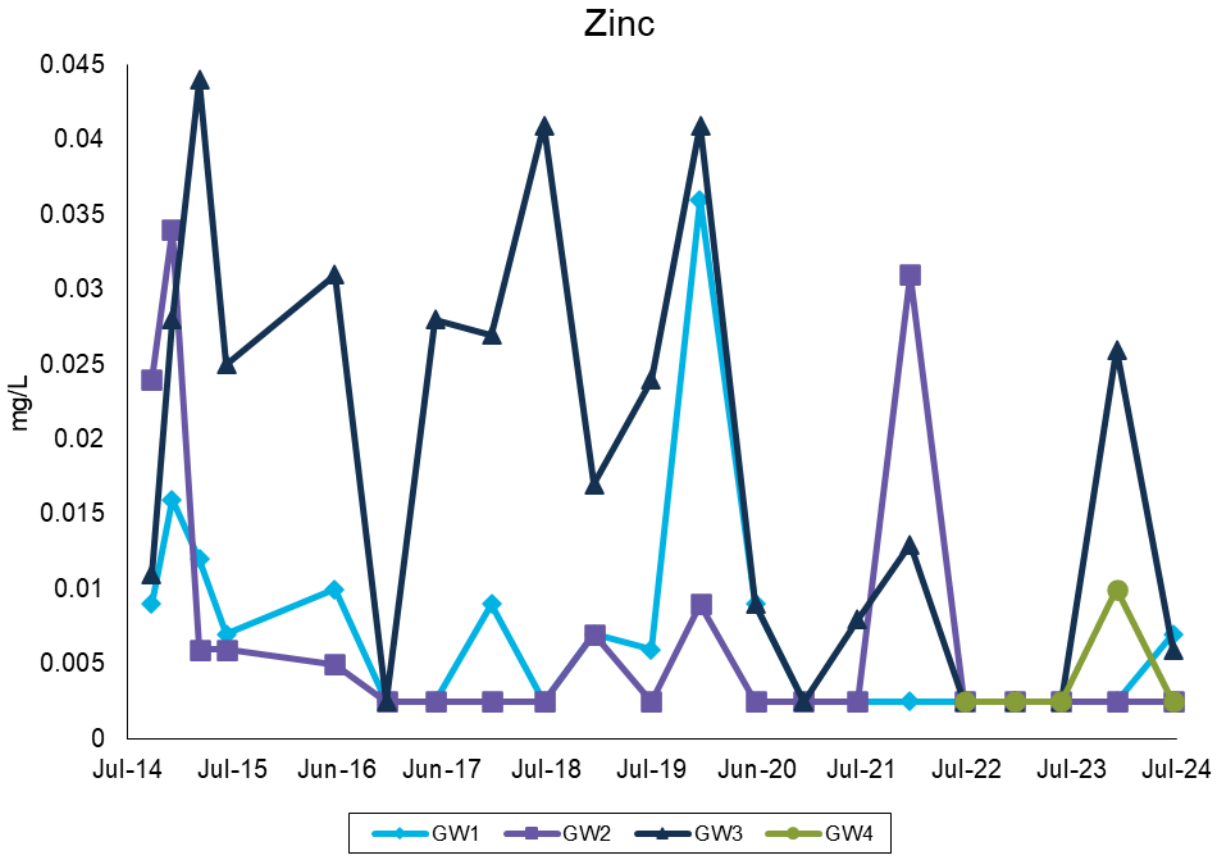
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Manganese
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Nickel
mg/L
0.12
0.1
0.08
0.06
0.04
0.02
0
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4


Zinc
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
mg/L
Jul-14
Jul-15
Jun-16
Jun-17
Jul-18
Jul-19
Jun-20
Jul-21
Jul-22
Jul-23
Jul-24
GW1
GW2
GW3
GW4

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14. Appendix F Goodbush Report

Bushland Restoration Final Report

Boral: Rocklow Road, Dunmore

Good Bush Pty Ltd

CONTRACT PERIOD: September 2023 - August 2024

REPORT PREPARED BY: Marcus Burgess and Tanita Gordon

DATE COMPLETED: 12th September 2024

Final Report for Bushland Restoration at

Boral Dunmore Quarry, Rocklow Road, Dunmore

Table of Contents

Introduction

This final report is for bushland and riparian restoration works carried out by Good Bush Pty Ltd at Boral Metro Quarries, Rocklow Road, Dunmore from September 2023 to August 2024.

The works carried out at this site are based on the recommendations outlined in the 'Boral Dunmore Vegetation Assessment 29/04/2017'.

Objectives

The objective of these works was to undertake bushland restoration works in order to:

- Protect and enhance the remnants of the existing vegetation communities: Illawarra Dry Subtropical Rainforest, Illawarra Grassy Woodland and Melaleuca armillaris Tall Shrubland
- To reduce the area of Boral Dunmore Quarry natural areas impacted by WoNs and environmental invasive weeds
- Treat significant woody weeds throughout establishing 20-year-old revegetation areas to assist development and establishment
- To improve connectivity between local remnant bushland fragments through weed control activities and assisted regeneration
- Assist natural regeneration by removing significant weed species using bush regeneration techniques and methods
- Monitor works, progress and completing using visual based documentation

Vegetation Assessment Report Outcomes

The 'Boral Dunmore Vegetation Assessment 29/04/2017' identified three zones surrounding the hard rock quarry at Tabbitta Road and Rocklow Road, Dunmore as priority areas for restoration work. The three zones are as follows:

Zone 1 – Remnant Vegetation Conservation Area

Zone 2 – Offset Area

Zone 3 – Compensatory Habitat Area

Summary of Works for All Zones

A total of 1,427 hours have been carried out within the three zones during the period from September 2023 to August 2024 resulting in a total cost of $71,350.00 for this period.

The following table is a summary of all hours carried out within the three work zones:

Site	Hours Worked
Zone 1 Remnant Vegetation Conservation Zone	No hours
Zone 2 Offset Area	625 hours
Zone 3 Compensatory Habitat Area	802 hours
Gorse Control	No hours
Total	**1,427 hours**

Works this year focused on maintaining previously worked areas and continuing primary weed control with the Zone 2 and Zone 3 work areas to protect and enhance natural vegetation within the bushland remnants.

The March to April period this year was one of the wettest seasons in history with between approximately 100 to 200 mm of rain falling in one night on 6th April 2024. All sites were muddy and accumulation of flood debris is still visible in some areas from this event. Since this rain event though the trend has moved toward much drier conditions. At the time of this field survey on 9th of September 2024 the majority of sites have become significantly dry.

During the field survey for this report a herd of approximately ten Hereford cattle were observed within the fenced areas surrounding Zone 3 and an attempt was made to push them toward the gate but they were flighty and timid and disappeared into the Melaleuca armiallaris Tall Shrubland community at the top of the hill. As the fencing within this area is intact it appears that this herd of cattle have come from one of the properties to the south of this zone rather than the Rocklow Road farms.

Deer were also sighted during the field survey for this report and evidence of rutting has been observed on the soft wooded trees such as Giant Stinging Tree. Good Bush staff have observed a significant rise in deer populations within the other quarry sites at Holcim and Cleary Bros over the past two years and it seems they have become well established within the Boral managed areas of the Dunmore Hills now as well. Some form of Deer control must be carried out to protect and conserve the significant natural areas that occur on Boral land within the Dunmore Hills.

The following summaries demonstrate the success of these works:

Zone 1 Remnant Vegetation Conservation Zone: No works were carried out within this zone due to inaccessibility of the site during wet periods and cattle accessing the site where fencing is inadequate.

