Department of Planning, Housing and Infrastructure

NSW Planning ref: DA85/2865-PA-38
Mr Ewen McKenzie
Acting Environmental Compliance Manager
BENEDICT RECYCLING PTY LIMITED
11 NARABANG WAY
BELROSE New South Wales 2085
02/08/2024

Sent via the Major Projects Portal only

Subject: Menangle Quarry - 2023 Annual Review

Dear Mr McKenzie

Reference is made to your post approval matter, DA85/2865-PA-38, Annual Review for the period 1January 2023 to 31 December 2023 for Menangle Quarry, submitted as required by Schedule D, Condition 9 of DA85/2865 (the consent) to the NSW Department of Planning, Housing and Infrastructure (NSW Planning) on 22 April 2024.

NSW Planning has reviewed the Annual Review and considers it to generally satisfy the reporting requirements of the consent and the NSW Planning Annual Review Guideline (October 2015). Please make publicly available a copy of the 2023 Annual Review on the company's website within 30 days.

Please also upload to the website the monitoring associated with all management plans (that is, 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) in accordance with Condition D15(iv), Rehabilitation monitoring and a complaints number in accordance with D15(vii) (contact details to enquire about the development or to make a complaint) within 30 days from the date of this letter:

Please ensure that the website is kept up-to-date with all required information and documents.

For future Annual Reviews please include the following information:

- maps of the operation showing the regional context (aspects relevant to the community such as residential areas or other key relevant land uses), development consent boundary, current operational disturbance footprint, and any offset areas and approved limits of extraction; and
- a summary of criteria, performance, trends/ key management implications and proposed management actions (similar to Table 6 in the mining Annual Review Guidelines).

Please note that the NSW Planning's acceptance of this Annual Review is not an endorsement of the compliance status of the project.

In accordance with the conditions of consent please ensure that strategies, management plans and programs are reviewed and if necessary revised and submitted to the Planning Secretary's for approval.

Should you wish to discuss the matter further, please contact me on 0429400261 or email compliance@planning.nsw.gov.au

Yours sincerely

Katrina O'Reilly
Team Leader - Compliance
Compliance
As nominee of the Planning Secretary

MENANGLE SAND AND SOIL

ANNUAL REVIEW (Condition D9)

Benedict Sands Menangle (LEC 2018/342158)

01 January 2023 - 31 December 2023

Contents

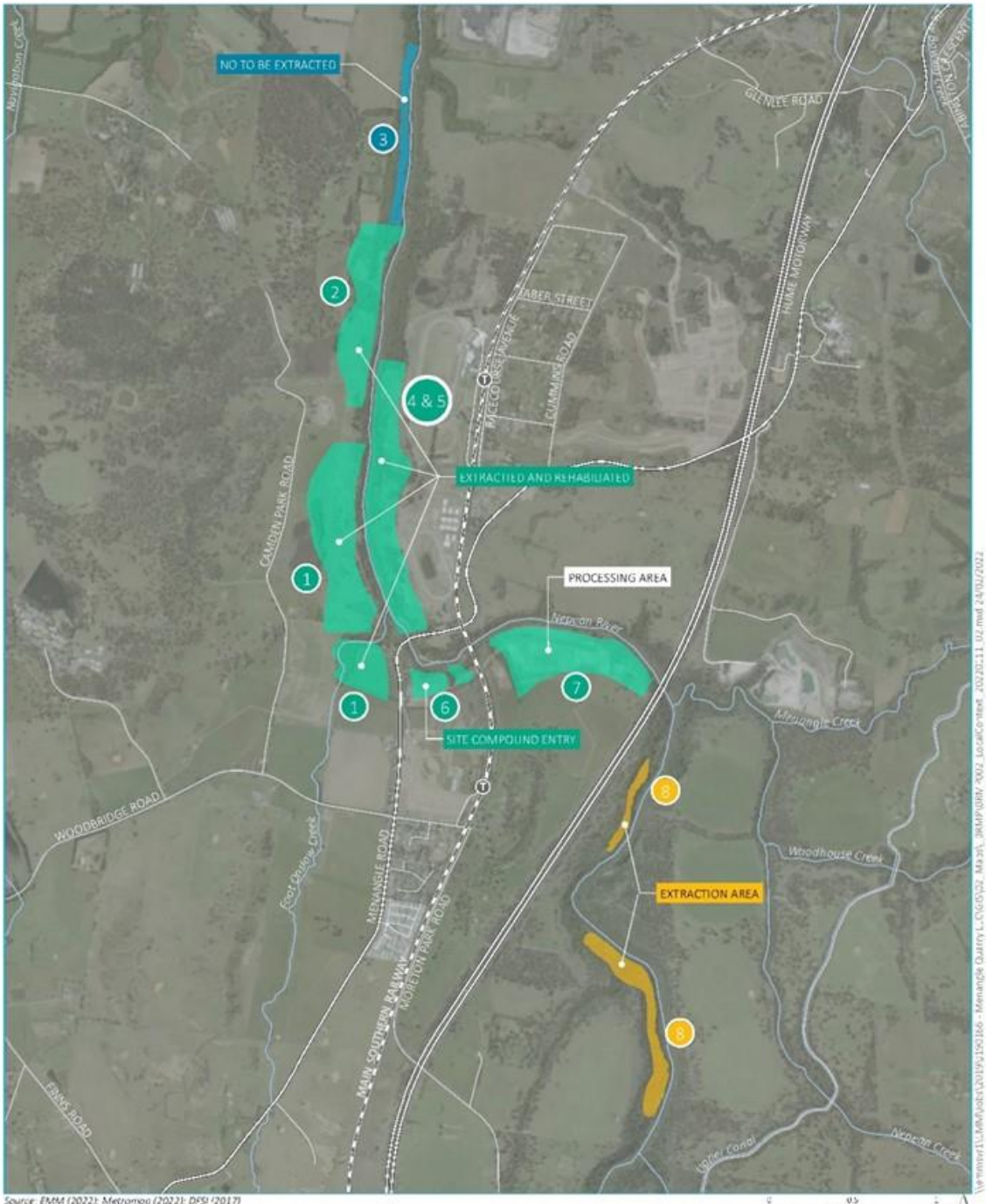
1 Introduction

1.1 Overview

Benedict Industries Pty Ltd (Benedict) is the operator of the Menangle Soil and Sand Facility located at 31 Menangle Road, Menangle NSW 2568.

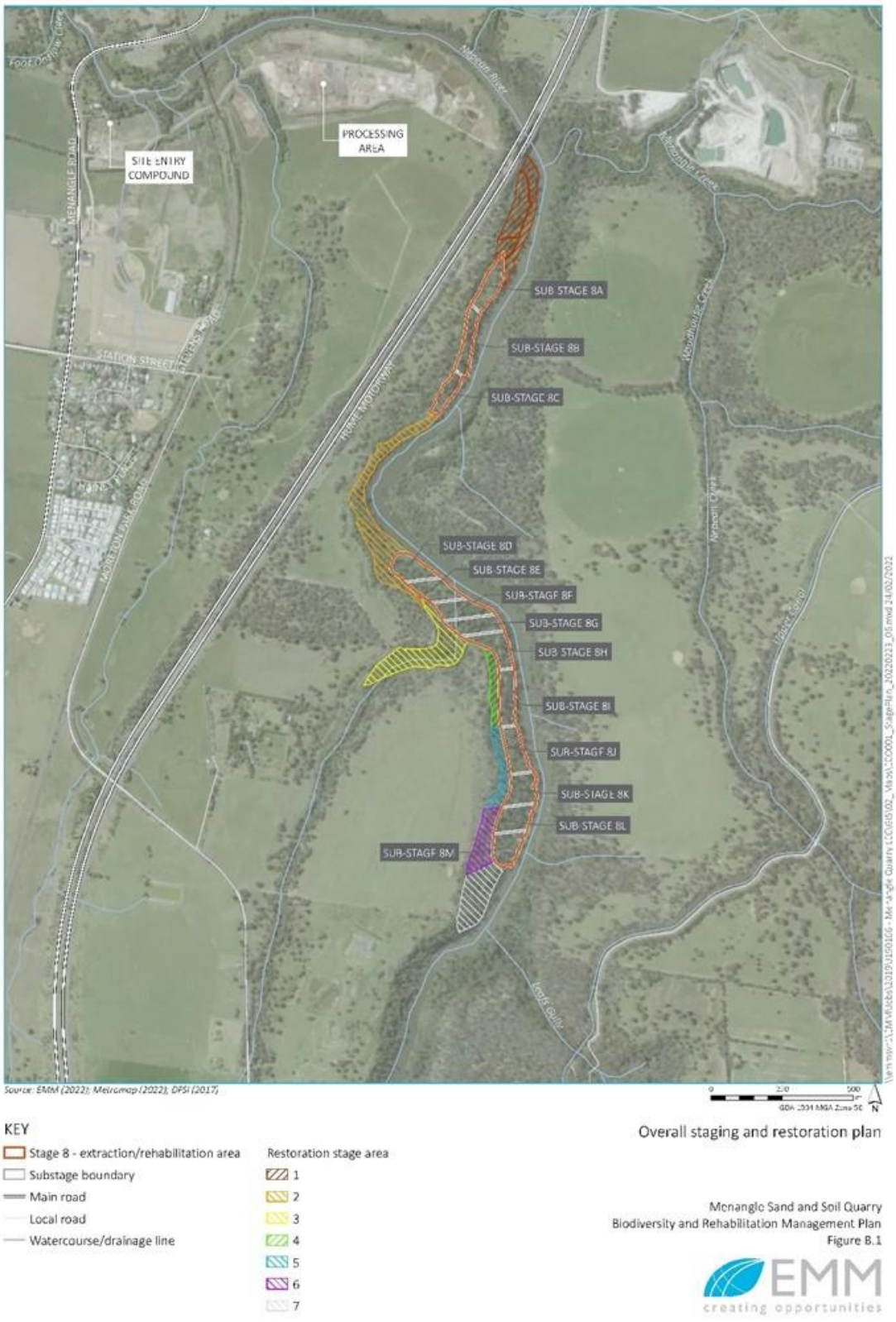
Condition D9 of the Consolidated Consent approval requires the preparation of an annual review of the environmental performance of the Development.

This is the first annual review and is for the period 01 January 2023 – 31 December 2023. It should be noted that the Stage 8 quarrying operations commenced on 4 September 2023, so the relevant operational information will be tailored for the period 4 September 2023 – 31 December 2023.



Menangle Quarry stages 1 to 8

Menangle Sand and Soil Quarry
Figure 1.2


PROCESSING AREA
SITE ENTRY COMPOUND
MENANGLE ROAD
STATION STREET
HUME MOTORWAY
SUB-STAGE 8A
SUB-STAGE 8B
SUB-STAGE 8C
SUB-STAGE 8D
SUB-STAGE 8E
SUB-STAGE 8F
SUB-STAGE 8G
SUB-STAGE 8H
SUB-STAGE 8I
SUB-STAGE 8J
SUB-STAGE 8K
SUB-STAGE 8L
SUB-STAGE 8M
Source: EMM (2022); Metromap (2022); DFSI (2017)
KEY
Stage 8 - extraction/rehabilitation area
Substage boundary
Main road
Local road
Watercourse/drainage line
Restoration stage area
1
2
3
4
5
6
7
Overall staging and restoration plan
Menangle Sand and Soil Quarry
Biodiversity and Rehabilitation Management Plan
Figure B.1
EMM
creating opportunities

2 Development

Describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year?

2023 development included:

- the creation of the formal underpass in conjunction with TfNSW.
- Establishment of Restoration Area 1 and associated monitoring plots in Stage 8
- Commencement of quarrying in Substage 8A

3 Monitoring Results and Complaints

Include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:

- ***relevant statutory requirements, limits or performance measures/criteria***

NOISE MONITORING

Appendix 4 Noise Compliance Assessment

> *Compliance Monitoring*
>
> *3. A noise compliance assessment must be undertaken within two months of commencement of Quarrying Operations in the Stage 8 Area. The assessment must be conducted by a suitably qualified and experienced acoustical practitioner and must assess compliance with noise criteria in this consent. A report must be provided to EPA within 1 month of the assessment.*

Appendix 4 was the first operational noise assessment task undertaken by MSS. As Stage 8 of the Quarry extraction commenced in September 2023, EMM were engaged to conduct the Noise Compliance Assessment included in Clause 3 of Appendix 4 (see below). This Assessment was to be conducted within two months of Quarry operations commencement (4 Sept 2023) and were conducted on 6 October 2023.

The summary of the results from EMM was that the “Noise levels from site complied with all relevant limits and consent noise conditions”. P11 Menangle Sand and Soil Quarry - Noise Compliance Assessment Oct 2023 (See Attachment A for full report)

A copy of the assessment has been forwarded to the EPA.

Noise (Condition B4)

B4. The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.

Table 2: Operational Noise Criteria dB(A) ***Residences a***	***Day***		***Shoulder Period*** 6.00 am to 7.00 am Monday to Saturday
LAeq (15 minute)	*LAeq (15 minute)*		LA(max)
2, 3, 5b, 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

The first of the required quarterly attended noise monitoring was conducted by EMM on 28 February 2024

The summary of the results from EMM was that the **"Noise levels from the site complied with all relevant limits and noise conditions "** p10 Menangle Sand and Soil Quarry – Noise Compliance Q1 Assessment (see Attachment B for full report)

AIR QUALITY MONITORING

Condition B14 requires the preparation of an Air Quality Management Plan which was produced by EMM and approved by the DPE on 19 April 2022. Within the AQMP there are two monitoring activities required:

1. Regular air quality monitoring

Permanent dust monitors are located on site at three locations. Since quarry operations commenced on Stage 8, the results of the dust monitoring have been posted online at www. benedict.com.au

Summary dust monitor results from September 2023 – December 2023 are listed below, and the individual results are in Attachment C

Month	Particulate	Unit	Lowest value	Highest value	Mean of samples
September	Ash Content	g/m2	**0.3**	**2.8**	**1.4**
	Combustible matter	g/m2	**0.2**	**2.4**	**1.2**
October	Ash Content	g/m2	**0.3**	**1.8**	**1.0**
	Combustible matter	g/m2	**0.3**	**1.6**	**0.9**
November	Ash Content	g/m2	**0.4**	**7.7**	**3.0**
	Combustible matter	g/m2	**0.3**	**6.0**	**2.4**
December	Ash Content	g/m2	**1.1**	**4.4**	**2.4**

	Combustible matter	g/m2	**0.8**	**3.4**	**1.9**

The dust monitoring results are generally compliant. The only monitoring anomaly is in the November/December where at DDG1 (site entry compound) the results are impacted by seasonal mowing in preparation for bushfire season. This was also identified by EMM in the Ambient air quality monitoring. It is worth noting that this DDG1 location is also impacted by the nearby Menangle Road and significant land subdivision release earthworks to the North and South of the location.

2. Ambient air quality monitoring

EMM conducted real time particulate monitoring at two locations over 2 x 4 weeks (8 weeks) monitoring. This was conducted between 3 November 2023 and 10 January 2024.

"A summary of the monitoring results are as follows:

• one exceedance of the 24-hour PM_{10} criterion (50 µg/m³) was recorded at the AQM01 monitoring location due to the influence of local lawn mowing emissions, no exceedances were recorded at the 3 other monitoring locations

• no exceedances of the 24-hour average $PM_{2.5}$ criterion (25 µg/m³) were recorded at any of the monitoring Locations

• the PM_{10} and $PM_{2.5}$ concentrations recorded at the quarry were generally comparable with the concurrent measurements at the DCCEEW Campbelltown West and Camden AQMS for the two campaign periods, indicating that regional emissions sources are the primary driver of ambient particulate matter concentrations." P35 Menangle Sand and Soil Quarry – Air Quality Monitoring Campaign Feb 2024 (see Attachment D for full report)

GROUNDWATER MONITORING

Condition B19 requires annual groundwater monitoring to be conducted at 5 locations. This was done on Jan/Feb 2023 (see Attachment E). The next groundwater monitoring is scheduled and booked for 8 April 2024.

COMPLAINTS (EPA Licence)

Site complaints have been monitored since January 2021.

In 2023 there we no site complaints received. (see www.benedict.com.au)

CONSENT CONDITIONS COMPLIANCE – compliance or triggered analysis for full Consent – see Appendix A

- ***requirements of any plan or program required under this consent.***

The requirements and triggers are addressed through the Consent Condition compliance comments and triggers. Other key plan actions are listed below:

Annual Production data supplied to MEG	Supplied 2023 (March 2024)
Annual engineering assessment of Hume Highway Underpass	Due 4 September 2024
Site Rehabilitation and Restoration Annual Progress Report Includes: Landform establishment and stability assessment Growth medium development assessment Floristic Monitoring assessment Weed monitoring assessment. Nest-Box and Woody debris assessment	Supplied - see Attachment F
Review of BRMP monitoring reporting	Supplied - see Attachment G
Independent Environmental Audit	Due November 2024
Annual water balance review	Due September 2024
Surface Water Monitoring Program	Commenced March 2024 and will be collected monthly for 12 months and then default to quarterly monitoring.

- **monitoring results of previous years**

The required EPL Complaints Monitoring for the site prior to 2023 has been carried out monthly since 2001 and posted on the www.benedict.com.au website.

- **relevant predictions in the documents listed condition A7(c) [MOD 1 Summary, Layout, Report]**

The commencement of quarrying in Stage 8 occurred on 4 September 2023. The development has been occurring in accordance with all the respective development Conditions of Consent and Management Plans.

A schedule of all the Compliance actions for 2024 has been developed in line with the Stage 8 start date and this has been attached as Attachment H

4 Non-compliances or incidents

Identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence.

The site, as required by the EPA, operates a Pollution Incident Response Management Plan (PIRMP)

The PIRMP documents are held on site and involve scenario toolbox training for staff. These are reviewed annually as part of the EPA Annual Report Process.

During the course of 2023 the following preventative staff training was implemented:

- Warden / Chief Warden Training
- Building Evacuation Training
- Live Fire Training - Use of Portable Fire Fighting Equipment
- Silica Dust Awareness Training
- Isolation, Lockout and Safety Tagging Training
- Risk Assessment training

Mining Regulator Audits were conducted as follows:
- Air Quality or Dust and Other Airbourne Contaminants
- Electrical
- Pressure Vessels
- Mobile Plant
- Legislation Gap Analysis (Mining Regs)

There were no significant incidents or lost time through injury in 2023.

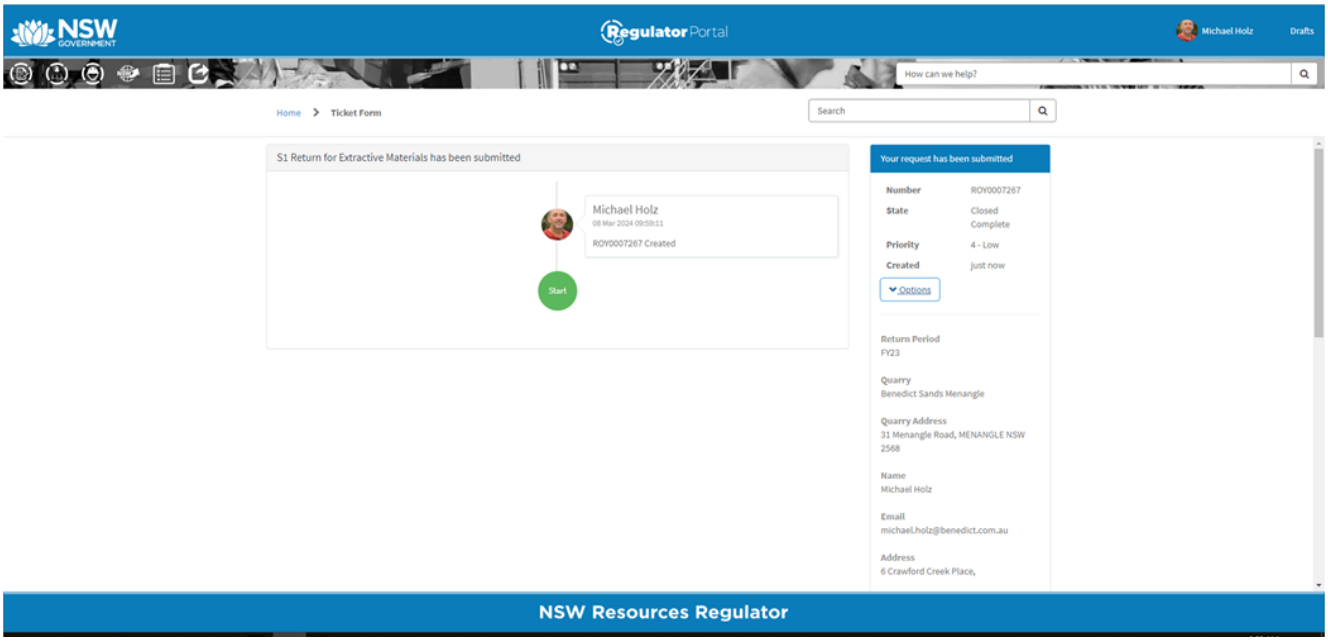
5 Compliance status summary

- ***Each year, from the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide calendar year quarry production data to MEG by no later than 30 January. The data must be provided using the relevant standard form and a copy of the data must be included in the Annual Review. [Condition A37]***

A photographic record of the MEG lodgement is included below:

The Stage 8 Tonnes lodged for Sept to Dec 2023 were: 72,541 Tonnes.

The commercial value of the tonnes extracted was: $2,617,912.



- ***The Applicant must report on any water captured, intercepted or extracted from the site each year (directly and indirectly) in the Annual Review, including water taken under each Water Access Licence as applicable. [Condition B30]***

Water is extracted by water pump from the Nepean River for dust suppression purposes. This activity is recorded and interfaced with WaterNSW. A copy of the Sept – Dec 2023 records are attached as Attachment I

- ***The Applicant must ensure that the flood storage capacity of the final rehabilitated landform is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Details of the available flood storage capacity must be reported in the Annual Review. [Condition B35]***

The Stage 8 quarry is in its Infancy. The only final rehabilitated landforms applicable to this review is the extraction at Substage 8A. We can confirm that the difference between the commencement levels and the final landform levels was a reduction in landform levels ranging between 2.08m and 5.1 lower. The mean final landform reduction was 4.198m for Substage 8A which confirms that the flood storage capacity has not been compromised (see Condition B35 in Appendix A).

- ***the effectiveness of the noise and air quality management systems***

These management plans are in their infancy and baseline data has been gathered. They will be reviewed within 3 months of this Annual Review and feedback given in the 2024 Annual Review.

- ***report on waste minimisation and management in the Annual Review.***

The Stage 8 development generates little waste by products. Clearing of land generates useful rehabilitation vegetation which is stored and reused. Weed residues such as Lantana and the like can be buried in the extraction hole. Any other debris that might occasionally arrive onsite via elevated river levels would be taken to the site rubbish bin and removed by the regular contractor service.

- ***compliance with the performance measures, criteria and operating conditions in this consent, as they relate to the Stage 8 Area***

Every effort has been made to comply with the operating and performance measures in place in effect this Annual review is measuring operational performance over a four-month period and management performance leading into 2024. It has been onerous to create and implement all the required elements, however, as the development has been staged so will the rollout and reporting. There will be a review of the management plans within three months of this 2023 Annual Review and DPE feedback. A full year of operations will feed into the 2024 Annual Review lodgement and all elements of the Consent and Management Plans will have been engaged. A full comparison of the obligations of all the Consolidated Consent Conditions has been addressed in Appendix A

6 Trends in performance measures, criteria and operating conditions

Identify any trends in the monitoring data over the life of the development.

Baseline date has been collected and in most cases, we are awaiting a 12 month cycle to make comparisons.

Dust monitoring has an initial trend is the impact of mowing and nearby construction sites on the DDG1 dust monitor. MMS intends to keep the 'front of house" tidy, bushfire ready and regularly mow. This is counterproductive on the dust monitor in summer months.

7 Predicted v Actual impact of the development

Identify any discrepancies between the predicted and actual impacts of the development and analyse the potential cause of any significant discrepancies.

Not yet – too early in the operations to comment definitively.

8 Proposed Environmental Improvements

Describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.

Ongoing nest box roll out – 33% installed currently.
Infill planting and weed management.
Staged rehabilitation
Modified mulching strategy.
Modified woody debris placement.

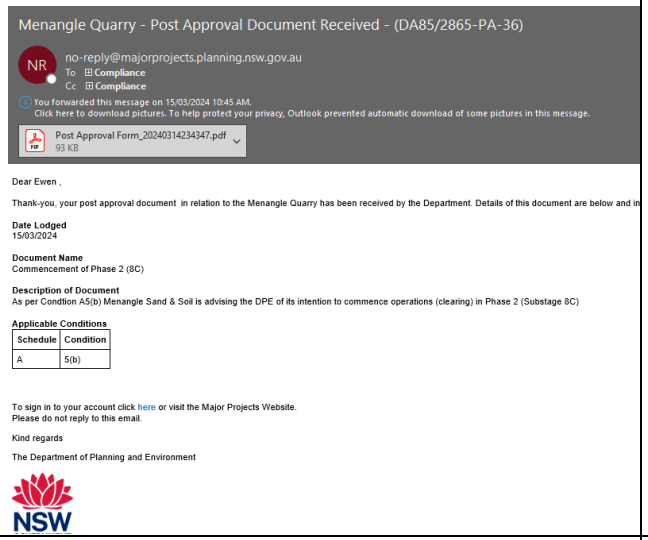
Appendixes

Appendix A – Conditions Compliance Report

(b) Provide a conditions compliance report which tracks the compliance of the development with the conditions of this approval

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A2	The conditions in this Schedule do not apply retrospective requirements in relation to Quarrying Operations undertaken in Stages 1 to 7 of the development that have been completed prior to 31 December 2020 (inclusive).	Noted	Compliant
A3	From the commencement date of construction activities associated with Stage 8 Operations, as notified under condition A5(a) of this Schedule, the obligations in Schedule 1 of this development consent will continue to apply in relation to Stages 1 to 7 of the development, except in so far as they are specifically amended by the conditions of this Schedule.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A4	In the event of an inconsistency, ambiguity or conflict between the conditions in Schedules 1 and 2 of this development consent, as they relate to the Stage 8 Operations, the conditions in Schedule 2 prevail to the extent of the inconsistency, ambiguity or conflict.	Noted	Compliant
A5	The Applicant must notify the Department in writing of the date of commencement of any of the following phases of the development, at least two weeks before that date:	Construction notification 20/12/22 – commenced works 16 Jan 2023 Operations commencement notification - 9/8/2023. Extraction in Substage 8A commenced 4/9/2023. Phase 2 (substage 8C) commencement notification 15/3/2024	Compliant
	a. construction activities associated with Stage 8 Operations;		Compliant
	b. Quarrying Operations in each of Phases 1 to 7;		Compliant
	c. cessation of Quarrying Operations (i.e. quarry closure); and		Not Triggered
	d. any period of suspension of Quarrying Operations (i.e. care and maintenance).		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 Menangle Quarry - Post Approval Document Received - (DA85/2865-PA-36) NR no-reply@majorprojects.planning.nsw.gov.au To Compliance Cc Compliance You forwarded this message on 15/03/2024 10:45 AM. Click here to download pictures. To help protect your privacy, Outlook prevented automatic download of some pictures in this message. Post Approval Form_20240314234347.pdf 93 KB Dear Ewen , Thank-you, your post approval document in relation to the Menangle Quarry has been received by the Department. Details of this document are below and in **Date Lodged** 15/03/2024 **Document Name** Commencement of Phase 2 (8C) **Description of Document** As per Condtion A5(b) Menangle Sand & Soil is advising the DPE of its intention to commence operations (clearing) in Phase 2 (Substage 8C) **Applicable Conditions** Schedule: A; Condition: 5(b) To sign in to your account click here or visit the Major Projects Website. Please do not reply to this email. Kind regards The Department of Planning and Environment NSW	
A6	In addition to meeting the specific performance measures and criteria in this consent, all reasonable and feasible measures must be implemented to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the operation of the development, and any rehabilitation required under this Schedule.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A7	The development (as modified) may only be carried out:	Noted	
	a. in compliance with the conditions of this consent;		Compliant
	b. in accordance with all written directions of the Planning Secretary; and		Compliant
	c. generally in accordance with the EIS, EA (Mod 1), Amended Project Summary and the Development Layout and Modification Report.		Compliant
A8	Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant in relation to:	Noted	Compliant
	a. the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Planning Secretary; and		Compliant
	b. the implementation of any actions or measures contained in any such document referred to in condition A8(a) of Schedule 2.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A9	The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document/s listed in condition A7(c) of Schedule 2. In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition A7(c) of Schedule 2, the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.	Noted	Compliant
A10	The Applicant must establish and maintain a Nepean River Buffer Zone during Quarrying Operations in the Stage 8 Area. This buffer zone must:	Vegetation Identification Report Approved by DPE 26/04/2022	Compliant
	a. include a minimum horizontal setback of 10 m extending landward from the 64 m AHD contour on the western side of the Nepean River;		Complaint