Zone 2 Offset Area: Works within this zone focused on regeneration of the endangered ecological communities (EEC's) Illawarra Grassy Woodland, Illawarra Subtropical Rainforest and Melaleuca armiallaris Tall Shrubland. Secondary weed control and maintenance works were carried out within this zone throughout all previously worked areas to treat re-growth from woody weeds and invasive vines. Additional primary weed control was carried out at the eastern extent of this zone covering approximately 2,150m². Additional populations of the threatened species White Wax Flower *(Cynanchum elegans)* were observed at the eastern extent of the work area and bush regeneration works were carried out within this area to protect and enhance the populations of this threatened species.

Zone 3 Compensatory Habitat Area: Works within this zone focused on regeneration of the endangered ecological communities (EEC's) Illawarra Subtropical Rainforest and Melaleuca armiallaris Tall Shrubland. Secondary weed control and maintenance works were carried out within this zone throughout all previously worked areas to treat re-growth from woody weeds and invasive vines. Additional primary weed control was carried out within subtropical rainforest remnants around the populations of the threatened species Illawarra Socketwood *(Daphnandra johnsonii)* and Illawarra Zieria *(Zieria granulata)* with the Melaleuca armiallaris Tall Shrubland remnants covering approximately 2,150m². The latter readily regenerated within areas where weed control works were carried out.

Gorese Treatment: No Gorse treatment was carried out during this work period due to the lack of Gorse plants appearing throughout this work period. Monitoring surveys on the 9th September 2024 identified a small number of Gorse plants flowering within the paddock to the north of Rocklow Road. This will be a priority for treatment in the 2024/25 work period and will be carried out asap to minimise additional seed setting

Zone 1 Remnant Conservation Area

Zone 1 Remnant Vegetation Conservation Area Site Description

This site consists of a large gully with a south easterly aspect with a drainage line that forms part of the Rocklow Creek catchment. The total site area of this zone is approximately 15 hectares. The gully is framed by basalt cliffs on the northern and western boundaries and large basalt boulders dominate the ground layer throughout much of this gully. The southeastern corner at the lower end of the gully has been cleared for pasture and grazing and a waterfall exists at the high end within the north western corner. Immediately west of the waterfall the Dunmore hard rock quarry dominates the landscape.

The basalt at this site erodes to a fine grained highly fertile soil that supports a diverse subtropical rainforest remnant that has remained largely intact despite the clearing of vegetation that was carried out here and within the surrounding areas in the mid 1800's.

The vegetation at this site consists of subtropical rainforest within the deep shaded and wet areas at the top of the gully and planted woodland at the lower end of the gully.

The subtropical rainforest within this zone consists of diverse rainforest remnants that have remained intact due to the rocky nature of the site, difficulty of removing timber species and low value of timber species present. A diverse range of canopy species exists within this gully including Sassafras *(Doryphora sassafras),* Myrtle Ebony *(Diospyros pentamera)* and all five of the local Fig *(Ficus sp.)* species. An abundance of vines exist within this remnant including Round Vine *(Legnephora moorei),* Kangaroo Grape *(Cissus antarctica)* and Milk Vine *(Marsdenia spp.)* and many species of ferns are present as epiphytes, lithophytes and within the ground layer.

Where gaps in the canopy occur, the gully has been invaded by woody weeds and a large percentage of the open areas on the slopes of the gully are dominated by Lantana.

The lower end of the gully has been revegetated within the last ten years using a range of local native tree species, some of which are not entirely relevant to this site. The revegetated areas are also subjected to grazing by cattle and woody weeds have colonised these areas.

Summary of Works

Works within this zone consisted of primary weed control targeting woody weeds throughout established approximately 20 year old revegetation. Large amounts of Wild Tobacco and Lantana were dominating the revegetation areas on the southern side of the creek while encroachment of Kikuyu was impacting the plantings on the northern side of the creek. A total of 25,000m² of primary weed control was carried out within this zone.

Infill planting was scheduled for this zone but the fencing has fallen into disrepair. Cattle have accessed this site on a number of occasions. The hardwood stakes installed to monitor the photo points were removed and lost and cow pats litter the floor throughout the worked areas.

The following hours worked and square metres covered were carried out within this site:

Date	Hrs	Weed Control	Primary (m²)
* No weed control activity undertaken within this zone due to wet weather restricting access and disruption due to cattle access within the work areas.			

Description of Works

- No works were carried out within this area during this period due to the lack of fencing surrounding the site. Work will recommence within this area once the fencing has been repaired.

- Treatment of Gorse was carried out during July and August 2023 during the flowering period to break the seed cycle

Zone 2 Offset Area Works

Zone 2 Offset Area Site Description

This zone is located south of Rocklow Road and consists of a large bushland remnant with a creek line flowing through the middle. The total site area of this zone covers approximately 18.3 hectares. The majority of this zone is perched on the rocky hillside immediately adjacent to Rocklow Road and supports the 'Melaleuca armillaris tall shrubland' vegetation community. The creekline drops toward the eastern end of the site forming a gully which is well defined by the presence of the rainforest tree species and is identified as the 'Illawarra Subtropical Rainforest' vegetation community. The creek flows close to Rocklow Road at one point where dumping of rubbish and weed material has introduced several highly invasive weed species. Recent improvements to the fencing has been helpful in reducing the rubbish dumping within this area. On the southern side of the gully a tall intact canopy of Forest Red Gum *(Eucalyptus tereticornis)* exists that defines the 'Illawarra Grassy Woodland' vegetation community on site.

The Offset Area has been divided into three zones based on the three different vegetation communities found within this zone. Each of the three vegetation communities have had primary and secondary weed control works targeting woody weeds and invasive vines. The three zones with the Offset Area are as follows:

Zone 2a: Melaleuca armillaris Tall Shrubland

Zone 2b: Illawarra Subtropical Rainforest

Zone 2c: Illawarra Grassy Woodland

Summary of Works

This contract period bush regeneration works focused on secondary and primary weed control within the woodland and rainforest remnants and the rainforest ecotone at the eastern extent of this zone. Regeneration of native canopy species within these areas this year has been rapid and a connected sub-canopy exists within the RF remnant.

Primary weed control was carried out at the eastern extent of this zone during this contract period. Additional populations of the threatened plant species White Wax Flower *(Cynanchum elegans)* were located within the ecotone between the rainforest and woodland remnants. Mass regeneration of Illawarra Zieria *(Zieria granulata)* has been observed within some areas and *Homalanthus stillingiifolius* has emerged within the site and is regenerating naturally and secondary populations of this regionally rare plant can be found throughout the site.