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. be informed by a native vegetation identification report, which must: (i) be prepared by a suitably qualified and experienced botanist or ecologist, whose appointment has been endorsed by the Planning Secretary; (ii) include detailed site surveys to identify the DBH of all native trees that occur within the 10 m horizontal setback from the 64 m AHD contour referred to in sub-paragraph (a); (iii) classify all native trees identified in subparagraph (b)(ii) with a DBH of greater than or equal to 0.1 m as Protected Trees and provide their GPS coordinates; and (iv) include a map illustrating a 7.5 m setback (measured at the outside of the native tree trunk) around each of the identified Protected Trees; (v) the map required under subparagraph (iv) must overlay high-resolution ortho-photographs, with supporting digital terrain data files		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	provided in spatial format for GIS and as high-resolution JPEG files; and		
	c. be amended to include the findings of the native vegetation identification report, such that it is widened to include areas where the Protected Tree setbacks extend beyond the minimum 10 m horizontal setback referred to in subparagraph (a).		Compliant
A11	The Applicant must submit a copy of the native vegetation identification report and associated survey plans, GPS coordinates and data files required under condition A10(b) of	Report Approved by DPE 26/04/2022	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Schedule 2 and associated final landform plans to the Planning Secretary for each of Phases 1 to 7 of the development prior to commencing any vegetation clearing or Quarrying Operations in the relevant phase.		
A12	With the written agreement of the Planning Secretary, the Applicant may seek to reduce the minimum 7.5 m horizontal setback distance for Protected Trees to an appropriate distance recommended by a consulting arborist assessment. Any variation request must be supported by an expert report prepared by the consulting arborist and will be determined by the Planning Secretary on a case by case basis.	Noted	Not Triggered
A13	The Applicant must retain and manage the minimum Nepean River Buffer Zone in accordance with the commitments in the documents listed in condition A7(c) of Schedule 2 (as may be amended by the conditions of this consent).	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A14	Prior to undertaking Quarrying Operations in Substage 8G, the Applicant must update the TUFLOW hydrodynamic model used to generate the flood sensitivity analysis in the Additional Flood Impact Sensitivity Assessment dated 17 December 2019, prepared by Advisian in the Amended Project Summary, to include the post extraction topography for Substages 8G-M, using hydraulic roughness Scenario B, and simulate the 1% AEP flood.	This Condition relates to activities prior to extraction and operations in Substage 8G. This is some years away.	Not Triggered
A15	Prior to undertaking Quarrying Operations in Substage 8G, the Applicant must provide the Planning Secretary with a copy of the model required under condition A14 and a plan depicting any areas identified as having a post extraction 1% AEP peak flow velocity of 4 metres/second or greater.	This Condition relates to activities prior to extraction and operations in Substage 8G. This is some years away.	Not Triggered
A16	The Applicant must not carry out construction works or Quarrying Operations or locate any ancillary infrastructure within the Exclusion Areas.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A17	The Applicant must not:	Noted	
	a. carry out Quarrying Operations or regrading; and/or		Compliant
	b. remove vegetation, except where necessary for Weed control, within the Nepean River Buffer Zone, without the prior written agreement of the Planning Secretary.		Compliant
	The written agreement of the Planning Secretary may be provided in circumstances where those activities are necessary for environmental management purposes.		Not Triggered
A18	The Applicant must ensure that any Weed control activities undertaken within the Nepean River Buffer Zone:	Noted	Compliant
	a. are limited to Weed removal techniques that use hand-held tools; and		Compliant
	b. minimise ground disturbance to the greatest extent practicable.		Compliant
A19	The Applicant must not undertake extraction within 7.5 m of any Protected Trees without the written agreement of the Planning Secretary under condition A12 of Schedule 2.	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A20	The Applicant must maintain a minimum 7.5 m setback between Quarrying Operations and any native trees a located in the Restoration Area, except where a reduced setback is supported by an assessment by a suitably qualified and experienced arborist, and evidence of this assessment has been provided to the Planning Secretary. * In this condition, the setback is to be measured from the outside of the tree trunk.	Noted	Not Triggered
A21	The Applicant must not carry out any extraction:	Noted	
	a. in Stages 1, 2, 4, 5, 6 or 7 after the date specified in condition 30 of Schedule 1; or		Not Triggered
	b. in Stage 3 at any time.		Compliant
A22	Prior to the commencement of Quarrying Operations in each of Phases 1 to 7, the Applicant must:	Phase 1-7 are parts of the Stage 8 area defined in the definitions. Phase 1 is substages 8A-8B. Phase 2 is substage 8C. Both these Phases have been pegged and have been documented by JMD in the Sketch of Setout Works provided as part of Appendix A of the Biodiversity and Rehabilitation Management Plan (page A12)	
	a. engage a registered surveyor to mark out the boundaries of the approved limits of extraction for the relevant Substages in each phase (as set out conceptually in the Appendix		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	1 and as amended by the conditions of this consent);	The survey plan for 8A and 8B was provided through the Portal to address Conditions A10 and A11 which includes the required survey information. The 20 protected trees are marked and listed in the BRMP page 137	
	b. submit a survey plan of these boundaries and their GPS coordinates to the Planning Secretary; and		Compliant
	c. ensure that these boundaries are clearly marked at all times during the life of the development in a manner that allows operating staff and inspecting officers to clearly identify those limits.		Compliant – ongoing

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A23	Stage 8 Operations may be carried out on the site until 31 December 2035. Note: Under this consent, the Applicant is required to decommission and rehabilitate the site and carry out other requirements in relation to Quarrying Operations. Consequently, this consent will continue to apply in all respects other than to permit the carrying out of Quarrying Operations until the rehabilitation of the site and other requirements have been carried out to the required standard.	Noted	Not Triggered
A24	A maximum of 150,000 tonnes of extractive material may be extracted from the site in any calendar year.	For the calendar year 2023, 72,541 tonnes were extracted from Stage 8.	Compliant
A25	Truck movements at the site (ie inbound combined with outbound movements) must not exceed:	Truck volumes to site have been published on the Benedict website (www.benedict.com.au) A25-Truck-Movement-Summary.pdf) since January 2021. To date the truck movement volume has not exceeded the Consented number. This data has been updated every 6 months since 2021	
	a. a maximum of 248 movements on any given weekday;		Compliant
	b. an average of 148 movements per weekday, averaged on a weekly basis; and		Compliant
	c. a maximum of 80 movements per day on Saturdays.		Compliant

<table>
<tr><th>Condition</th><th>Requirement</th><th>Tracking</th><th>Compliant Y/N

Triggered Y/N</th></tr>
<tr><td>A26</td><td>The Applicant must comply with the op
Table 1: Operating Hours
<table><tr><th>Activity</th><th>Permissible Hours</th></tr><tr><td>Construction work</td><td>• 7 am to 5 pm Monday to Friday
• 7 am to 1 pm Saturday
• At no time on Sundays or public holidays</td></tr><tr><td>Quarrying Operations including loading and dispatch of laden trucks</td><td>• 6 am to 5 pm Monday to Friday
• 6 am to 12 noon Saturday
• At no time on Sundays or public holidays</td></tr><tr><td>Maintenance, security, office work, cleaning, etc</td><td>• May be conducted at any time, provided that these activities are not audible at any residence on privately-owned land</td></tr></table></td><td>Noted. General Quarry Operating hours are Mon-Fri 6am-5pm & Sat 6am-12pm</td><td>Compliant</td></tr>
<tr><td rowspan="4">A27</td><td>The following activities may be carried out outside the hours specified in Table 1.</td><td rowspan="4">Noted</td><td></td></tr>
<tr><td>a. delivery or dispatch of materials as requested by Police or other public authorities; and</td><td>Not Triggered</td></tr>
<tr><td>b. emergency work to avoid the loss of lives, property or to prevent environmental harm.</td><td>Not Triggered</td></tr>
<tr><td>In such circumstances, the Applicant must notify the Department and affected residents prior to</td><td>Not Triggered</td></tr>
</table>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	undertaking the activities, or as soon as is practical thereafter.		
A28	Where conditions of this consent require consultation with an identified party, the Applicant must:	Noted	
	a. consult with the relevant party prior to submitting the subject document; and		Compliant
	b. provide details of the consultation undertaken including: (i) the outcome of that consultation, matters resolved and unresolved; and (ii) details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A29	The Applicant may prepare and submit the Soil and Water Management Plan and/or Biodiversity and Rehabilitation Management Plan required under conditions B36 and B73 of Schedule 2 on a staged basis, prior to the commencement of Quarrying Operations in each of Phases 1 to 7. Quarrying Operations must not commence in any phase until a management plan has been approved by the Planning Secretary for that phase.	SWMP (B36) has been approved by DPE on 24/09/2021 BRMP (B73) has been approved by DPE on 9/03/2022 Published on the www.benedict.com.au website The Soil and Water Management Plan and Biodiversity and Rehabilitation Management Plan only apply to Substages 8A to 8C (also called Phases 1-2 in the Consent). These Plans need to be updated and approved before commencing in Substage 8D (also called Phase 3 in the Consent). The current plans also need to be reviewed and updated within 3 months of certain triggers (see Condition D5).	
A30	With the approval of the Planning Secretary, the Applicant may:	Noted	
	a. prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	relationship of the stage to any future stages and the trigger for updating the strategy, plan or program);		
	b. combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined); and		Compliant
	c. update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development).		Compliant
A31	If the Planning Secretary agrees, a strategy, plan or program may be approved, staged or updated without consultation being undertaken with all parties required to be consulted in the relevant condition in this consent.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A32	Unless the Applicant and the applicable authority agree otherwise, the Applicant must:	Noted	
	a. repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by carrying out the development; and		Not Triggered
	b. relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development.		Not Triggered
	Note: This condition does not apply to any damage to roads caused as a result of general road usage or otherwise addressed by contributions required by condition 26 of Schedule 1.		Noted
A33	All plant and equipment used on site, or to monitor the performance of the development must be:	Noted	
	a. maintained in a proper and efficient condition; and		Compliant
	b. operated in a proper and efficient manner.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A34	The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development.	Noted. This has been included in site inductions	Compliant
A35	References in the conditions of this consent to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, Standards or policies in the form they are in as at the date of this consent.	Noted	Compliant
A36	However, consistent with the conditions of this consent and without altering any limits or criteria in this consent, the Planning Secretary may, when issuing directions under this consent in respect of ongoing monitoring and management obligations, require compliance with an updated or revised version of such a guideline, protocol, Standard or policy, or a replacement of them.	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A37	Each year, from the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide calendar year quarry production data to MEG by no later than 30 January.	There was some uncertainty with the MEG as to whether the MEG required us to report being a private landholding. It was eventually confirmed, and the Stage 8 quarry production data was registered on the portal - the data was logged on 7 March 2024.	Now Compliant
A38	The data must be provided using the relevant standard form and a copy of the data must be included in the Annual Review.	The provision of data for the MEG was by portal. A summary of the date required is included in Section 5 of this Annual Review (above)	Compliant
A39	The Applicant must obtain all necessary approvals, licences and consents required for the carrying out of the development, including but not limited to, approvals under the Roads Act 1993, the Water Management Act 2000 and the POEO Act.	Noted	Compliant
B1	The Applicant may prepare an Early Works Construction Environmental Management Plan for the Early Works, to the satisfaction of the Planning Secretary. This plan must:	Condition B1 was originally inserted by DPE to allow some works to commence while the full management plans were being prepared/approved. It's not relevant now.	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. describe measures to be implemented to minimise construction-related impacts on biodiversity, including: (i) specific measures to minimise impacts on tree hollows, termite mounds and fauna; and (ii) detailed procedures for pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees within disturbance areas associated with the Early Works;		Not Triggered
	b. describe measures to be implemented to manage sediment and erosion risks, including: (i) a detailed description of the surface water management measures to be implemented in relation to the Early Works; and (ii) appropriate clean water diversion systems and construction of appropriate erosion and sediment controls for the management of disturbed areas associated with the Early Works;		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. include a Trigger Action Response Plan which outlines actions to be undertaken to rectify impacts associated with erosion and sedimentation during the Early Works (to the extent that these actions are not addressed by other management plans required to be in place prior to the commencement of Early Works); and		Not Triggered
	d. describe detailed procedures to be implemented to receive, record, handle and respond to complaints associated with the Early Works construction.		
B2	If the Applicant opts to seek approval for Early Works, the Applicant must not commence Early Works until the Early Works Construction Environmental Management Plan is approved by the Planning Secretary.	N/A	Not Triggered
B3	If the Planning Secretary approves an Early Works Construction Environmental Management Plan, the Applicant must implement that	N/A	Not Triggered

<table>
<tr><th>Condition</th><th>Requirement</th><th>Tracking</th><th>Compliant Y/N

Triggered Y/N</th></tr>
<tr><td></td><td>plan as approved by the Planning Secretary.</td><td></td><td></td></tr>
<tr><td rowspan="2">B4</td><td>The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.
Table 2: Operational Noise Criteria dB(A)</td><td>The Noise Management Plan outlines our commitments for Quarterly Noise monitoring (see pages 26 onwards).

Quarterly Monitoring will occur in the Months of March, June, September and December in 2024.

As outlined in Appendix 4 (3) of the Consent a Noise Compliance Assessment was conducted in the first two months of operations – A copy of this has been forwarded to the EPA as required.</td><td>Compliant</td></tr>
<tr><td>Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA, 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.</td><td><table>
<tr><th>Residences [a]</th><th>Day</th><th colspan="2">Shoulder Period
6.00 am to 7.00 am Monday to Saturday</th></tr>
<tr><th></th><th>$L_{Aeq\ (15\ minute)}$</th><th>$L_{Aeq\ (15\ minute)}$</th><th>$L_{A(max)}$</th></tr>
<tr><td>2, 3, 5[b], 6, 7, 8, 9</td><td>45</td><td>45</td><td>55</td></tr>
<tr><td>4</td><td>54</td><td>52</td><td>62</td></tr>
<tr><td>10, 11</td><td>35</td><td>35</td><td>45</td></tr>
<tr><td>All other Residences</td><td>35</td><td>35</td><td>45</td></tr>
</table>
[a] Residence locations are shown as "Assessment Locations" in Figure in Appendix 3.
[b] Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 1 in Appendix 3.</td><td>Compliant</td></tr>
</table>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B5	The noise criteria in condition B4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.		Not Triggered
B6	The Applicant must:	Noted	
	a. take all reasonable steps to minimise all noise from operational activities, including low frequency noise and other audible characteristics, as well as road noise associated with the development;		Compliant
	b. take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions, particularly when the noise criteria in this consent do not apply (see Appendix 4);		Compliant
	c. carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is		Compliant – testing conducted during March 2024

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	complying with the relevant conditions of Schedule 2; and		
	d. regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.		Compliant
B7	The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Plan completed by EMM on 25/02/2022.	Compliant
	a. be prepared by a suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with the EPA;		Compliant
	c. describe the measures to be implemented to ensure: (i) compliance with the noise criteria and operating conditions in this consent; (ii) best practice noise management is being employed; and (iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions; under which the noise		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	criteria in this consent do not apply (see Appendix 4); and		
	d. include a monitoring program that: (i) is capable of evaluating the performance of the development against the noise criteria; (ii) monitors noise at the nearest and/or most affected residences; and (iii) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.		Compliant
B8	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Noise Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 23/03/2022. Published on the www.benedict.com.au website.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 NSW GOVERNMENT Department of Planning and Environment Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Narabang Way BELROSE NSW 2085 23/03/2022 Dear Ms Campbell **Menangle Quarry (DA85/2865)** **Noise Management Plan** I refer to the updated Noise Management Plan which was submitted in accordance with Condition B7 of Schedule 2 of the consent for Menangle Quarry (DA85/2865). The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the condition. Accordingly, the Secretary has approved the Noise Management Plan (Revision 7, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on 0292746209. Yours sincerely Jessie Evans Director, Resource Assessments Resource Assessments	
B9	The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.	Noted	Compliant
B10	The Applicant must ensure that no offensive odours (as defined under the POEO Act) are emitted by the development.	Noted	Compliant

<table>
<tr><th>Condition</th><th>Requirement</th><th>Tracking</th><th>Compliant Y/N

Triggered Y/N</th></tr>
<tr><td>B11</td><td>The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land.
Table 3: Air Quality Criteria</td><td>DDG1/DDG2/DDG3 have been installed. Monitoring and website posting began September 2023

Two real-time particulate matter monitoring units initially for 2 x 4-week campaigns between Nov and Jan 2024. EMM have prepared a PM 2.5 and PM 10 assessment report which was completed on 19 February 2024. (See Attachment D)

The need to continue this real-time monitoring will be reviewed in conjunction with DPE after the 2 separate monitoring events.

<table><tr><th>Pollutant</th><th>Averaging period</th><th colspan="2">Criterion</th></tr><tr><td rowspan="2">Particulate matter < 10 µm (PM_{10})</td><td>Annual</td><td colspan="2">[a, c] 25 µg/m³</td></tr><tr><td>24 hour</td><td colspan="2">[b] 50 µg/m³</td></tr><tr><td rowspan="2">Particulate matter < 2.5 µm ($PM_{2.5}$)</td><td>Annual</td><td colspan="2">[a, c] 8 µg/m³</td></tr><tr><td>24 hour</td><td colspan="2">[b] 25 µg/m³</td></tr><tr><td>Total suspended particulate (TSP) matter</td><td>Annual</td><td colspan="2">[a, c] 90 µg/m³</td></tr><tr><td>[d] Deposited dust</td><td>Annual</td><td>[b] 2 g/m²/month</td><td>[a] 4 g/m²/month</td></tr></table>Notes:
[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).
[c] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.
[d] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method</td><td>Compliant</td></tr>
<tr><td>B12</td><td>The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.</td><td>Noted</td><td></td></tr>
<tr><td>B13</td><td>The Applicant must:</td><td>Noted</td><td></td></tr>
</table>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. take all reasonable steps to: (i) minimise odour, fume, greenhouse gas and dust (including PM10 and PM2.5) emissions of the development; (ii) minimise any visible off-site air pollution generated by the development; and (iii) minimise the extent of potential dust generating surfaces exposed in the Stage 8 Area at any given point in time;		Compliant
	b. minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see Note c to Table 3 above);		Compliant
	c. carry out regular air quality monitoring to determine whether the development is complying with the relevant conditions of Schedule 2; and		Compliant
	d. regularly assess meteorological and air quality monitoring data and relocate, modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B13 A	The Applicant must construct and maintain all haul roads to minimise:	Noted – the haul roads are constructed and maintained and regularly treated by a water cart to manage dust emissions. (see Attachment I for water truck filling and water use)	
	a. excessive dust emissions by (including but not limited to): (i) sealing the road surface with a clean coarse aggregate or equivalent, and minimising the surface silt content of the roads or implementing other surface treatment options such as chemical suppressants or paving; and (ii) watering the haul roads at the appropriate water rate when in use.		Compliant
	b. erosion and sediment loss through the appropriate design and installation of drainage having regard to the Erosion and sediment control on unsealed roads A field guide for erosion and sediment control maintenance practices (OEH 2012) or latest version.		Compliant
B14	The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Plan approved by DPE 19/04/2022. Published on the www.benedict.com.au website.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. be prepared by a suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with the EPA;		Compliant
	c. describe the measures to be implemented to ensure: (i) compliance with the air quality criteria and operating conditions in this Schedule; (ii) best practice air quality management is being employed; and (iii) air quality impacts of the development are minimised during adverse meteorological conditions and extraordinary events; and		Compliant
	d. include an air quality monitoring program that: (i) is capable of evaluating the performance of the development against the air quality criteria; and (ii) includes a protocol for identifying any air quality-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B15	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Air Quality Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 19/04/2022. Published on the www.benedict.com.au website  NSW GOVERNMENT Planning, Industry & Environment Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Narabang Way BELROSE NSW 2085 19/04/2022 Dear Ms Campbell **Menangle Quarry - Air Quality Management Plan (DA85/2865)** **Air Quality Management Plan - Version 9** I refer to the updated Air Quality Management Plan which was submitted in accordance with condition B14 of Schedule 2 of the consent for Menangle Quarry (DA85/2865). The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions. Accordingly, the Secretary has approved the Air Quality Management Plan - Version 9 (dated March 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on 0292746209. Yours sincerely JEvans Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary	Compliant
B16	The Applicant must implement the Air Quality Management Plan as approved by the Planning Secretary.	Noted	Compliant
B17	Prior to the commencement of Quarrying Operations in the Stage 8 Area, and for the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in close proximity to the site that:	Fully Installed and Operational at the site weighbridge since 3/08/2022	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. complies with the requirements in the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007); and		Compliant
	b. is capable of measuring meteorological conditions in accordance with the NSW Industrial Noise Policy (EPA, 2000), unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.		Compliant
B18	The Applicant must ensure that diesel spills and the like are cleaned up immediately so as not present a risk to water quality if the relevant Substage is inundated by floodwaters.	Noted – Part of the PIRMP process	Compliant
B19	The Applicant must monitor groundwater levels at Groundwater Bores BH01_S, BH01_D, BH02, BH03 and BH04 as shown in Figure 1 in Appendix 5, using continuous data loggers, for the duration of Quarrying Operations in the Stage 8 Area.	A groundwater monitoring report was prepared by EMM in February 2023. (see Attachment E). The next report is due in 2024 and is being conducted on 8 April 2024 Quarterly download logger data has been collected onsite and the information forwarded to EMM for the next annual review. Downloads have been executed in June 23, Sep 23, Jan 24	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B20	The Applicant must ensure that Quarrying Operations do not compromise the integrity of the monitoring bores identified in condition B19 of Schedule 2.	Noted	Compliant
B21	The Applicant must:	Sampling once per year - EMM. EMM completed report end Jan 2023 (See Attachment E)	Compliant
	a. collect groundwater quality samples at each of the monitoring locations identified in condition B19; and		
	b. analyse collected groundwater quality samples for all major anions and cations and field parameters; on an annual basis for the duration of Quarrying Operations in the Stage 8 Area.		
B22	The Applicant must ensure that:	1 bore prior to start of extraction, monitored for 7 days prior to extraction, water level recorded twice a day. As extraction progresses, the first bore can be moved to the base of the pit and additional 1-2 bores placed in pit too. All 2-3 bores to be monitored daily while extracting.	Compliant
	a. temporary bores are drilled or augered progressively in each Substage to determine the local water table position immediately prior to commencing extraction in each Substage; and		Compliant
	b. the pit floor in each Substage remains at least 1 metre above the measured water table level averaged over a seven-day period following the date of drilling or augering.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B23	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of the development to match its available water supply.	Noted	Compliant
B24	The Applicant must develop a groundwater model using a variant of Modflow standard software, or equivalent software, to quantify the progressive takes from water sources during Quarrying Operations in the Stage 8 Area.	Completed as part of the Soil and Water Management Plan	Compliant
B25	The Applicant must:	Completed as part of the Soil and Water Management Plan	Compliant
	a. initially construct the groundwater model required under condition B24 of Schedule 2 using the first three months of groundwater monitoring data collected from 17 June 2020 to 16 September 2020;		
	b. update the groundwater model following collection of the first 12 months of data collected from 17 June 2020 to 16 June 2021; and		Complaint
	c. incorporate the outputs of the groundwater model into the Site Water Balance as required under condition B36(c)(i) of Schedule 2.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B26	If a potential flood event (equivalent to a level of 64 m AHD at Menangle Weir, which represents the approximate height of overtopping of the Nepean River bank) does not occur between 17 June 2020 to 16 June 2021, then the Applicant must update the groundwater model required under condition B24 of Schedule 2 following the first flood event equivalent to or greater than this level when it occurs.	Completed	Compliant
B27	The Applicant must obtain any necessary Water Access Licences for the development under the Water Act 1912 and/or the Water Management Act 2000.	Approval was granted on 11 February 2022 by the Natural Resources Access Regulator (CAA-2021-	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		11223) for the Stage 8 Sand extraction  2 Natural Resources Access Regulator **Notice of Decision** *Water Management Act 2000* **Application details** Approval number: CAA-2021-11223 Application type: Controlled activity approval under section 92 of the *Water Management Act 2000* for integrated development Description of activity: Stage 8 Sand Extraction Applicant/s: El Bethel Pty Ltd C/- Menangle Sand & Soil Pty Ltd 11a Narabang Way Belrose NSW 2085 **Decision** Decision: **Granted, subject to conditions** This decision was made under section 95 of the *Water Management Act 2000*. Date of decision: 11 February 2022 Determining officer: David Zerafa by delegation from the Minister administering the *Water Management Act 2000* under the *Instrument of Delegation (Water Management Act) 2011* **Reason/s for decision**	
B28	When making an application for any necessary Water Access Licence, the Applicant must specify the annual take of water from each affected water source, as estimated by the groundwater model required under condition B24 of Schedule 2.	Noted - already have a water licence	Compliant
B29	Should the maximum annual water take as calculated by the groundwater model increase due to subsequent revisions of the groundwater model, as required under conditions B25 and B26 of	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Schedule 2, the Applicant must acquire the necessary additional licence shares to account for the maximum predicted annual volume.		
B30	The Applicant must report on any water captured, intercepted or extracted from the site each year (directly and indirectly) in the Annual Review, including water taken under each Water Access Licence as applicable.	The review of the water balance is an annual reporting requirement in the Soil and Water Management Plan (SWMP) and the collection of 12 months of data will occur in September 2024	Not Triggered – due September 2024
B31	The Applicant must install and maintain suitable erosion and sediment control measures in the Stage 8 Area. These measures must be designed and implemented having regard to the guidance series Managing Urban Stormwater: Soils and Construction, and be detailed in the Soil and Water Management Plan required under condition B36 of Schedule 2.	This is ongoing and the Rehabilitation and Restoration Annual Progress Report (see Attachment F) included Attachment A which monitors and records drainage, erosion and sediment control inspections. This Report has also been independently reviewed (see Attachment G)	Compliant
B32	The Applicant must prepare a Flood Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Plan completed by EMM on 25 February 2022	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. be prepared by suitably qualified and experienced person/s;		Compliant
	b. identify measures to: (i) proactively prepare for, and respond to, any flood event in which the active extraction area is likely to be inundated by floodwaters emanating from the Nepean River; (ii) ensure the safety of site personnel; (iii) minimise, to the greatest extent practicable, the areas of exposed ground on the site that would be susceptible to flood risks (including scour and erosion and potential transport of sediment to downstream waters); (iv) ensure that the active extraction area in any Substage does not exceed 0.33 hectares at any one time; (v) ensure that the batter adjacent to the Nepean River Buffer Zone does not exceed: • a maximum slope of 1:1 at any time; and • a maximum slope of 1:5 in preparation for flood events;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(vi) ensure that no more than a 30 metres length of the batter adjacent to the Nepean River Buffer Zone (measured in total) has a slope exceeding 1:5 at any one time; and (vii) rectify any flood-related damage to areas undergoing rehabilitation; and		
	c. include a Trigger Action Response Plan which outlines actions to be undertaken in preparation for, and immediately following, a flood event including detailed protocols and timeframes for: (i) backfilling the active extraction area to achieve a maximum batter slope of 1:5 adjacent to the Nepean River Buffer Zone in preparation for flood events;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(ii) avoiding the downstream movement of debris from the site; (iii) recommencing Quarrying Operations following a flood event; and (iv) rectifying any damage to areas undergoing rehabilitation following a flood event.		
B33	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Flood Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 9/4/2021. Revised version approved 25/10/2022. Published on the www.benedict.com.au website 	Compliant

Department of Planning and Environment

NSW GOVERNMENT

Our ref: (DA85/2865-PA-26)

Ms Alycia Campbell
Environmental Compliance Manager
Benedict Recycling PTY Limited
11 Narabang Way
BELROSE NSW 2085

25/10/2022

Subject: Revised Flood Management Plan for Menangle Quarry (Condition B32 of DA85/2865)

Dear Ms Campbell

I refer to your submission requesting approval of the revised Flood Management Plan (Version 3, dated February 2022) which was submitted following modification 2 of the development consent and in accordance with Condition B32 of Schedule 2 (DA85/2865).

I also acknowledge your representatives' recent email (EMM Consulting) to the Department on 14 October 2022 confirming that the criteria presented in Table 5.2 detailing the flood scour risk and remedial responses are consistent with the information provided to NSW Natural Resources Access Regulator, as part of the Controlled Activity Approval (CAA-2021-11223) issued on 14 February 2022.

I therefore approve the revisions to the management plan.

You are reminded that if there is any inconsistency between the approved document and the conditions of consent, then the requirements of the conditions of consent prevail.

If you wish to discuss the matter further, please contact Kevin Reid on 02 927 46209 or via email kevin.reid@dpie.nsw.gov.au

Yours sincerely

Carl Dumpleton
Team Leader
Resource Assessments

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150 www.dpie.nsw.gov.au 1
Locked Bag 5022, Parramatta NSW 2124