The following hours worked and square metres covered were carried out within the three zones at this site:

Date	**Hrs**	**Weed Control**	**Primary (m²)**
28/9/2023	56	Primary weed control heading east through the woodland, targeting Lantana, Wild Tobacco and *Senna septemtrionalis.* Use the cut and paint method to treat woody weeds, and process Lantana pieces as small as possible to attempt to prevent further regrowth. Hand remove ascending Cape Ivy, bundle and securely raft. *Boobook Owl spotted on site - afternoon*	400m²
5/10/2023	70	Secondary weed control targeting mass Lantana *(L. camara)* regrowth throughout the eastern extent of previously worked areas (woodland). Cut and paint treatment of woody weeds Lantana and Easter Cassia *(Senna pendula var. glabrata).* Processing materials to break down onsite. Hand removal of woody weed seedlings (African Olive, Lantana, Easter Cassia) and Moth Vines *(Araujia sericifera).* Primary weed control of Lantana pushing at the eastern boundary, area of approximately 100m².	3,000m²
9/10/2023	62	Continue primary weed control targeting woody weeds and ascending vines through woodland. Cut and paint Lantana, Wild tobacco, Cassia and Ink Weed.Hand remove, bundle and securely raft	180m²

		ascending Moth Vine and Cape Ivy. Frill one large African Olive.	
28/12/2023	38	Begin maintenance sweep heading southeast through eastern woodland remnant, targeting woody weed regrowth and ascending vines. Cut and paint Lantana, African olive, Wild tobacco, and Cassia seedlings. Hand remove, bundle and securely raft ascending Cape Ivy, or patches of on ground Cape Ivy to prevent further spread and smothering of native ground covers. Begin maintenance sweep on the south-eastern extent of the natural regeneration. Cut and paint Lantana, African olive Cassia and Wild tobacco. Hand remove, bundle and securely raft ascending Moth Vine and Cape Ivy.	1,000m²
10/4/2024	42	Begin maintenance sweep through Zone 2 Area 3, beginning south of the pulpit rock. Target woody weed regrowth, including Lantana, Wild tobacco and African Olive.Hand remove, bundle and securely raft ascending Cape Ivy and Moth Vine to prevent vegetative growth. Continue sweep east through to the areas most recently treated with primary weed control. Processed Lantana fragments as small as 1inch long were found reshooting, these were hand removed and rafted to prevent any further growth. Continue hand removal of ascending vines throughout this area, including White Passionfruit, Cape Ivy and Blue Passionfruit.	1,500m²
28/6/2024	63	Primary weed control in the Grassy Woodland pushing back mass weed infestation on the eastern perimeter of the worked area. Cut and paint treatment of Lantana and African Olive. Processing materials to break down on site.	700
2/07/2024	77	Primary weed control covering 800m². Cut and paint treatment of Lantana and African Olive. Processing materials to break down on site. Continue secondary weed control, hand removal of ascending vines throughout this area, including	2200

		White Passionfruit, Cape Ivy and Blue Passionfruit. See map for details.	
11/07/2024	91	Continue primary weed control targeting Lantana and wild tobacco heading east from the previously worked areas. See below for management issues. Continue hand removal of Cape Ivy through previously worked areas.	2100
2/08/2024	56	Continue primary weed control through remnant woodland, heading east targeting woody weeds including Lantana, Wild tobacco and Cassia. See photos below. Due to the fertile and somewhat water logged nature of the soil in the area we worked it was decided again to not process woody weed materials to help mitigate fragment reshooting. Continue treatment of ascending Cape Ivy by intensive hand removal, bundling and securely rafting to prevent further vegetative growth on site through areas that have been previously worked. It was noted that there is approx.. 90% ground cover of native grasses through some of the initial areas of primary weed control. Flowers of Cape Ivy were removed prior to bundling and crushed to suspend seeding.	820
9/08/2024	70	Intensive hand removal in freshly regenerating areas, targeting of Cape Ivy and secondary woody weed growth. Hand removal of Cape Ivy, bundling all material and securely rafting off-ground. Hand removal of woody weed seedlings and regrowth including Lantana and African Olive.	3000
TOTAL	**625 hours**		**14,900m²**

New population of White Wax Flower (*Cynanchum elegans)* as identified on the 2nd of August 2024): N 6167106 E 300187 (+/- 5m), 42m

Work Areas Map

The following map identifies the approximate areas worked within the three zones:

Map: 2/7/2024 Primary weed control covering 800m² and secondary weed control covering 1400m².

Photo: 2/8/2024 New population of *Cynanchum elegans* found on site within Lantana, record of its location taken (GPS).

Map: 9/8/2024 Secondary weed control covering 3000m², including *cynanchum* population pin.

Vegetation Condition Assessment

The vegetation condition assessments are based on a 20m² area surrounding the established photo points within each zone.

Zone 2a: Melaleuca armillaris Tall Shrubland

Photo Point	A1, A3		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Melaleuca armillaris* *Eucalyptus tereticornis*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Zieria granulata* *Dodonaea viscosa*	80% native cover 20% weed cover	95% native cover 5% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Indigofera australis* *Leucopogon juniperinus*	30% native cover 70% weed cover	80% native cover 20% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Plectranthus graveolens*	80% native cover 20% weed cover	95% native cover 5% weed cover

* indicates exotic plant species

Zone 2b: Illawarra Subtropical Rainforest

Photo Point	B1		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of rainforest species such as *Toona celata* *Polysias elegans* *Pittosporum undulatum* *Eucalyptus amplifolia*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by rainforest species such as *Hibiscus heterophyllus* *Guioa semiglauca*	95% native cover 5% weed cover	100% native cover
Shrub layer	The shrub layer surrounding this photo point is dominated by small regenerating rainforest species and *Solanum mauritianum** *Solanum aviculare* *Lantana camara** *Homalanthus stillingiifolius*	20% native cover 80% weed cover	70% native cover 30% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by regenerating native rainforest trees and ferns as well as a range of annual weeds and invasive vines such as *Delairea odorata** *Arujiua sericifera** *Stephania japonica*	40% native cover 60% weed cover	70% native cover 30% weed cover

* indicates exotic plant species

Due to the wet season experienced in 2023/24 there has been a flush of invasive woody weeds, somewhat reversing the progress of the site's shrub and ground layers.

Zone 2c: Illawarra Grassy Woodland

Photo Point	A2		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Melaleuca armillaris* *Eucalyptus tereticornis*	100% native cover	100% native
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Notolea venosa* *Dodonaea viscosa* *Acacia maidenii* *Olea europaea subsp. cuspidata**	80% native cover 20% weed cover	90% native 10% weed
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Indigofera australis*	30% native cover 70% weed cover	80% native 20% weed
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses and annual weeds *Bidens pilosa**	40% native cover 60% weed cover	90% native 10% weed

Zone 2 Photographs

A1 Photo point prior to commencement of works in 2017.

A1 Photo point after primary weed control and maintenance, August 2024

A3 Photo point prior to commencement of works in 2017

A3 Photo point showing regeneration of woodland species and *Zieria granualata,* August 2024.

Mature Forest Red Gum *(Eucalyptus tereticornis)* surrounded by dense woody weeds such as Lantana, prior to commencement of works in 2017.

The same view post works demonstrating woodland regeneration after Lantana removal, August 2024.

Primary weed control area within the rainforest and woodland ecotone - view, August 2022.

The same view showing native regeneration where Lantana has been removed August 2024 (not the top of the Celery Wood tree next to the big Eucalypt ahs been blown out by wind).

Regeneration of rainforest such as Giant Stinging Tree since Lantana removal was completed, August 2022.

Regeneration of rainforest such as Giant Stinging Tree,same view, August 2024.

Large/mature male kangaroo within the Zone 2 woodland remnant - 2022.

Native Passionfruit *(Passiflora herbertiana)* particularly abundant within these areas.

Regenerating *Homalanthus stillingiifolius* 2022.

Photo: Dry *Pterostylis curta,* no flowers.

Zone 3 Compensatory Habitat Area

Zone 3 Compensatory Habitat Area Site Description

This zone is located south of Rocklow Road and consists of a large bushland remnant on a hilltop with a small ephemeral creek line within a gully to the south of the hill. The total site area of this zone covers approximately 23.1 hectares. The majority of this zone is perched on the rocky hillside and supports the Melaleuca armillaris tall shrubland vegetation community. The gully drops at the southern end of the zone which is well defined by the presence of rainforest species and some very impressive land large Moreton Bay Fig (Ficus macrophylla) trees.

Extensive revegetation has been carried out within this zone within the southern gully and on the eastern and western edges of the zone. Hundreds of thousands of trees have been planted within this zone and are now reaching maturity. Many open areas that have been cleared of vegetation also exist within this zone with the majority of these clearings occurring on the rocky hill tops.

Works within this zone have focused on treating woody weeds within the establishing revegetation along the western boundary of the zone.

Vegetation community boundaries within the compensatory habitat zone are as follows:

Summary of Works

Works within this contract period focused heavily on primary weed control throughout established revegetation areas. Works commenced for the northern fence line that defines this zone and have continued south covering over 2ha. The western fence line defined the boundary of this work area and an old dry-stone wall that divides the revegetation areas from the natural bushland was defining the eastern boundary.

Work continued south focusing on primary weed control within the Melaleuca armillaris Tall Shrubland vegetation community and many individual plants of the threatened species Illawarra Zieria *(Zieria granulata)* were uncovered within this area.

Primary weed control works continued eastward from this point and a large subtropical rainforest remnant was reached that is dominated by several large and very old Ficus macrophylla.

The following hours worked and square metres covered were carried out within this site:

Date	Hrs	Weed Control	Primary (m^2)
4/9/2023	56	Secondary weed control sweep on the eastern side of dry creek channel in Zone 3 revegetation area heading in a southern direction , targeting woody weeds and vigorous ascending vine growth. Cut and paint treatment of large woody weed regrowth, namely Lantana, Wild Tobacco, Senna. Hand removal and skirting of Moth Vine that was ascending into the existing revegetation canopy.	1,000
12/9/2023	42	Continue intensive vine and woody weed removal on the western side of the dry creek bed, sweeping south to the *Daphnandra johnsonii* populations to help consolidate worked areas. Cut and paint Wild Tobacco, Lantana and Arsenic Bush. Hand remove ascending Cape Ivy and Moth, bundle and securely raft to prevent vegetative growth.	900
13/9/2023	27	Continued secondary sweep heading south on the eastern side of the dry creek bed, connecting and consolidating areas previously worked. Target woody weeds (Wild tobacco and Lantana regrowth) and ascending vines (Moth vine and Cape Ivy) via cut and paint or hand removal methods.	500

18/9/2023	40	*Echidna spotted in the FIRST patch of removed Sida rhombifolia on the eastern side of the dry creek bed* Continue secondary sweep on the eastern side of the dry creek bed, continuing consolidation of woody weed control from the previous visit. Cut and paint Wild tobacco, Lantana, *Senna septemtrionalis*. Hand remove and securely raft ascending vines such as Moth vine and Cape Ivy. Push encroaching Lantana wall back over the western rock wall as pockets of natural regeneration were being smothered.	800
26/10/2023	84	Continue intensive primary weed control on the southern end – consolidating the previously worked areas on both the eastern and western sides of the dry creek bed. Hand remove, bundle and securely raft ascending Moth Vine and Cape Ivy. Cut and paint Lantana, Wild Tobacco and Cassia. Prune back Lantana on the western fence line to prevent further encroachment into the work site.	240
13/11/2023	63	Primary weed control pushing south to the Daphnandra/Sarsaparilla areas, targeting ascending vines and woody weeds. Cut and paint Tobacco, Lantana, Cassia, Ink Weed. All woody weeds were processed on site. Intense hand removal on ascending native vegetation including Moth Vine, Cape Ivy and White Passionfruit. All vines were hand removed, bundled and securely rafted. Begin primary weed control on the western wall of Lantana (including Tobacco), pushing back approx. 2m to the old fence line and uncovering native recruitment including but not limited to: Red Cedar, Melicope, White Cedar, Red Ash and Whale Bone. One Eucalyptus had a juvenile Giant Pepper Vine *(Piper novae hollandiae)* which has been previously unseen throughout this work zone.	120
22/12/2023	45	Secondary and maintenance weed control sweep targeting woody weeds and ascending vines in revegetation area starting from access gate. Cut and paint treatment of Lantana, Wild Tobacco, Inkweed and Paddy's Lucerne. Hand removal of ascending vines growing in regenerating plants and canopy species, targeting mainly Moth Vine and Cape Ivy.	450

11/1/2024	84	Zone 3, Area 2: Primary and secondary weed control conducted along the ecotone between Area 2, the Melaleuca armillaris Tall Shrubland and the Subtropical Rainforest Area 3, from the Big Fig towards the Daphnandra population in Area 1. Cut and paint treatment of woody weeds, primarily Lantana and Wild Tobacco. Materials processed on site to break down naturally.	2,000
7/2/2024	45	Continue primary weed control heading east through the woodland remnant adjacent to the rainforest eco tone. Cut and paint Lantana and Wild tobacco, process all woody weed materials on site. Some areas beneath large Eucalypts were left due to 30km southerly winds and potential for falling limbs to harm staff. Continue secondary weed control through previously worked areas of primary weed control, targeting ascending Cape Ivy, which was hand removed, bundled, and securely rafted. Cut and paint Lantana, Wild tobacco and African olive regrowth.	1,725
7/5/2024	93	Begin maintenance sweep from the gate in Zone 3 heading south targeting all woody weed regrowth and ascending vines on the western side of the stream. Intensive hand weed controls around western creek line monitoring point targeting ascending vines, woody weeds and annuals which were hand removed or treated using the cut and paint method. Continue secondary and maintenance sweeps on the eastern side of the creek line focusing on Paddy's Lucerne and Moth Vine to create space for native ground covers and pioneer canopy species which were being outcompeted by weed coverage. Cut and paint large clumps of Lantana regrowth, Wild tobacco and African olive. Hand remove bundle and raft Moth Vine and Cape Ivy.	600
24/5/2024	49	Continue intensive secondary/maintenance sweep from previous visit (May 7) on the eastern side of the creek line, targeting all woody weeds and ascending vines including but not limited to: Lantana, Wild tobacco, African olive, Paddy's lucerne, Moth Vine and Cape Ivy. Woody weeds were hand removed and upturned to prevent regrowth from processed fragments (processed fragments	570

		found with root systems due to wet soil conditions) and ascending vines were bundled and securely rafted to prevent vegetative growth. A new small patch of Cynanchum was identified within a grove of Paddy's lucerne, this has been GPS marked (photo and screenshot attached below).	
21/6/2024	70	Maintenance sweep through the western edge of the zone 3 area, targeting secondary growth of woody weeds and ascending vines. Hand removal of Paddy's Lucerne and Moth Vine. Cut and paint control of Lantana, Wild Tobacco and Senna.	2,000
12/07/2024	56	Continue intensive sweep of woody weeds and vines on the eastern side of the creek, targeting Paddy's Lucerne, Lantana, Wild tobacco, Moth Vine and Cape Ivy. Removal of weeds in these smothered areas has seen a positive growth rate of native ground covers, mid story shrubs and pioneer canopy species that are still showing signs of healthy growth and connection between areas previously treated.	910
15/07/2024	49	Secondary weed control sweeps were undertaken across high priority areas within Zone 3 targeting woody weed regrowth and ascending vines. Cut and paint treatment of Lantana, Wild Tobacco primarily. Hand removal and rafting of Lantana regrowing from fragments. Hand removal and skirting of ascending Moth Vine and Cape Ivy.	10,000
TOTAL	**802**		**11,915m²**

New population of White Wax Flower (*Cynanchum elegans)* as identified on the 24th of May 2024): N 6166949 E 299854 (+/- 16m), 66m

Work Areas Map

The following map identifies the approximate areas worked within this contract period:

Map: Weed control work area conducted 15/7/24 covering approximately 10,000m².

Vegetation Condition Assessment

The vegetation condition assessments are based on a 20m² area surrounding the established photo points within each zone.