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B34	The Applicant must implement the Flood Management Plan as approved by the Planning Secretary.	Noted	
B35	The Applicant must ensure that the flood storage capacity of the final rehabilitated landform is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Details of the available flood storage capacity must be reported in the Annual Review.	The only substage that has been finally rehabilitated is substage 8A. Before and after levels indicate a range of level reductions of between2.08m and 5.1m – The mean reduction in landform level is 4.198m there flood storage capacity has increased. 	
B36	The Applicant must prepare a Soil and Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Plan completed by EMM on 25/02/2022.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. be prepared by suitably qualified and experienced person/s;		
	b. be prepared in consultation with EPA and DPIE Water; and		Compliant
	c. include a: i. Site Water Balance that: • includes details of: - sources and security of water supply; - water use and management on the site; - reporting procedures, including the annual preparation of a site water balance; and • minimises clean and potable water use on the site; • incorporates the outputs of the groundwater water model required under condition B24 of Schedule 2;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	ii. Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in watercourses and/or water bodies that could potentially be affected by the development; • surface water impact assessment criteria, including trigger levels for investigating any potentially adverse impacts, and surface water management performance measures; • a detailed description of the surface water management system on the site, including the: - clean water diversion system; - erosion and sediment controls (including the construction of bunds and swales within each Substage); and - water storages (including a description of measures to maintain the storage capacity of sediment basins); • a program to monitor and report on:		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	- any surface water discharges; - the effectiveness of the water management system; - surface water quality in sediment basins; and - water levels and quality in the Nepean River both upstream and downstream of the site; and • a protocol for identifying and investigating any exceedances of the surface water impact assessment criteria and for notifying the Department and relevant stakeholders of these events;		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	iii. Groundwater Management Plan that includes: • all available baseline data for the site; • groundwater performance criteria, including trigger levels for investigating any potentially adverse groundwater impacts, particularly with respect to aquatic habitat and regional groundwater systems; • a protocol to ensure that Quarrying Operations do not exceed the extraction depth limit specified in condition B22(b) of Schedule 2; • measures to ensure that the integrity of the groundwater monitoring network is not compromised by Quarrying Operations; • a clear description of the reporting processes and procedures to be adopted for the routine collation, analysis and provision of monitoring data as required under conditions B21 and B22 of Schedule 2; and • a protocol for identifying		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	and investigating any exceedances of the groundwater performance criteria and for notifying the Department and relevant stakeholders of these events.		
B37	Subject to condition A29, the Applicant must not commence Quarrying Operations in the Stage 8 Area until the Soil and Water Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 25/03/2022. Published on the www.benedict.com.au website.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 Planning, Industry & Environment Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 NARABANG WAY BELROSE NSW 2085 25/03/2022 Dear Ms Campbell **Menangle Quarry (DA 85/2865)** **Soil and Water Management Plan - Version 3** I refer to the updated Soil and Water Management Plan - Version 3 which was submitted in accordance with Condition B36 of Schedule 2 of the consent for Menangle Quarry (DA 85/2865). The Department has carefully reviewed the document and is satisfied that it is satisfied that it generally meets the requirements of the conditions. Accordingly, the Secretary has approved the Soil and Water Management Plan (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on 0292746209. Yours sincerely Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary	
B38	The Applicant must implement the Soil and Water Management Plan approved by the Planning Secretary.	Noted	Compliant
B39	The Applicant must ensure that all surface discharges from the site comply with the relevant provisions of the POEO Act.	Noted	Compliant
B40	The Applicant must prepare an Ephemeral Creek Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	The Ephemeral Creek Management Plan is required before starting in substage 8E (after 2025).	Not Triggered
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. describes the measures that would be implemented to manage and control soil erosion and bank stabilisation (if required) and limit the risk of impacts on downstream receiving environments;		Not Triggered
	c. provide details of the methods and timing of extraction within Substages 8E, 8F or 8G that demonstrate the integrity of the ephemeral creek (shown conceptually in Figure 5 of Appendix 1) would be maintained for as long as practicable during operations;		Not Triggered
	d. provide for construction and stabilisation of appropriate diversion channels to divert surface water flows around the disturbance area, unless otherwise approved by the Planning Secretary;		Not Triggered
	e. provide final designs for the road crossing and realigned section of creek that are supported by hydrological modelling and meet the rehabilitation objectives in Table 4; and		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	f. describe the methods and timing for rehabilitation of the final realigned section of creek channel.		Not Triggered
B41	The Applicant must not undertake any construction activities or Quarrying Operations within Substages 8E, 8F or 8G until the Ephemeral Creek Management Plan is approved by the Planning Secretary.	Noted	Not Triggered
B42	The Applicant must implement the Ephemeral Creek Management Plan approved by the Planning Secretary.	Noted	Not Triggered
B43	Prior to commencing Quarrying Operations in the Stage 8 Area, the Applicant must make an application to TfNSW under Section 138 of the Roads Act 1993 for any proposed works within the Hume Highway Motorway Road Reserve (including the area under the Menangle Bridges).	WAD # SYD17/00793/04 between TfNSW & MSS was completed with construction securities accepted on 7 December 202 CommonwealthBank Commonwealth Bank of Australia ABN 48 123 123 124 BANK GUARANTEE G736296 BANK: Commonwealth Bank of Australia, Level 2, 5 - 7 Central Ave, South Eveleigh, NSW 2015, ACN 123 123 124 BENEFICIARY: Transport for NSW (ABN 18 804 239 602), 231 Elizabeth Street, Sydney, NSW 2000 BANK'S CUSTOMER: Menangle Sand & Soil Pty Ltd, 11 Narabang Way, Belrose, NSW 2085, ABN 48 001 425 921 GUARANTEED TRANSACTION: Works Authorisation Deed ***SYD17/00793/04 - Access road under Hume Hwy for Menangle Sand & Soil Quarry*** dated 17/08/2022 between **TfNSW** and **Menangle Sand & Soil Pty Ltd** (the Developer) GUARANTEED AMOUNT: $100,000.00 (One Hundred Thousand Dollars) 2	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B44	The Applicant must enter into a legally binding agreement with TfNSW (eg a licence, not a lease or an easement), for the operation and ongoing maintenance of the section of the haul road and associated infrastructure within the Hume Highway Motorway Road Reserve (including under the Menangle Bridges). The legally binding agreement must be executed prior to any construction within the road reserve. All TfNSW legal costs associated with drafting and executing the legally binding agreement must be borne by the Applicant.	WAD as above	Compliant
B45	The Applicant must:	WAD as above	
	a. provide an appropriately designed sealed access under and adjacent to the Menangle Bridges and comply with TfNSW drainage and pavement standards;		Compliant
	b. Deleted		
	c. provide unrestricted access to TfNSW to undertake maintenance on the Menangle Bridges and associated facilities at all times;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. remove any detritus associated with the construction and use of the access and haul road under and adjacent to the Menangle Bridges; and		Compliant
	e. protect the piers of the Menangle Bridges, as well as any other part of the bridge structure and associated facilities from any potential damage as a result of the development;		Compliant
B46	In making the application to TfNSW required under condition B43, the Applicant must provide:	WAD as above	
	a. details demonstrating how the requirements in condition B45 will be met during the early establishment phase of the development, including: (i) sealing and drainage design details for the access road under and adjacent to the Menangle Bridges; and (ii) anchoring details for any structure(s) associated with the development that may become floating debris during flood events; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. details demonstrating how the compliance with the requirements in condition B45 will be maintained over the life of the development.		Compliant
B47	The Applicant must ensure that works undertaken within the Hume Highway Motorway Road Reserve do not in any way destabilise the foundations of the Hume Highway, including the Menangle Bridges. Should rectification works be required as a result of the development, they must be undertaken by the Applicant in accordance with TfNSW requirements and standards, and at no expense to TfNSW.	Noted	Compliant
B48	The Applicant must not undertake any works within the Hume Highway Motorway Road Reserve (including the area under the Menangle Bridges) without the consent of TfNSW under Section 138 of the Roads Act 1993.	WAD – TfNSW gave construction approval on 13 December 2022	Compliant
B49	Within 12 months of commencing Quarrying Operations in the Stage 8 Area, and every five years thereafter until the conclusion of Quarrying	Quarry Operations commenced 4 September 2023 – The Road Safety and Condition Audit will be completed within 12 months (4 September 2024) of commencing quarrying operations then every 5	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Operations, the Applicant must undertake a Road Safety and Condition Audit for the development, to the satisfaction of the Planning Secretary. This Audit must:	years thereafter A report on structural condition of road annually for TFNSW as part of the WAD will be done at the same time where applicable	
	a. be undertaken by a suitably qualified independent expert/s whose appointment has been endorsed by the Planning Secretary;		Not Triggered
	b. be prepared in consultation with Council;		Not Triggered
	c. assessment the safety, performance and condition of the site's vehicular access onto Menangle Road, including the associated acceleration and deceleration lanes;		Not Triggered
	d. identify any road works that are required to ensure compliance with relevant Austroads standards or relevant Council requirements;		Not Triggered
	e. be documented in a Road Safety and Condition Audit Report which must be submitted to Council and the Planning Secretary for approval within three months of commencing the Audit.		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B50	Within 12 months of completing each Road Safety and Condition Audit required under condition B49 of this Schedule, unless otherwise agreed by the Planning Secretary, the Applicant must complete any road works recommended in the Audit, to the satisfaction of Council. If there is a dispute regarding the implementation of any recommendations contained in the Audit, the Applicant may refer the matter to the Planning Secretary for resolution.	Noted	Not Triggered
B51	For the duration of the Stage 8 Operations, the Applicant must continue to pay Council a rehabilitation levy on all sand and soil removed from the Stage 8 Area in accordance with the existing rates, calculation methods and indexation required under condition 26 of Schedule 1. The first instalment of these payments is to be made based on the most recent Index Review Date under Schedule 1.	Noted – The Trust Deed is currently being negotiated between MSS and DPE and currently is with DPE	Compliance being sough

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B52	The Applicant must keep accurate records of all truck movements to and from the site (including time of arrival and dispatch) and publish a summary of records on its website every 6 months.	Weighbridge data is collected for each truck movement. A summary of the truck movements is published on the www.benedict.com.au website	Compliant
B53	No direct access to or from the development via the Hume Highway is permitted.	Noted	Compliant
B54	The Applicant must:	Noted	
	a. ensure that all laden trucks entering or exiting the site have their loads covered;		Compliant
	b. ensure that all laden trucks exiting the site are cleaned of material that may fall from vehicles, before leaving the site;		Compliant
	c. take all reasonable steps to minimise traffic safety issues and disruption to local road users; and		Compliant
	d. take all reasonable steps to ensure that appropriate signage is displayed on all trucks used to transport quarry products from the development so they can be easily identified by other road users.		Compliant
	The Applicant must:	Noted	

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B54A	a. prevent headlights from the off-road haul truck impacting upon the Hume Motorway; and		Compliant
	b. ensure the off-road haul truck operating within the site is restricted to a travel speed of 20 km/hour or less.		Compliant
B55	The Applicant must prepare a Traffic Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Completed by EMM v7 February 2022	
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Compliant
	b. be prepared in consultation with TfNSW and Wollondilly Shire and Campbelltown Councils;		Compliant
	c. include details of all transport routes and traffic types to be used for development-related traffic;		Compliant
	d. describe the processes in place for the control of truck movements entering and exiting the site;		Compliant
	e. include details of the measures to be implemented to minimise		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	traffic safety issues and disruption to local road users;		
	f. include a Drivers' Code of Conduct that includes procedures to ensure that drivers: (i) adhere to posted speed limits or other required travelling speeds; (ii) adhere to designated transport routes; and (iii) implement safe and quiet driving practices;		Compliant
	g. describe the measures to be put in place to ensure compliance with the Drivers' Code of Conduct; and		Compliant
	h. describe measures to minimise the transmission of dust and tracking of material onto the surface of public roads from vehicles exiting the site; and		Compliant
	i. describe measures to be put in place to ensure the off-road haul truck complies with its operating conditions.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B56	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Traffic Management Plan is approved by the Planning Secretary.	Approved by DPE on 23/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/J190166_24_MSS_Traffic-MP_v7.pdf NSW Planning, Industry & Environment Ms Alycia Campbell Operations Planning Support Manager Benedict Recycling PTY LIMITED 11 Narabang Way BELROSE NSW 2085 23/03/2022 Dear Ms Campbell **Menangle Quarry (DA85/2865)** **Traffic Management Plan** I refer to the updated Traffic Management Plan which was submitted in accordance with Condition B54A and B55(i) of Schedule 2 of the consent for the Menangle Quarry (DA85/2865). The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions. Accordingly, the Secretary has approved the Traffic Management Plan (Revision 7, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on 0292746209. Yours sincerely Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary	Compliant
B57	The Applicant must implement the Traffic Management Plan as approved by the Planning Secretary.	Noted	Compliant
B58	The Applicant must ensure that the development does not cause any direct or indirect impact on any identified heritage item located outside the approved disturbance area.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B59	If suspected human remains are discovered on site, then all work surrounding the area must cease, and the area must be secured. The Applicant must immediately notify NSW Police and Heritage NSW, and work must not recommence in the area until authorised by NSW Police and Heritage NSW.	Noted	Not Triggered
B60	If any previously unknown Aboriginal object or Aboriginal place is discovered in the Stage 8 Area:	Noted	Not Triggered
	a. all work in the immediate vicinity of the object or place must cease immediately;		Not Triggered
	b. a 10 metre buffer area around the object or place must be cordoned off; and		Not Triggered
	c. Heritage NSW must be contacted immediately.		Not Triggered
B61	Work in the immediate vicinity of an object or place subject to condition B60 may only recommence if:	Noted	Not Triggered
	a. the potential Aboriginal object or Aboriginal place is confirmed by Heritage NSW upon consultation with the Registered Aboriginal		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Parties not to be an Aboriginal object or Aboriginal Place; or		
	b. an Aboriginal Heritage Impact Permit is obtained under section 90 of the National Parks and Wildlife Act 1974, and the Aboriginal Cultural Heritage Management Plan is revised to include appropriate measures in respect the Aboriginal object or Aboriginal place, to the satisfaction of the Planning Secretary.		Not Triggered
B62	The Applicant must prepare an Aboriginal Cultural Heritage Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Completed by EMM v3 February 2022	Compliant
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Compliant
	b. be prepared in consultation with Heritage NSW and Registered Aboriginal Parties;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. describe the measures to be implemented within the Stage 8 Area, Nepean River Buffer Zone and Restoration Area to: (i) ensure all workers on the site receive suitable Aboriginal cultural heritage inductions prior to carrying out any activities which may cause impacts to Aboriginal objects or Aboriginal places, and that suitable records are kept of these inductions; (ii) protect, monitor and manage Aboriginal objects and Aboriginal places; (iii) protect Aboriginal objects and Aboriginal places located outside the approved disturbance area from impacts of the development; (iv) manage any new Aboriginal objects or Aboriginal places discovered during the life of the development; (v) maintain and manage reasonable access for relevant Aboriginal stakeholders to Aboriginal objects and Aboriginal places (outside of the approved disturbance		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	area); and (vi) facilitate ongoing consultation and involvement of Registered Aboriginal Parties in the conservation and management of Aboriginal cultural heritage on the site.		
B63	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Aboriginal Cultural Heritage Management Plan is approved by the Planning Secretary.	Approved by DPE on 25/03/2022. Published on the website https://www.benedict.com.au/about/policies-compliance/	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		NSW Planning, Industry & Environment Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 NARABANG WAY BELROSE NSW 2085 25/03/2022 Dear Ms Campbell **Menangle Quarry (DA85/2865)** **Aboriginal Heritage Management Plan - Version 3** I refer to the updated Aboriginal Heritage Management Plan - Version 3 which was submitted in accordance with Conditions B58-B64 of Schedule 2 of the consent for the Menangle Quarry (DA85/2865). The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions. Accordingly, the Secretary has approved the Aboriginal Heritage Management Plan - Version 3 (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on 02 92746209. Yours sincerely JEvans Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary	
B64	The Applicant must implement the Aboriginal Cultural Heritage Management Plan approved by the Planning Secretary.	Noted	Compliant
B65	Prior to commencing construction of any linear infrastructure required for the carrying out of the development (including conveyors, access roads and haul roads), the Applicant must:	Existing tracks are being used, and no additional clearing will be required, therefore, there will be no need to survey, map vegetation or provide offsets.	Compliant
	a. determine the final alignment of the linear infrastructure by survey;		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. minimise the environmental impacts of the alignment of this infrastructure, where practicable;		Not Triggered
	c. map the final vegetation clearance, excluding any vegetation within the approved disturbance area as identified under condition A22 of Schedule 2;		Not Triggered
	d. submit a survey plan of the disturbance boundaries for linear infrastructure and their respective GPS coordinates to the Planning Secretary; and		Not Triggered
	e. identify relevant ecosystem and species credits required to compensate for the clearance identified in subparagraph (c), to the satisfaction of BCD.		Not Triggered
B66	The Applicant must retire the ecosystem and species credits identified under condition B65(e) in accordance with the Biodiversity Offsets Scheme of the BC Act, to the satisfaction of the BCT.	Not required if there is no clearing.	Not triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B67	Prior to commencing Quarrying Operations in the Stage 8 Area, or other timeframe agreed by the Planning Secretary, the Applicant must make suitable arrangements for the long-term protection of the Restoration Area as described in the documents listed in condition A7(c) of Schedule 2, to the satisfaction of the Planning Secretary.	This process commenced in February of 2023 and remains an ongoing legal negotiation at the time of this review.	Seeking Compliance
B68	If the Restoration Area does not meet the listing criteria of the targeted communities or the completion criteria in Table 6 in Appendix 7, within the timeframes established in the Biodiversity and Rehabilitation Management Plan, then the Applicant must retire the relevant deficient biodiversity credits in accordance with the Biodiversity Offsets Scheme of the BC Act, to the satisfaction of the BCT.	Noted	Not triggered
B69	The Applicant may satisfy condition B67 of Schedule 2 by establishing a positive covenant on title under section 88E of the NSW Conveyancing Act 1919. If the	Noted as per B67	

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Applicant seeks to establish a positive covenant on title:		
	a. the positive covenant must stipulate that the Applicant will manage the Restoration Area and all rehabilitated Substages in accordance with the Biodiversity and Rehabilitation Management Plan required under condition B73 of Schedule 2; and		
	b. the Applicant must establish a trust with sufficient funds (calculated in accordance with the total fund deposit requirements for a biodiversity stewardship site in accordance with BC Act) to provide for the ongoing management of the Restoration Area and all rehabilitated Substages in accordance with the Biodiversity and Rehabilitation Management Plan, to the satisfaction of the Planning Secretary.		