Photo Point	A2		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of revegetation *Melaleuca armillaris* *Eucalyptus saligna* *Acacia maidenii*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Hakea salicifolia* *Dodonaea viscosa* *Glochidion ferdinandi*	100% native cover 0% weed cover	100% native cover 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Solanum mauritianum**	40% native cover 60% weed cover	70% native cover 30% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Sida rhombifolia** *Bidens pilosa** *Sigesbeckia orientalis*	40% native cover 60% weed cover	60% native cover 40% weed cover

Photo Point	3B		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of revegetation *Melaleuca armillaris* *Eucalyptus saligna* *Acacia maidenii*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Hakea salicifolia* *Dodonaea viscosa* *Glochidion ferdinandi*	100% native 0% weed	100% native 0% weed
Shrub layer	The shrub layer surrounding this photo point was dominated by *Lantana camara** *Solanum mauritianum** *Ageratina adenophora**	30% native 70% weed	90% native cover 10% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Sida rhombifolia** *Sigesbeckia orientalis* *Asplenium flabelafolium* *Aneilema biflorum*	30% native cover 70% weed cover	90% native cover 10% weed cover

Photo Point	3C		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Melaleuca armillaris* *Acacia maidenii*	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by *Clerodendrum tomentosum* *Maclura cochinensis* *Ehretia accuminata* *Solanum mauritianum**	80% native cover 20% weed cover	90% native cover 10% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Zieria granulata* *Croton verreauxii*	70% native cover 30% weed cover	90% native cover 10% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Bidens pilosa** *Pellaea falcata* *Ehrharta erecta**	60% native cover 30% weed cover	80% native cover 20% weed cover

Photo Point	3D		
Commencement Date	September 2023		
Monitoring Survey Date	9th September 2024		
Vegetation Condition		**Percentage Cover (PRIOR)**	**Percentage Cover (POST)**
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of *Ficus macrophylla*	100% native cover	100% native cover
Mid Stratum (sub canopy	The mid stratum surrounding this photo point is dominated by *Elaeodendron australe* *Clerodendrum tomentosum* *Maclura cochinensis*	80% native cover 20% weed cover	100% native 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by *Lantana camara** *Cestrum nocturnum** *Pittosporum multiflorum*	30% native cover 70% weed cover	80% native cover 20% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds and woody weed seedlings such as *Oplismenus imbecillis* *Bidens pilosa** *Solanum pseudocapsicuum** *Ehrata erecta**	40% native cover 60% weed cover	80% native cover 20% weed cover

Zone 3 Photographs

3B Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

3B Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

3C Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

3D Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

Big Fig: Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

Big Fig: Photo point prior to commencement of works.

The same view after intensive hand removal of weeds, August 2024.

Evidence of rutting/damage caused by deer - 2 doe identified on site the day of surveying 9th September 2022.

Photos: May *Cynanchum elegans* population.

Photos: Weed control (maintenance) works throughout Zone 3.

Gorse Treatment

Gorse populations have been treated in previous years by Good Bush (July/August 2023) and Illawarra District Weeds Authority (IDWA) using spray controls. This treatment method, while effective in the initial treatment allowed plants to regrow from the base after a period of four or five months showing the spraying method to be an ineffective treatment method.

No Gorse control works have been conducted in the September 2023 - August 2024 contract period however, due to monitored regrowth it is recommended that treatment be a focus of the September 2024 - August 2025 works.

All Gorse plants treated during these works used the cut and paint method to ensure success of the weed treatments. Materials were not processed or removed from site as there was no seed present during the treatment period. All Gorse plants treated at this time were in full flower which is the optimum time for treatment to break the seed cycle and ensure no additional seeds were borne this year. Follow work will be required over consecutive years to treat the flush of seed stored in the soil and it is anticipated after a period of approximately five years the Gorse plants should be effectively eradicated from this site.

Work area maps for Gorse treatment below:

Photo: Gorse infestation off Rocklow Road prior to treatment 2022.

Appendix 1 Vegetation Monitoring Field Sheets

Good Bush Monitoring Survey sheet		Site: Boral Zone 3 (west of creek)	
Date: 09/09/2024		Plot No: 3A Post Assessment	
Recorder: Marcus Burgess and Tanita Gordon		Plot Size: 20 x 20m	
GPS Northing	616694	GPS Easting	0299814
GPS Accuracy	+-7m	GPS Elevation	69m
Vegetation Community: Established Revegetation with Rainforest understory			

NATIVE			WEED		
Botanical Name	Abundance	% Cover	Botanical Name	Abundance	% Cover
Acacia maidenii	U	<5%	*Ageratina riparia*	NP	
Acmena smithii	U	<5%	*Araujia sericifera*	U	<5%
Breynia oblongifolia	U	<5%	*Bidens pilosa*	NP	
Carex longibrachiata	U	<5%	*Cirsium vulgare*	NP	
Celastrus australis	U	<5%	*Delairea odorata*	U	<5%
Commelina cyanea	U	<5%	*Ehrharta erecta*	U	<5%
Eucalyptus quadrangulata	U	<5%	*Lantana camara*	U	<5%
Eucalyptus saligna	U	<5%	*Modiola caroliniana*	NP	
Ficus coronata	U	<5%	*Olea europaea subsp. cuspidat*	U	<5%
Geitonoplesium cymosum	U	<5%	*Sida rhombifolia*	U	<5%
Glycine sp.	U	<5%	*Solanum mauritianum*	NP	
Guioa semiglauca	U	<5%			
Hakea salicifolia	U	<5%	**Natives Continued**		
Hibbertia scandens	NP		*Pandorea pandorana*	U	<5%
Hibiscus heterophyllus	U	<5%	*Pittosporum multiflorum*	U	<5%
Maclura cochinchinensis	U	<5%	*Oplismenus imbecillis*	U	10%
Melaleuca armillaris	U	<5%	*Sicyos australis*	NP	
Notelaea venosa	U	<5%	*Sigesbeckia orientalis*	NP	

Vegetation Condition:	Degraded revegetation, annual flush of woody and herbaceous weeds, vines.

Fauna Evidence:	Bandicoot diggings near the Daphnandra population, loads of Kangaroos

Good Bush Monitoring Survey sheet		Site: Boral Zone 3 (east of creek)	
Date: 09/09/2024		Plot No: 3B Post Condition Assessment	
Recorder: Marcus Burgess and Tanita Gordon		Plot Size: 20 x 20m	
GPS Northing	6166983	GPS Easting	299805
GPS Accuracy	+-7m	GPS Elevation	64m
Vegetation Community: Established Revegetation with Rainforest understory.			

NATIVE			WEED		
Botanical Name	Abundance	% Cover	Botanical Name	Abundance	% Cover
Acacia maidenii	I	40%	*Bidens pilosa*	NP	
Acmena smithii minor	U	5%	*Solanum mauritianum*	Np	
Breynia oblongifolia	U	<5%	*Ehrharta erecta*	U	<5%
Carex longibrachiata	U	<5%	*Cirsium vulgare*	NP	
Cayratia clematidea	U	<5%	*Delairea odorata*	NP	
Geijera salicifolia	I	<5%	*Sida rhombifolia*	U	<5%
Dodonaea viscosa	I	<5%	*Ageratina riparia*	I	<5%
Elaeodendron australe	I	<5%	*Olea europaea subsp. cuspidat*	NP	
Eucalyptus saligna	I	<5%	*Araujia sericifera*	I	<5%
Ficus coronata	U	40%	*Olea europaea subsp. cuspidata*	I	<5%
Geitonoplesium cymosum	O	<5%			
Geranium homeanum	U	<5%	**Natives Continued**		
Glochidion ferdinandi	I	<5%	*Oplismenus imbecillis*	C	5%
Glycine sp.	NP		*Pandorea pandorana*	U	<5%
Guioa semiglauca	U	<5%	*Passiflora herbertiana*	NP	
Hakea salicifolia	U	<5%	*Pittosporum multiflorum*	O	<5%
Hibbertia scandens	I	<5%	*Pittosporum revolutum*	I	<5%
Hibiscus heterophyllus	U	5%	*Melaleuca armillaris*	I	<5%

Maclura cochinchinensis	U	5%	*Melaleuca decora*	I	<5%
Toona ciliata	I	5%	*Streblus brunonianus*	U	<5%
Anelima	O	60%	*Urtica incisa*	U	<5%
Notalea venosa	I	<5%	*Sigesbeckia orientalis*	O	<5%
Alphitonia excelsa	I	<5%	*Celastrus australis*	I	<5%

Vegetation Condition:	15 year old established revegetation, major wind damage - dry. Inappropriate Hakeas are dying and acting as vectors of ascension.

Good Bush Monitoring Survey sheet		Site: Zone 3 Mel armillaris Shrubland	
Date: 09/09/2024		Plot No: 3C Post Assessment	
Recorder: Marcus Burgess and Tanita Gordon		Plot Size: 20 x 20m	
GPS Northing	6166725	GPS Easting	0299937
GPS Accuracy	+-8m	GPS Elevation	87m
Vegetation Community: Ecotone Rainforest and Melaleuca armillaris Tall Shrubland			

NATIVE			WEED		
Botanical Name	Abundance	% Cover	Botanical Name	Abundance	% Cover
Acacia maidenii	I	5%	*Delairea odorata*	U	%10
Alphitonia excelsa	I	<5%	*Ehrharta erecta*	U	<5%
Aneilema biflorum	C	<5%	*Modiola caroliniana*	NP	
Asplenium flabellifolium	C	<5%	*Sida rhombifolia*	I	<5%
Breynia oblongifolia	O	<5%	*Solanum mauritianum*	I	<1%
Carex appressa	NP		*Senecio madagascariensis*	U	<1%
Cheilanthes tenuifolia	NP		*Oxalis sp.*	NP	
Clerodendrum tomentosum	U	<5%	*Stellaria media*	NP	
Commelina cyanea	NP		*Lantana camara*	I	<5%
Croton verreauxii	O	<5%	*Passiflora subpeltata*	I	<5%
Cryptocarya microneura	I	<5%			
Dichondra repens	C	<5%	**Natives continued**		
Ehretia acuminata	NP		*Pittosporum multiflorum*	C	<5%
Einadia hastata	NP		*Planchonella australis*	I	<5%
Eustrephus latifolius	I	<5%	*Plectranthus graveolens*	C	<5%
Geitonoplesium cymosum	C		*Poa labillardieri*	U	<5%
Guioa semiglauca	U	<5%	*Pseuderanthemum var.*	O	<5%
Gymnostachys anceps	U	<5%	*Sarcopetalum harveyanum*	U	<5%
Hibiscus heterophyllus	U	<5%	*Streblus brunonianus*	U	<5%
Maclura cochinchinensis	O	5%	*Trophis scandens*	O	5%

Melaleuca armillaris	U	<5%	*Xerochrysum bracteatum*	NP	
Phyllanthus gunnii	U	<5%	*Zieria granulata*	O	<5%
Notelaea venosa	I	5%	*Pandorea pandorana*	U	<5%
Oplismenus imbecillis	C	<5%	*Parsonsia straminea*	U	<5%
Oplismenus imbecillis	C	<5%	*Pellaea falcata*	O	<5%
Sigesbeckia orientalis	U	<5%	*Stephania japonica*	U	<5%
Diploglottis australia	I	<5%	*Nysanthies erecta*	U	<5%
Melicope micrococca	I	<5%	*Marsdenia rostrata*	I	<5%
Microlaena stipoides	U	<5%	*Clematis aristata*	I	<5%

Vegetation Condition:	Disturbed regenerating eco-tone (Rainforest to M. armillaris Woodland). Very dry.
Fauna Evidence:	2 deer (doe) seen just beyond the perimeter of this plot.
Significant Species:	*Zieria granulata*

Good Bush Monitoring Survey sheet		Site: Zone 3 Subtropical RF Big Fig Area	
Date: 09/09/2024		Plot No: 3D Post Assessment	
Recorder: Marcus Burgess and Tanita Gordon		Plot Size: 20 x 20m	
GPS Northing	6166719	GPS Easting	0300124
GPS Accuracy	+- 10m	GPS Elevation	55m
Vegetation Community: Remnant Subtropical Rainforest			

NATIVE			WEED		
Botanical Name	Abundance	% Cover	Botanical Name	Abundance	% Cover
Alchornea ilicifolia	C	5%	*Lantana camara*	O	<5%
Ficus macrophylla	I	90	*Cestrum parqui*	I	<5%
Pittosporum multiflorum	O	<5%	*Solanum mauritianum*	NP	
Maclura cochinchinensis	O	<5%	*Delairea odorata*	U	<5%
Alectryon subcinereus	O	<5%	*Passiflora subpeltata*	NP	
Claoxylon australe	U	<5%	*Araujia sericifera*	I	<5%
Notelaea venosa	U	<5%	*Bidens pilosa*	U	<5%
Breynia oblongifolia	O	<5%	*Solanum psuedocapsicum*	C	25%
Diploglottis australis	C	<5%	*Ehrharta erecta*	C	20%
Brachychiton acerifolia	U	<5%	*Phytolacca octandra*	NP	
Streblus brunonianus	C	<5%	*Sida rhombifolia*	O	15%
Clerodendrum tomentosum	C	<5%	*Olea europaea subsp. cuspidata*	I	<5%
Elaeodendron australe	O	<5%			
Melicytus dentatus	O	<5%	**Natives continued**		
Geitonoplesium cymosum	O	<5%	*Plectranthus parviflorus*	NP	-
Eustrephus latifloius	U	<5%	*Aphanopetalum resinosum*	C	<5%
Pandorea pandorana	O	<5%	*Sigesbeckia orientalis*	C	5%
Parsonsia straminea	I	<5%	*Sarcomelicope simplicifolia*	U	<5%
Nyssanthes erecta	C	10%	*Gynocthodes jasminoides*	U	<5%

Wilkiea huegeliana	I	<5%	*Cayratia clematidea*	O	<5%
Gymnostachys anceps	U	<5%	*Melia azedarach*	U	<5%
Oplismenus imbecillis	O	<5%	*Urtica incisa*	C	<5%
Pseuderanthemum var.	C	<5%	*Phyllanthus gunnii*	U	<5%
Pellaea falcata	I	<5%	*Actephila lindleyi*	U	<5%
Asplenium flabellifolium	U	<5%	*Dendrocnide excelsa*	O	<5%
Parietaria debilis	NP	-	*Croton verreauxii*	O	<5%
Legnephora moorei	U	<5%	*Trophis scandens*	U	<5%
Piper novae hollandiae	U	<5%	*Aneilema biflorum*	U	<5%
Stephania japonica	U	<5%	*Melicope micrococca*	U	<5%
Smilax australis	I	<5%	*Geranium homeanum*	I	<5%
Nyssanrhes erecta	C	15%	*Rubus rosifolius*	U	<5%

Vegetation Condition:	Good regeneration under the Fig, poor condition in the open but is regenerating underneath the canopy.
Fauna Evidence:	Kangaroo, Topknot Pigeon, Deer rutting and damage on Stinging Trees.
Significant Species:	*Actephila lindleyi*

Photo Reference

All Image of checkpoint photos:

Taken on September 2nd 2021 and September 11th 2024 by Marcus Burgess and Tanita Gordon.