<table>
<tr>
<td>B70</td>
<td>The Applicant must rehabilitate all areas impacted by the Stage 8 Operations to the satisfaction of the Planning Secretary. This rehabilitation must be consistent with the final rehabilitation plans submitted to the Planning Secretary under condition A11 of Schedule 2 and must comply with the objectives in Table 4, to the satisfaction of the Planning Secretary.
Table 4: Rehabilitation objectives</td>
<td>Noted – subject to the Annual Review proceess

<table>
<tr><th>Feature</th><th>Objective</th></tr>
<tr><td>Stage 8 Area</td><td>• Safe (both within the site and in relation to downstream environs, including under flood conditions)
• Hydraulically, geotechnically and geomorphologically stable
• Non-polluting
• Fit for the intended post-Quarrying Operations land use(s)
• Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land or the Hume Highway</td></tr>
<tr><td>Surface infrastructure</td><td>• Infrastructure within the Hume Motorway road reserve (including the area under the Menangle Bridges) decommissioned and rehabilitated in accordance with TfNSW requirements
• All other surface infrastructure decommissioned and removed, unless otherwise agreed by the Planning Secretary</td></tr>
<tr><td>Quarry Substages</td><td>• Pit floor partially backfilled with sufficient and appropriate material to promote establishment of River-Flat Eucalypt Forest EEC
• Substages progressively landscaped and vegetated to meet the objectives, performance and completion criteria in Table 6 in Appendix 7
• Batters to be established to a maximum slope of 1:1 (V:H) along the landward edge of each Substage and 1:5 (V:H) adjacent to the Nepean River Buffer Zone</td></tr>
<tr><td>Final Landform</td><td>• No reduction in flood storage capacity, compared with pre-development conditions, unless otherwise agreed by the Planning Secretary
• Designed to incorporate geomorphological features to allow for the free draining discharge of clean water from the site
• Minimise sediment laden run-off into the Nepean River</td></tr>
<tr><td>Water Quality</td><td>• Water discharged from the site is suitable for receiving waters and capable of supporting existing aquatic ecology and riparian vegetation</td></tr>
<tr><td>Community</td><td>• Ensure public safety</td></tr>
</table>
</td>
<td>Not Triggered</td>
</tr>
<tr>
<td>B71</td>
<td>The Applicant must rehabilitate the Substages progressively, to the</td>
<td>Noted</td>
<td></td>
</tr>
</table>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	satisfaction of the Planning Secretary.		
B72	Unless otherwise agreed by the Planning Secretary, the Applicant must ensure that:	Noted – Quarry Operations commenced on 4 September 2023 and the DPE was advised on 9 August 2023 of the commencement	Compliant
	a. no more than two Substages are opened, excavated or worked at any one time without the written approval of the Planning Secretary;		Compliant
	b. the active extraction area in all combined Substages does not exceed 0.33 hectares at any one time;		Compliant
	c. the area of exposed ground at any one time is minimised as far as reasonable and feasible, for the life of the development;		Compliant
	d. Quarrying Operations do not progress from one phase of the development to another unless the progressive rehabilitation performance criteria in the Biodiversity and Rehabilitation Management Plan have been met (with the exception of in the active extraction area) for the previous phase (see condition B73(d) of Schedule 2); and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	e. the post-extraction batter along the landward edge of each Substage does not exceed a maximum slope of 1:1 (V:H) or the natural underlying sandstone profile.		Compliant
B73	The Applicant must prepare a Biodiversity and Rehabilitation Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	BRMP and VMP was completed by EMM v3.1 February 2022. It was approved by DPE on 9/3/2022.	Compliant
	a. be prepared by suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with BCD and Council;		Compliant
	c. describe the short, medium, and long-term measures to be undertaken to: (i) ensure compliance with the biodiversity objectives outlined in Table 6 in Appendix 7; (ii) ensure compliance with the rehabilitation objectives outlined in Table 4 of Schedule 2; and (iii) prevent impacts on aquatic biodiversity, including through the stabilisation of riverbanks and the prevention of sediment-laden runoff;		Compliant

NSW GOVERNMENT Planning, Industry & Environment

Miss Alycia Campbell
Environmental Compliance Manager
Benedict Recycling Pty Ltd
11 Narabang Way
Belrose, NSW, 2085

20/07/2021

Dear Miss Campbell,

Menangle Sand and Soil Quarry (DA85/2865)
Combination of Management Plans

I refer to your request (DA85/2865-PA-16) to combine the Vegetation Management Plan (VMP) with the Biodiversity and Rehabilitation Management Plan (BRMP), which was submitted in accordance with condition A30 of Schedule 2 of the consent for the Menangle Sand and Soil Quarry (DA85/2865).

The Department understands that through the combination of the VMP and BRMP, you are attempting to ensure a consistent approach to vegetation management across the development. The Department has carefully reviewed your request and is satisfied that a clear relationship has been demonstrated between these two plans.

Accordingly, the Planning Secretary has approved the combination of the VMP and BRMP.

If you wish to discuss the matter further, please contact Callum Firth at callum.firth@dpie.nsw.gov.au.

Yours sincerely

Matthew Sprott
Director
Resource Assessments
as nominee of the Planning Secretary

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. include detailed progressive rehabilitation performance criteria that must be met for each phase of the development before extraction can progress into subsequent phases;		Compliant
	e. include detailed performance and completion criteria for the Restoration Area and the final rehabilitation of the Stage 8 Area (including timeframes for the achievement of the listing criteria of the targeted communities) based on the performance and completion criteria in Table 6 in Appendix 7;		Compliant
	f. include a program to monitor, independently audit and report on progress against the criteria in sub-paragraphs (d) and (e), including reporting in the Annual Review;		Compliant
	g. include an evaluation of the performance of the Restoration Area and the progressive rehabilitation of the Stage 8 Area against the performance and completion criteria required under paragraph (d) above;		Compliant
	h. include triggers for remedial action (including additional planting or seeding), where the performance		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	or completion criteria required under (d) and (e) above are not met;		
	i. describe management measures to ensure that Quarrying Operations do not encroach on the Nepean River Buffer Zone and Exclusion Areas;		Compliant
	j. include a detailed description of the measures to be implemented to:		Compliant
	(i) demonstrate compliance with conditions B76 and B78;		Compliant
	(ii) manage the collection and propagation of seed;		Compliant
	(iii) trial methods of extraction of seed resources on site and implement the most effective method of seed recovery;		Compliant
	(iv) minimise impacts on tree hollows and termite mounds where reasonable and feasible;		Compliant
	(v) minimise impacts on fauna, including undertaking pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees;		Compliant
	(vi) protect native vegetation and fauna habitat outside the		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	approved disturbance area, including in the Restoration Area;		
	(vii) implement the Stage 8 Area Weed Control Strategy in the Amended Project Summary, except where varied by condition A18 of Schedule 2;		Compliant
	(viii) control feral pests;		Compliant
	(ix) control erosion;		Compliant
	(x) control unrestricted access;		Compliant
	(xi) manage bushfire hazards;		Compliant
	(xii) rehabilitate any areas of the Nepean River that are materially harmed by the development (including indirect or incidental impacts); and		Compliant
	(xiii) progressively rehabilitate the site and reasonably and feasibly minimise disturbance areas; and		Compliant
	(xiv) ensure the successful rehabilitation and protection of Stages 6 and 7 until the completion of Quarrying Operations in the Stage 8 Area;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	k. include an annual program to monitor and report on: (i) the effectiveness of the measures required under (j) above; (ii) progress against the detailed performance and completion criteria required under (d) and (d) above; (iii) any progressive improvements that could be implemented to improve biodiversity outcomes; and (iv) any additional or remedial actions required over the next 12 months;		Compliant
	l. identify the potential risks to the successful rehabilitation of the Stage 8 Area, particularly where rehabilitation is damaged or delayed by flooding, and include a detailed description of the contingency measures to be implemented to mitigate against these risks; and		Compliant
	m. include details of who would be responsible for monitoring, reviewing, and implementing the plan.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B74	Subject to condition A29, the Applicant must not commence Quarrying Operations in the Stage 8 Area until the Biodiversity and Rehabilitation Management Plan is approved by the Planning Secretary.	Approved by DPE on 09/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/J190166_26_MSS_BRMP.pdf NSW GOVERNMENT Department of Planning and Environment Ms Alycia Campbell 11 NARABANG WAY BELROSE New South Wales 2085 09/03/2022 Dear Ms Campbell **Menangle Quarry (DA 85/2865)** **Biodiversity and Rehabilitation Management Plan** I refer to the Biodiversity and Rehabilitation Management Plan (Revision 3.1 dated 23 February 2022) which was submitted in accordance with condition B73 of the consent **(DA 85/2865)**. The Department has carefully reviewed the document and considers it meets the relevant conditions of consent. Accordingly, I approve the Biodiversity and Rehabilitation Management Plan (Revision 3.1, dated 23 February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Carl Dumpleton on carl.dumpleton@planning.nsw.gov.au / 9274 6283. Yours sincerely JEvans Jessie Evans Director, Resource Assessments Resource Assessments	Compliant
B75	The Applicant must implement the Biodiversity and Rehabilitation Management Plan as approved by the Planning Secretary.	Noted	Compliant
B76	The Applicant must place or create a minimum of 106 nest boxes or tree hollows within the Restoration Area within 12 months of commencing	In the six months of quarry operations 35 had been installed. The remainder to be installed by 4 Sept 2024.	Compliant to date

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Quarrying Operations in the Stage 8 Area.		
B77	The Applicant must, to the greatest extent practicable, maximise the salvage of resources within the Stage 8 Area, including retention of:	Noted - operational	Compliant
	a. nut and seed resources from native trees; and		Compliant
	b. leaf and small branch material for mulching, for beneficial reuse on the site, including in rehabilitated Substages and in the Restoration Area.		Compliant
B78	Following the conclusion of extraction in each Substage, the Applicant must actively place logs and woody debris salvaged from the approved disturbance area within the completed Substage at the following ratios:	Noted - operational	Not Triggered
	a. logs and woody debris at least 10 cm in diameter and greater than 0.5 m in length are to be placed in a configuration that reflects natural systems, such that there is overall at least 400 m of this woody debris per		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	hectare for all completed Substages; and		
	b. large woody debris at least 50 cm in diameter and greater than 0.5 m in length, such that there is overall at least 100 m of this large woody debris per hectare for all completed Substages.		Not Triggered
B79	The Applicant may undertake timber milling in Stage 8, provided this timber milling occurs outside of the Nepean River Buffer Zone and the Exclusion Areas, and that the Applicant can demonstrate ongoing compliance with condition B78 of this Schedule.	Noted	Not Triggered
B80	The Applicant must rehabilitate 1.22 ha within Stage 6 and 3.44 ha within Stage 7 of the development in accordance with the objectives and the performance and completion criteria in Table 6 in Appendix 6.	This has been occurring and has been inhibited by past flooding – Status update for both stages are in Attachment F – Site Rehabilitation Progress Report -	Compliant
B81	By the end of December 2020, or other timing as agreed by the Planning Secretary, the Applicant must submit a Vegetation Management Plan for Stages 6 and 7	Approval was received from DPE to combine the Vegetation Management Plan with B73 BRMP on	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	to the Planning Secretary for approval. This plan must:	20/7/2022. 	
	a. satisfy the relevant requirements of condition 13 of Schedule 1;		Compliant
	b. clearly define the extent and scope of Stage 6 vegetated lands;		Compliant
	c. clearly define the extent and scope of Stage 7 vegetated lands and identifies that the diversity of species established via retention of current species, tubestock planting or direct seeding is to be raised to deliver the native plant species diversity identified in Table 5 in Appendix 6;		Compliant
	d. establish baseline data for the existing habitat in the Stage 6 and 7 areas;		Compliant
	e. describe how the Stage 6 and 7 vegetated lands would be managed and how habitat would be established and retained; and		Compliant
	f. include detailed biodiversity objectives and performance and completion criteria for Stages 6 and 7 of the development, based on the general objectives and performance		Compliant

Planning, Industry & Environment

Miss Alycia Campbell
Environmental Compliance Manager
Benedict Recycling Pty Ltd
11 Narabang Way
Belrose, NSW, 2085

20/07/2021

Dear Miss Campbell,

Menangle Sand and Soil Quarry (DA85/2865)
Combination of Management Plans

I refer to your request (DA85/2865-PA-16) to combine the Vegetation Management Plan (VMP) with the Biodiversity and Rehabilitation Management Plan (BRMP), which was submitted in accordance with condition A30 of Schedule 2 of the consent for the Menangle Sand and Soil Quarry (DA85/2865).

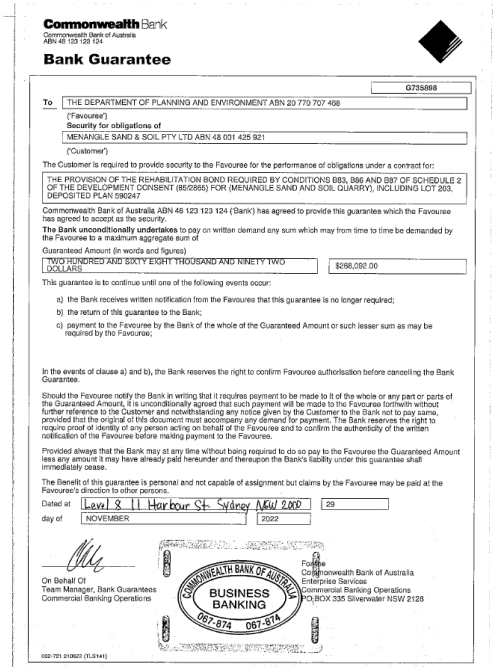
The Department understands that through the combination of the VMP and BRMP, you are attempting to ensure a consistent approach to vegetation management across the development. The Department has carefully reviewed your request and is satisfied that a clear relationship has been demonstrated between these two plans.