15. Appendix G Boral Response to Audit Recommendations

Response to Recommendations and Non-Compliances – Independent Environmental Audit 2023 – Dunmore Quarry

Table 1 – Response to Non-Compliances

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
S4.C60C Within three years of the determination of Modification 11, and every five years thereafter (if directed to do so by the Planning Secretary), the Applicant must commission and pay the full costs of a Transport Options Review for the development. This review must: (a) Be conducted by a suitably qualified, experienced and independent expert/s whose appointment has been endorsed by the Planning Secretary; (b) Be prepared in consultation with TfNSW, RMS and Council; (c) Review the economic, social and environmental costs and benefits of all reasonable and feasible options for the transport of quarry products from the site (including by rail and road); (d) Review and report on available rail terminal capacity; (e) Recommend any appropriate measures or actions to:	Transport Options Review not completed within consent condition timeframe. Opportunity for Improvement [DQ11/23]: Boral to coordinate Transport Option Review 6 months prior to renewal period.	Non-Compliant – Low Risk	The Transport Options Review has been drafted and is under review. This will be reviewed and submitted to the Department, TfNSW and Council as soon as possible for approval.	Boral to complete review and submit Transport Options Review to the Department, TfNSW and Council as soon as possible.

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
i. Reduce the economic, social and environmental costs associated with transport of quarry products by road from site; and ii. Maximise the use of rail deliveries from the site; and (f) Be conducted and reported to the satisfaction of the Planning Secretary. Within three months of commencing this review, or within another timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the review report to the Planning Secretary and any other NSW agency that requests it, together with it response to any recommendations contained in the review report.				
S5.C8 The Applicant must provide regular reporting on the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.	The website includes copies of the latest Independent Audit, the AEMR/Annual Reviews 2011 – 2023 except for AR 2020-2021. No AR for 2020-2021 on website.	Non-Compliant – Low Risk	The 2020-2021 Annual Review will be uploaded to the website as soon as possible.	Boral to upload 2020-2021 Annual Review to website.
S5.C9 By the end of September each year, or other timing as may be agreed by	AR issued late in Oct 2020 without evidence of	Non-Compliant – Low Risk	Punctual submission of Annual Reviews will be prioritised.	Boral to ensure punctuality of Annual Review submission.

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
the Planning Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Planning Secretary. This review must: (a) Describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year; (b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against the: • Relevant statutory requirements, limits or performance measures/criteria; • Requirements of any plan or program required under this consent; • Monitoring results of previous years; and	agreement by Planning Secretary.			

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
• Relevant predictions in the documents listed incondition 2 of schedule 3; (c) Identify any non-compliance over the last financial year, and describe what actions were (or are being) taken to ensure compliance; (d) Identify any trends in the monitoring data over the life of the development; (e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and (f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development. The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of schedule 5) and any interested person upon request.				
S5.C10 Prior to 1 April 2017, and every three years thereafter, unless the Planning	Current IEA in Nov 2023 – Feb 2024 submission – for compliance the IEA 2023 was	Non-Compliant – Low Risk	Future Independent Environmental Audits will be commissioned and paid for	Boral to ensure that Independent Environmental Audits are commissioned

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. This audit must: (a) Be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Planning Secretary; (b) Include consultation with the relevant agencies and the CCC; (c) Assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent and any relevant EPL and/or Water Licences (including any assessment, plan or program required under these approvals); (d) Review the adequacy of any approved strategies, plans or programs required under the abovementioned approvals; (e) Recommend appropriate measures or actions to improve the environmental performance of the development, and/or any assessment plan or program	required to be undertaken in April 2023.		by 1 April of the audit year to ensure compliance.	and paid prior to 1 April of the audit year.

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
required under the abovementioned approvals; and (f) Be conducted and reported to the satisfaction of the Planning Secretary. Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Planning Secretary.				
S5.C12 By 31 December 2016, unless otherwise agreed by the Planning Secretary, the Applicant must: (a) Make the following information publicly available on its website: • The documents listed in condition 2 of Schedule 3; • Current statutory approvals for the development; • Approved strategies, plans or programs required under the conditions of this consent; • A comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;	2020-2021FY AR is not on website.	Non-Compliant – Low Risk	The 2020-2021 Financial Year Annual Review will be uploaded to the website as soon as possible.	Boral to upload 2020-2021 Financial Year Annual Review to website.

Condition Reference	Description	Audit Risk Rating	Response	Boral Actions
• A complaints register, updated quarterly; • The Annual Reviews (over the last 5 years); • Any independent environmental audit, and the Applicant's response to the recommendations in any audit; • Any other matter required by the Planning Secretary; and (b) Keep this information up-to-date, to the satisfaction of the Planning Secretary.				