Accordingly, the Planning Secretary has approved the combination of the VMP and BRMP.

If you wish to discuss the matter further, please contact Callum Firth at callum.firth@dpie.nsw.gov.au.

Yours sincerely

Matthew Sprott
Director
Resource Assessments
as nominee of the Planning Secretary

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	and completion criteria in Table 5 in Appendix 6, to the satisfaction of the Planning Secretary.		
B82	The Applicant must implement the Vegetation Management Plan for Stages 6 and 7 to the satisfaction of the Planning Secretary.	Noted	Compliant
B83	Within 6 months of the approval of the Biodiversity and Rehabilitation Management Plan, the Applicant must lodge a Rehabilitation Bond with the Department to ensure that rehabilitation of the Stage 8 Area is implemented in accordance with the performance and completion criteria set out in the plan and the relevant conditions in Schedule 2 of this consent. The sum of the bond must be an amount agreed by the Planning Secretary and determined by:	Bond lodged with DPE 29/11/2022 $268,092 	Compliant
	a. calculating the cost of rehabilitating all disturbed areas of the site at third party rates (other than land acquisition costs), taking into account the likely surface disturbance over the next 3 years of Quarrying Operations; and		Compliant

Commonwealth Bank
Commonwealth Bank of Australia
ABN 48 123 123 124

Bank Guarantee

G735868

To THE DEPARTMENT OF PLANNING AND ENVIRONMENT ABN 20 770 707 468
("Favouree")
Security for obligations of
MENANGLE SAND & SOIL PTY LTD ABN 48 001 425 921
("Customer")

The Customer is required to provide security to the Favouree for the performance of obligations under a contract for:

THE PROVISION OF THE REHABILITATION BOND REQUIRED BY CONDITIONS B83, B86 AND B87 OF SCHEDULE 2 OF THE DEVELOPMENT CONSENT (85/2865) FOR (MENANGLE SAND AND SOIL QUARRY), INCLUDING LOT 203, DEPOSITED PLAN 590247

Commonwealth Bank of Australia ABN 48 123 123 124 (Bank) has agreed to provide this guarantee which the Favouree has agreed to accept as the security.

The Bank unconditionally undertakes to pay on written demand any sum which may from time to time be demanded by the Favouree to a maximum aggregate sum of

Guaranteed Amount (in words and figures)

TWO HUNDRED AND SIXTY EIGHT THOUSAND AND NINETY TWO DOLLARS — $268,092.00

This guarantee is to continue until one of the following events occur:

a) the Bank receives written notification from the Favouree that this guarantee is no longer required;
b) the return of this guarantee to the Bank;
c) payment to the Favouree by the Bank of the whole of the Guaranteed Amount or such lesser sum as may be required by the Favouree;

In the events of clause a) and b), the Bank reserves the right to confirm Favouree authorisation before cancelling the Bank Guarantee.

Should the Favouree notify the Bank in writing that it requires payment to be made to it of the whole or any part or parts of the Guaranteed Amount, it is unconditionally agreed that such payment will be made to the Favouree forthwith without further reference to the Customer and notwithstanding any notice given by the Customer to the Bank not to pay same, provided that the original of this document must accompany any demand for payment. The Bank reserves the right to require proof of identity of any person acting on behalf of the Favouree and to confirm the authenticity of the written notification of the Favouree before making payment to the Favouree.

Provided always that the Bank may at any time without being required to do so pay to the Favouree the Guaranteed Amount less any amount it may have already paid hereunder and thereupon the Bank's liability under this guarantee shall immediately cease.

The Benefit of this guarantee is personal and not capable of assignment but claims by the Favouree may be paid at the Favouree's direction to other persons.

Dated at Level 8 11 Harbour St Sydney NSW 2000 — 29
day of NOVEMBER — 2022

On Behalf Of
Team Manager, Bank Guarantees
Commercial Banking Operations

COMMONWEALTH BANK OF AUSTRALIA
BUSINESS BANKING
067-874 067-874

Post to
Commonwealth Bank of Australia
Enterprise Services
Commercial Banking Operations
PO BOX 335 Silverwater NSW 2128

002-721 210623 (TL0141)

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. employing a suitably qualified, independent and experienced person to verify the calculated costs.		Compliant
B84	The calculation of the Rehabilitation Bond must be submitted to the Department for approval at least 2 months prior to the lodgement of the bond.	Noted	Compliant
B85	The Rehabilitation Bond must be reviewed and if required, an updated bond must be lodged with the Department within 3 months following:	Noted	Compliant
	a. any update or revision to the Biodiversity and Rehabilitation Management Plan;		Not Triggered
	b. the completion of an Independent Environmental Audit in which recommendations relating to the implementation of the Biodiversity and Rehabilitation Management Plan have been made; or		Not Triggered
	c. in response to a request by the Planning Secretary.		Not Triggered
B86	If rehabilitation is completed generally in accordance with the relevant performance and	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	completion criteria, to the satisfaction of the Planning Secretary, the Planning Secretary will release the bond.		
B87	If rehabilitation is not completed generally in accordance with the relevant performance and completion criteria, the Planning Secretary will call in all, or part of, the bond, and arrange for the completion of the relevant works.	Noted	Not Triggered
B88	If the Applicant establishes a positive covenant on title under section 88E of the NSW Conveyancing Act 1919 under condition B69, then the Planning Secretary may waive the requirement for all or part of the Rehabilitation Bond required under conditions B83 to B87.	Noted	Not Triggered
B89	The Applicant must manage noxious weeds on the site in accordance with the Biodiversity and Rehabilitation Management Plan, and subject to the restrictions in condition A18 of this Schedule, to the satisfaction of the Planning Secretary.	Noted. Weed management occurring onsite – operational and ongoing	Compliant
B90	The Applicant must:	Noted	

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. take all reasonable steps to minimise the visual and off-site lighting impacts of the development, including potential lighting impacts on the Hume Highway;		Compliant
	b. ensure that the visual appearance of all new structures, facilities or works (including paint colours and specifications) is aimed at blending as far as possible with the surrounding landscape; and		Compliant
	c. take all reasonable steps to: (i) shield views of Quarrying Operations and associated equipment from users of public roads and at privately-owned residences; and (ii) direct any on-site lighting downwards to avoid lighting impacts on the Hume Highway.		Compliant
B91	The Applicant must:	Noted	
	a. manage on-site sewage treatment and disposal in accordance with the requirements of an applicable EPL, and to the satisfaction of EPA and Council;		Compliant
	b. minimise the waste generated by the development;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. ensure that the waste generated by the development is appropriately stored, handled, and disposed of; and		Compliant
	d. report on waste minimisation and management in the Annual Review.		Compliant
B92	Except as expressly permitted in an applicable EPL, specific resource recovery order or exemption under the Protection of the Environment Operations (Waste) Regulation 2014, the Applicant must not receive waste at the site for storage, treatment, processing, reprocessing or disposal.	Noted	Compliant
B93	The Applicant must ensure that all tanks and similar storage facilities (other than for water) are protected by appropriate bunding or other containment, in accordance with the relevant Australian Standards.	Noted	Compliant
B94	The Applicant must ensure that the storage, handling, and transport of dangerous goods is done in accordance with the latest version of the Australian Standards, particularly AS 1940-2004 The storage and handling of flammable and	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	combustible liquids (Standards Australia, 2004) and AS/NZS 1596:2014 The storage and handling of LP Gas (Standards Australia, 2014), and the Australian Dangerous Goods Code.		
B95	The Applicant must:	Fire Safety training is conducted for all staff annually as part of the PIRMP process	
	a. ensure that the development: (i) provides for asset protection in accordance with the relevant requirements in the Planning for Bushfire Protection (RFS, 2006) guideline; and (ii) ensure that there is suitable equipment to respond to any fires on the site; and		Compliant
	b. assist the RFS and emergency services to the extent practicable if there is a fire in the vicinity of the site.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
C1	As soon as practicable and no longer than 7 days after obtaining monitoring results showing an exceedance of any noise or air quality criterion in PART B of Schedule 2 following the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide details of the exceedance to any affected landowners/tenants if the Applicant has not otherwise reached an agreement to exceed the relevant criteria with the affected landowner pursuant to condition B5 or B12. For any exceedance of any air quality criterion in PART B of this consent, the Applicant must also provide to any affected land owners and tenants a copy of the fact sheet entitled “Mine Dust and You” (NSW Health, 2017).	Noted	Compliant
C2	If, at any time following the date of commencement of Quarrying Operations in the Stage 8 Area, a landowner considers the development to be exceeding any noise or air quality criterion in PART	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	B of Schedule 2, they may ask the Planning Secretary in writing for an independent review of the impacts of the development on their land.		
C3	If the Planning Secretary is not satisfied that an independent review is warranted, the Planning Secretary will notify the landowner in writing of that decision, and the reasons for that decision, within 21 days of the request for a review.	Noted	Not Triggered
C4	If the Planning Secretary is satisfied that an independent review is warranted, then within 3 months of the Planning Secretary's decision, or as otherwise agreed by the Planning Secretary and the landowner, the Applicant must:	Noted	Not Triggered
	a. commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to: (i) consult with the landowner to determine their concerns; (ii) conduct monitoring to determine whether the development is complying with the relevant		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	criteria in PART B of Schedule 2; and (iii) if the development is not complying with that criteria, identify measures that could be implemented to ensure compliance with the relevant criteria; and		
	b. give the Planning Secretary and landowner a copy of the independent review; and		Not Triggered
	c. comply with any written requests made by the Planning Secretary to implement any findings of the review.		Not Triggered
D1	An Environmental Management Strategy must be prepared for the development to the satisfaction of the Planning Secretary. This strategy must:	Completed by EMM 25 Feb 2022	Compliant
	a. provide the strategic framework for environmental management of the development;		Compliant
	b. identify the statutory approvals that apply to the development;		Compliant
	c. set out the role, responsibility, authority and accountability of all key personnel involved in the		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	environmental management of the development;		
	d. set out the procedures to be implemented to: (i) keep the local community and relevant agencies informed about the operation and environmental performance of the development; (ii) receive record, handle and respond to complaints; (iii) resolve any disputes that may arise during the course of the development; (iv) respond to any non-compliance and any incident; (v) respond to emergencies; and		Compliant
	e. include: (i) references to any strategies, plans and programs approved under the conditions of this consent; and (ii) a clear plan depicting all the monitoring to be carried out under the conditions of this consent.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
D2	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Environmental Management Strategy is approved by the Planning Secretary.	Approved by DPE on 23/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/Environmental-Management-Strategy_V3.pdf  NSW Planning, Industry & Environment Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY LTD 11 Narabang Way BELROSE NSW 2085 23/03/2022 Dear Ms Campbell Menangle Quarry (DA85/2865) Environment Management Strategy I refer to the Environment Management Strategy which was submitted in accordance with Condition D1 of Schedule 2 of the consent for the Menangle Quarry (DA85/2865). The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions. Accordingly, the Secretary has approved the Environment Management Strategy (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience. If you wish to discuss the matter further, please contact Kevin Reid on (02) 92746209. Yours sincerely Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary	Compliant
D3	The Applicant must implement the Environmental Management Strategy as approved by the Planning Secretary.	Noted	Compliant
D4	Management plans required under this Schedule must be prepared in accordance with relevant guidelines, and include:	Management Plans are for Substages 8A-8C. When approaching 8D (Phase 3) MSS will need to review and update the Management Plans	Compliant
	a. a summary of relevant background or baseline data;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. details of: (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); (ii) any relevant limits or performance measures and criteria; and (iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;		Compliant
	c. a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;		Compliant
	d. a program to monitor and report on the: (i) impacts and environmental performance of the development; and (ii) effectiveness of the management measures set out pursuant to condition D4(c);		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	e. a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;		Compliant
	f. a program to investigate and implement ways to improve the environmental performance of the development over time;		Compliant
	g. a protocol for managing and reporting any: (i) incident, non-compliance or exceedance of the impact assessment criteria or performance criteria; (ii) complaint; or (iii) failure to comply with statutory requirements; and		Compliant
	h. a protocol for periodic review of the plan.		Compliant
	Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.		
D5	Within three months of:	Review of the Management Plans will commence post Annual Review (including DPE feedback) and	Not Triggered
	a. the submission of an incident report under condition D7;		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. the submission of an Annual Review under condition D9;	any updated plans will be forwarded to DPE by 31 June 2024	Compliant
	c. the submission of an Independent Environmental Audit under condition D11;		Compliant
	d. the approval of any modification to the conditions of this consent; or		Not Triggered
	e. the issue of a direction of the Planning Secretary under condition A8 which requires a review, the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant.		Not Triggered
D6	If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary and submitted to the Planning Secretary for approval within six weeks of the review.	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.		
D7	The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name) and set out the location and nature of the incident.	Noted	Not Triggered
D8	Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-compliant with, the way in which it does not comply and the	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.		
	Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.		
D9	By the end of March in each year after the commencement of Quarrying Operations in the Stage 8 Area, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must:	Annual Review report DUE March 31 each year following commencement of quarrying activities (first report should be due March 31, 2024. Copy to Website and Council	Compliant
	a. describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the: (i) relevant statutory requirements, limits or performance measures/criteria; (ii) requirements of any plan or program required under this consent; (iii) monitoring results of previous years; and (iv) relevant predictions in the documents listed condition A7(c).		Compliant
	c. identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;		Compliant
	d. evaluate and report on: (i) the effectiveness of the noise and air quality management systems; and (ii) compliance with the performance measures, criteria and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	operating conditions in this consent, as they relate to the Stage 8 Area;		
	e. identify any trends in the monitoring data over the life of the development;		Compliant
	f. identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and		Compliant
	g. describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.		Compliant
D10	Copies of the Annual Review must be submitted to Council and made available to any interested person upon request.	Noted	Compliant
D11	Within one year of the commencement of Quarrying Operations in the Stage 8 Area, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent	Commission Independent Environmental Audit by 4 September 2024 (submit within 3 months) Next Independent Environmental Audit required every three years 2027, 2030….	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Environmental Audit of the development. The audit must:		
	a. be led and conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Planning Secretary;		Not Triggered
	b. be carried out in consultation with the relevant agencies;		Not Triggered
	c. assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);		Not Triggered
	d. review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;		Not Triggered
	e. recommend appropriate measures or actions to improve the environmental performance of the		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	development and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and		
	f. be conducted and reported to the satisfaction of the Planning Secretary.		Not Triggered
D12	Within three months of commencing an Independent Environmental Audit, or within another timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the Planning Secretary.	Noted	Not Triggered
	Note: The audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Planning Secretary.		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
D13	Any condition of this consent that requires the carrying out of monitoring or an environmental audit, whether directly or by way of a plan, strategy or program, is taken to be a condition requiring monitoring or an environmental audit under Division 9.4 of Part 9 of the EP&A Act. This includes conditions in respect of incident notification, reporting and response, non-compliance notification, compliance report and independent audit.	Noted	Compliant
	Note: For the purposes of this condition, as set out in the EP&A Act, "monitoring" is monitoring of the development to provide data on compliance with the consent or on the environmental impact of the development, and an "environmental audit" is a periodic or particular documented evaluation of the development to provide information on compliance with the consent or the environmental management or impact of the development.		Compliant
D14	Noise and air quality monitoring under Part B of this Schedule is not required at all privately-owned residences and the use of	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	representative monitoring locations can be used to demonstrate compliance with criteria.		
D15	Prior to commencing Quarrying Operations in the Stage 8 Area, the Applicant must:		
	a. make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website:		
	(i) the document/s listed in condition A7(c);	Completed	Compliant
	(ii) all current statutory approvals for the development;	Completed	Compliant
	(iii) all approved strategies, plans and programs required under the conditions of this consent;	Completed	Compliant
	(iv) regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;	Copy of the Annual Review online	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(v) 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;	Copy of the Annual Review online	Not Triggered
	(vi) a summary of the current stage and progress of the development;	Copy of the Annual Review online	Not Triggered
	(vii) contact details to enquire about the development or to make a complaint;	Completed - also a sign at the front gate	Compliant
	(viii) a complaints register, updated monthly;	Completed	Compliant
	(ix) the Annual Reviews of the development;	Noted and being prepared for 2023	Compliant
	(x) audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report;	N/A – not due till last quarter 2024	Not Triggered
	(xi) any other matter required by the Planning Secretary; and	Noted	Not Triggered
	b. keep such information up to date for the life of the development and to the satisfaction of the Planning Secretary.	Noted	Compliant

CONSOLIDATED CONSENT

Appendix 4 Noise Compliance Assessment

Applicable Meteorological Conditions

1. The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:
   - (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
     - (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
     - (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or
     - (iii) temperature inversion conditions greater than 3°C/100m.
   - (b) where Pasquill Stability Classes have been assessed, then:
     - (i) wind speeds greater than 3m/s at 10m above ground level;
     - (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
     - (iii) stability category G temperature inversion conditions.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorol
that recorded by the meteorological station required under condition B17 of Schedule 2.