Table 2 – Response to Recommendations / Opportunities for Improvement

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
DQ1/23	DQ1/20	Boral to confirm budget for Lower Dam and implement Water Management Plan once approved by Boral Management.	Budget for Lower Dam Transition Plan will be determined and the Water Management Plan will be revised if required and submitted to the Department for approval.	Boral to determine budget for Lower Dam Transition Plan, revise Water Management Plan accordingly and submit it to the Department.
DQ2/23	DQ6/20	The Bushfire Management Plan is to be updated to	The Bushfire Management Plan will be revised such that it covers safe storage of	Boral to update Bushfire Management Plan with revised tyre storage details.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
		include information listed in 2020 Audit.	tyres in accordance with Tyre Stewardship Australia *Best Practice Guidelines for Tyre Storage and Emergency Preparedness* (March 2019) guidelines and Fire & Rescue NSW *Fire Safety Guideline – Guideline for bulk storage of rubber tyres* (December 2014).	
DQ3/23	DQ7/20	The document control table in each management plan should include a record of the annual review of the plan and whether any amendments were made.	All Management Plans, Strategies and Programs will be updated such that the document control table reflects any amendments and revisions undertaken subsequent to the Annual Review.	Boral to update all document control tables in Management Plans, Strategies and Programs.
DQ4/23	DQ12/20	Implement updated Water Management Plan when approved to reconfigure storage on site and prevent uncontrolled discharge events.	Budget for Lower Dam Transition Plan will be determined and the Water Management Plan will be revised if required and submitted to the Department for approval.	Boral to determine budget for Lower Dam Transition Plan, revise Water Management Plan accordingly and submit it to the Department.
DQ5/23	DQ22/20	The document control table in each management plan should include a record of the annual review of the plan and whether any amendments were made.	All Management Plans, Strategies and Programs will be updated such that the document control table reflects any amendments and revisions undertaken	Boral to update all document control tables in Management Plans, Strategies and Programs.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
			subsequent to the Annual Review.	
DQ6/23	Schedule 4, Condition 13 – Within 3 months of the date of this consent, and annually thereafter, unless directed otherwise by the Planning Secretary, the Applicant must: (a) Commission a suitably qualified person to assess whether the development is complying with the noise impact assessment criteria in Table 2, in general accordance with NSW Industrial Noise Policy and Australian Standard (AS) 1055-1997: "Description and Measurement of Environmental Noise"; and (b) Provide the results of this assessment to the EPA and Planning Secretary within a month of commissioning the assessment.	At next Modification will have clause (b) of condition amended to provide the results with the Annual Returns / Annual Reviews, rather than one month of commissioning the assessment to avoid a time related non-compliance.	A letter will be provided to the Department requesting this clause be amended such that the Noise Assessment results will be submitted with the Annual Return and Annual Review rather than being submitted separately as well.	Boral to send letter to the Department requesting a revision of this clause.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
DQ7/23	Schedule 4, Condition 20 – The Applicant must prepare a Blast Management Plan for the development to the satisfaction of the Planning Secretary.	Within the Plan Table 2.1 Authorised Personnel & Service Providers should be updated as required and date approved and name of person approving needs to be included. Attachment C: Blast Notification List last updated 27/02/19. This list should be reviewed for currency and confirmed in the document.	The Blast Management Plan will be updated with new Authorised Personnel, Service Providers, and a new Blast notification list.	Boral to update contacts in Blast Management Plan.
DQ8/23	Schedule 4, Condition 28 – The Applicant must comply with the discharge limits in any EPL, or with section 120 of the POEO Act.	Implement updated Water Management Plan when approved to reconfigure storage on site and better manage uncontrolled discharge events. As part of updated WMP also consider onsite storage capacity with regards to potential future climate change weather/storm intensity increases.	Budget for Lower Dam Transition Plan will be determined and the Water Management Plan will be revised if required and submitted to the Department for approval. A discussion with the author of the Water Management Plan will be organised to determine what measures should be taken to mitigate climate change related risks.	Boral to determine budget for Lower Dam Transition Plan, discuss climate change risks with contractor (EMM), revise Water Management Plan accordingly and submit it to the Department.
DQ9/23	Schedule 4, Condition 29 – In each Annual Review, the Applicant shall: (a) Recalculate the site water balance for the development; and	Ensure all future Annual Reviews address the reporting requirements in Schedule 4, Condition 29.	Section 6.5 in the 2020 Annual Review and Section 5.5 in the 2021 Annual Review did not adequately evaluate against the licencing requirements. However, Section 5.5 in the	Boral to ensure coherence with the layout and values of section 5.5 in the 2022 and 2023 Annual Reviews in future Annual Reviews.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
	(b) Provide information on evaporative losses, dust suppression, dam storage levels and (c) Evaluate water take against licensing requirements.		2022 and 2023 Annual Reviews evaluated water take against the licencing requirements. Section 5.5 of the 2022 and 2023 Annual Reviews will be used as a template for following Annual Reviews to ensure that they address this condition of consent.	
DQ10/23	Schedule 4, Condition 47 – The Vegetation Clearing Protocol must: (a) Delineate the areas of remnant vegetation to be cleared; and (b) Describe the procedures that would be implemented for: i. Pre-clearance surveys; ii. Progressive clearing; iii. Fauna management; iv. Conserving and reusing topsoil; v. Collecting seed from the site; vi. Salvaging and reusing material from the site; and vii. Controlling weeds.	Vegetation Clearing Protocol to be updated to address collecting seed from site and conserving and reusing topsoil.	Vegetation Clearing Protocol will be updated to include guidelines about collecting seeds from the site and include a Topsoil Management Plan.	Boral to update Vegetation Clearing Protocol including seed collection guidelines and a Topsoil Management Plan.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
DQ11/23	Schedule 4, Condition 60C – Applicant must provide transport options review, continuously update and share with the Planning Secretary for review.	Boral to coordinate Transport Option Review 6 months prior to renewal period.	The Transport Options Review has been drafted and is under review. This will be reviewed and submitted to the Department, TfNSW and Council as soon as possible for approval.	Boral to complete review and submit Transport Options Review to the Department, TfNSW and Council as soon as possible.
DQ12/23	Schedule 5, Condition 1 – Applicant must prepare an Environmental Management Strategy to the satisfaction of the Planning Secretary.	Legislation section needs to be updated with relevant legislation for *Biodiversity Conservation Act 2016*.	The Legislation section of the Environmental Management Strategy will be updated so that it reflects the relevant Biosecurity Conservation Act.	Boral to update the EMS to include the relevant Biodiversity Conservation Act legislation.
DQ13/23	Schedule 5, Condition 4 – Within 3 months of the submission of an: (a) Incident report under condition 7 below; (b) Annual review under condition 9 below (c) Audit report under condition 10 below; and (d) Any modifications to this consent, The applicant must review, and if necessary revise, the strategies, plans and programs required under this consent, to the	The document control tables within the all the plans, strategies and programs required under this consent do not reflect the reviews have occurred. Ensure all documents are reviewed in accordance with this condition of consent. Update the relevant management plans to contain information on timing of review. A register of reviews may assist.	All Management Plans, Strategies and Programs will be updated such that the document control table reflects any amendments and revisions undertaken subsequent to the Annual Review.	Boral to update all document control tables in Management Plans, Strategies and Programs.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
	satisfaction of the Planning Secretary. Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.			
DQ14/23	Must have updated PIRMP within public access.	Upload current PIRMP for Dunmore Quarry to website. PIRMP on Dunmore Website is dated 2019 (V13) This document requires updating to include the details of annual review and PIRMP drills.	The current PIRMP for Dunmore Quarry will be uploaded to the website to replace the outdated 2019 version.	Boral to upload latest PIRMP for Dunmore Quarry to the website.
DQ15/23	Schedule 5, Condition 1 – Applicant must prepare an Environmental Management Strategy to the satisfaction of the Planning Secretary.	Undertake an administrative update of the EMS to align with updated condition of consent that refers to 'Planning Secretary' instead of 'Secretary'.	The Environmental Management Strategy wording will be updated to reflect the wording in the current consolidated consent.	Boral to update "Planning Secretary" wording in Environmental Management Strategy.
DQ16/23	Schedule 5, Condition 1 – Provide the strategic framework for the environmental management of the development.	Update relevant legislation in section 3.2.7 – the new *Biodiversity Conservation Act 2016*. The Act supersedes the following:	Section 3.2.7 of the Environmental Management Strategy will be updated to remove references to the superseded legislation and ensure that any information pertaining to native	Boral to update section 3.2.7 of the Environmental Management Strategy to refer to current legislation and remove incorrect reference with regard to the

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
		• *Threatened Species Conservation Act 1995;* • *Native Vegetation Act 2003;* • *Nature Conservation Trust Act 2001;* • *Parts of the National Parks and Wildlife Act 1974*. Amend references to clearing of native vegetation under the NV Act as this is incorrect.	vegetation clearing is correct and references current legislation.	clearing of native vegetation.
DQ17/23	Schedule 4, Condition 20 – Applicant must prepare a Blast Management Plan to the satisfaction of the Planning Secretary.	Undertake an administrative update of the Blast Management Plan to align with updated condition of consent that refers to 'Planning Secretary' instead of 'Secretary'.	The Blast Management Plan wording will be updated to reflect the wording in the current consolidated consent.	Boral to update "Planning Secretary" wording in Blast Management Plan.
DQ18/23	Blast Management Plan	Within the Plan Table 2.1 – Authorised Personnel & Service Providers should be updated, and date approved and name of person approving needs to be included. Attachment C: Blast Notification List last updated 27/02/2019. This list should be reviewed for	The Blast Management Plan will be updated with new Authorised Personnel, Service Providers, and a new Blast notification list.	Boral to update contacts in Blast Management Plan.

Reference	Consent Condition/Issue	Recommendation	Response	Boral Actions
		currency and confirmed in the document.		
DQ19/23	Bushfire Management Plan	Boral should update plan in accordance with BMP Section 5.	The Bushfire Management Plan will be updated to address the relevant industry and NSW Fire and Rescue guidelines.	Boral to update Bushfire Management Plan to address relevant industry and NSW Fire and Rescue guidelines.