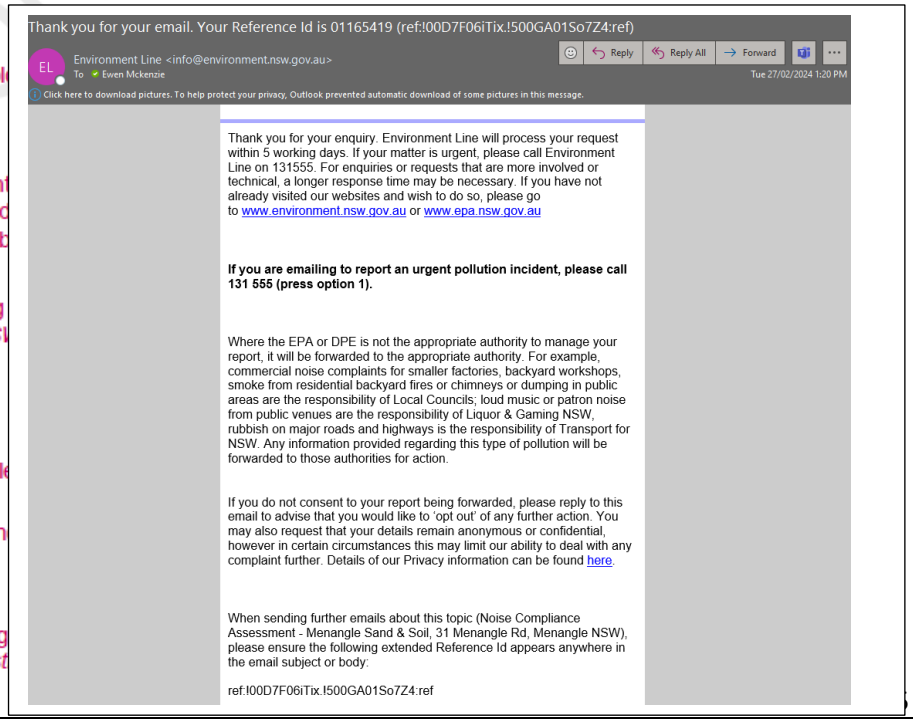
Compliance Monitoring

3. A noise compliance assessment must be undertaken within two months of commencement
in the Stage 8 Area. The assessment must be conducted by a suitably qualified and
practitioner and must assess comp ent. A report must b
1 month of the assessment.

Submitted to EPA 27/2/24

4. Unless otherwise agreed by the Planning Secretary, attended compliance monitoring
accordance with the relevant requirements for reviewing performance set out in the *NSW*
(EPA, 2000), in particular the requirements relating to:
   - (c) monitoring locations for the collection of representative noise data;
   - (d) meteorological conditions during which collection of noise data is not appropriate;
   - (e) equipment used to collect noise data, and conformity with Australian Standards rele
and
   - (f) modifications to noise data collected, including for the exclusion of extraneous n
modifying factors apart from adjustments for duration,
   - (g) modifying factors apart from adjustments for duration,

   with the exception of applying appropriate modifying factors for low frequency noise during
should be undertaken in accordance with Fact Sheet C of the *NSW Noise Policy for Indust*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EL Environment Line <info@environment.nsw.gov.au>
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Thank you for your enquiry. Environment Line will process your request within 5 working days. If your matter is urgent, please call Environment Line on 131555. For enquiries or requests that are more involved or technical, a longer response time may be necessary. If you have not already visited our websites and wish to do so, please go to www.environment.nsw.gov.au or www.epa.nsw.gov.au

If you are emailing to report an urgent pollution incident, please call 131 555 (press option 1).

Where the EPA or DPE is not the appropriate authority to manage your report, it will be forwarded to the appropriate authority. For example, commercial noise complaints for smaller factories, backyard workshops, smoke from residential backyard fires or chimneys or dumping in public areas are the responsibility of Local Councils; loud music or patron noise from public venues are the responsibility of Liquor & Gaming NSW, rubbish on major roads and highways is the responsibility of Transport for NSW. Any information provided regarding this type of pollution will be forwarded to those authorities for action.

If you do not consent to your report being forwarded, please reply to this email to advise that you would like to 'opt out' of any further action. You may also request that your details remain anonymous or confidential, however in certain circumstances this may limit our ability to deal with any complaint further. Details of our Privacy information can be found here.

When sending further emails about this topic (Noise Compliance Assessment - Menangle Sand & Soil, 31 Menangle Rd, Menangle NSW), please ensure the following extended Reference Id appears anywhere in the email subject or body:

ref:!00D7F06iTix.!500GA01So7Z4:ref

Appendix 6 Additional Stage 6 and 7 Biodiversity and Rehabilitation Requirements

Table 5: Additional Biodiversity Objectives and Performance and Completion Criteria for Stage 6 and 7 Vegetated Areas

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
Composition Objective				
The vegetation composition of Stages 6 and 7 are recognisable as River-flat Eucalypt Forest EEC.	Native plant species are characteristic of River-flat Eucalypt Forest EEC as described in the Final Determination. *HN526 benchmark for native plant species richness is ≥24 species.* *It is noted that* Eucalyptus botryoides x saligna *is not listed in the River-flat Eucalypt Forest EEC Final Determination, but is to count as one species towards the benchmark value.*	Presence of a suitable number or proportion of species listed in the Final Determination. This is considered to be ≥24 species, across all monitoring plots, that are aligned with the species list in the Final Determination.	Use of standard 20 x 20 m floristic sampling plot(s) where all flora species present are recorded.	This criterion should be met early (i.e. at 5 years post-establishment), otherwise it is unlikely to be met in the long-term.
Structure Objectives				
The vegetation structure of Stages 6 and 7 are recognisable as, or is trending towards, the target BVT HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC	Cover and abundance of plant growth forms are characteristic of, or are trending towards, the target BVT benchmarks, which are provided in the completion criteria.	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5– 32.5	Use of BAM where all flora species present in a 20 x 20 m plot are recorded, with foliage cover and abundance of each species.	Foliage cover of Tree (TG) growth form is trending towards target value.
		Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21-31		Foliage cover of Shrub (SG) growth form is trending towards target value.

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
		Total foliage cover of species allocated to Grass and Grass-like (GG) growth form is trending towards the benchmark range of 24.45-30.45		Foliage cover of Grass and Grass-like (GG) growth form is trending towards target value.
		Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45-30.45		Foliage cover of Forb (FG) growth form is trending towards target value.
Function Objectives				
Levels of ecosystem function have been established that demonstrate that Stages 6 and 7 are self-sustainable, or is trending towards self-sustainability	Evidence of plant reproduction and regeneration is present	The cover and species richness of the groundcover, including grasses and forbs, is stable or increasing, and is within the benchmark ranges	The ongoing persistence of groundcover species, which are relatively short lived and for which recruitment is not straightforward to measure, is regarded as evidence of reproduction and regeneration of these species	An initial decline in species richness and cover may occur, however a stabilisation in observed cover and richness should be observed by 5 to 10 years post-establishment.
		Second generation individuals of shrubs and trees are present	Presence of second-generation canopy species is evident within the rehabilitation domain (i.e. not limited to the plot, but present within rehabilitation of the same target community and age).	No performance guidance. The presence of second-generation trees and shrubs may not be evident for many years post-establishment.

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
	Cover of exotic species is low	Cover of 'high threat exotic' (HTE) and 'priority weeds' is no more than 2%.	Data collected in accordance with BAM. Sum foliage cover of species identified as 'high threat exotic' under the BAM and 'priority weeds' as identified by the Local Land Services (LLS) in the relevant strategic weed management plan for the region.	Cover of HTE and priority weed species are declining towards target value. Given the very high weed loads it is expected that it will take some time for weed growth to be brought under control and will require ongoing maintenance.
	Indicators of nutrient cycling are suitable for sustaining the target plant community type	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted	Data collected in accordance with BAM via five 1 m^2 subplots within the 20 m^2 floristic plot	Litter cover is increasing towards target value.

Notes:

Achieving biometric vegetation type (BVT) HN526 and/or plant community type (PCT) in the NSW Bionet Vegetation Information System (PCT835), can be used as a suitable surrogate for the EEC. BVT benchmarks are more specific (to vegetation type level, usually with lower and upper thresholds), whereas PCT benchmarks are to a broader vegetation class level (which is a grouping of similar vegetation types). For this reason, BVT benchmarks have generally been utilised in this table as being the best available.

The Completion Criteria column refers to the desired end goal, with the Performance Guidance column providing broad guidance on how the completion criteria should be interpreted in terms of producing future performance criteria in relevant Vegetation Management Plan(s). It is noted that the completion criteria and performance indicators in Table 5 will need to be resolved with more specific performance criteria relevant to different areas of the site.

It is also noted that stochastic events such as flood or fire might affect the achievement of performance standards and criteria, and whilst the intent will still be to achieve restoration and rehabilitation of the River-flat Eucalypt Forest EEC in the long-term, such events will need to be taken into account on a case by case basis for specific performance standards.

Appendix 7 Stage 8 Operations Biodiversity and Rehabilitation

Table 6: Biodiversity Objectives and Performance and Completion Criteria

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
Composition Objective				
The vegetation composition of the Restoration Area and rehabilitated substages are recognisable as River-flat Eucalypt Forest EEC.	Native plant species are characteristic of River-flat Eucalypt Forest EEC as described in the Final Determination. *HN526 benchmark for native plant species richness is ≥24 species.* *It is noted that* Eucalyptus botryoides x saligna *is not listed in the River-flat Eucalypt Forest EEC Final Determination, but is to count as one species towards the benchmark value.*	Presence of a suitable number or proportion of species listed in the Final Determination. This is considered to be ≥24 species, across all monitoring plots, that are aligned with the species list in the Final Determination.	Use of standard 20 x 20 m floristic sampling plot(s) where all flora species present are recorded.	This criterion should be met early (i.e. at 5 years post-establishment), otherwise it is unlikely to be met in the long-term.
Structure Objectives				
The vegetation structure of the Restoration Area and rehabilitated substages are recognisable as, or is trending towards, the target BVT HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC	Cover and abundance of plant growth forms are characteristic of, or are trending towards, the target BVT benchmarks, which are provided in the completion criteria.	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5– 32.5	Use of BAM where all flora species present in a 20 x 20 m plot are recorded, with foliage cover and abundance of each species.	Foliage cover of Tree (TG) growth form is trending towards target value.
		Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21-31		Foliage cover of Shrub (SG) growth form is trending towards target value.

CONSOLIDATED CONSENT

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
		Total foliage cover of species allocated to Grass and Grass-like (GG) growth form is trending towards the benchmark range of 24.45 - 30.45		Foliage cover of Grass and Grass-like (GG) growth form is trending towards target value.
		Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45 - 30.45		Foliage cover of Forb (FG) growth form is trending towards target value.
Function Objectives				
Levels of ecosystem function have been established that demonstrate the Restoration Area and rehabilitated substages are self-sustainable, or is trending towards self-sustainability	Evidence of plant reproduction and regeneration is present	The cover and species richness of the groundcover, including grasses and forbs, is stable or increasing, and is within the benchmark ranges	The ongoing persistence of groundcover species, which are relatively short lived and for which recruitment is not straightforward to measure, is regarded as evidence of reproduction and regeneration of these species	An initial decline in species richness and cover may occur, however a stabilisation in observed cover and richness should be observed by 5 to 10 years post-establishment.
		Second generation individuals of shrubs and trees are present	Presence of second-generation canopy species is evident within the rehabilitation domain (i.e. not limited to the plot, but present within rehabilitation of the same target community and age).	No performance guidance. The presence of second-generation trees and shrubs may not be evident for many years post-establishment.

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
	Cover of exotic species is low	Cover of 'high threat exotic' (HTE) and 'priority weeds' is no more than 2%.	Data collected in accordance with BAM. Sum foliage cover of species identified as 'high threat exotic' under the BAM and 'priority weeds' as identified by the Local Land Services (LLS) in the relevant strategic weed management plan for the region.	Cover of HTE and priority weed species are declining towards target value. Given the very high weed loads it is expected that it will take some time for weed growth to be brought under control and will require ongoing maintenance.
	Indicators of nutrient cycling are suitable for sustaining the target plant community type	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted	Data collected in accordance with BAM via five 1 m^2 subplots within the 20 m^2 floristic plot	Litter cover is increasing towards target value.

Notes:

Achieving biometric vegetation type (BVT) HN526 and/or plant community type (PCT) in the NSW Bionet Vegetation Information System (PCT835), can be used as a suitable surrogate for the EEC. BVT benchmarks are more specific (to vegetation type level, usually with lower and upper thresholds), whereas PCT benchmarks are to a broader vegetation class level (which is a grouping of similar vegetation types). For this reason, BVT benchmarks have generally been utilised in this table as being the best available.

The Completion Criteria column refers to the desired end goal, with the Performance Guidance column providing broad guidance on how the completion criteria should be interpreted in terms of producing future performance criteria within the Biodiversity and Rehabilitation Management Plan required under condition B73 of Schedule 2 of this consent. It is noted that the completion criteria and performance indicators in Table 6 will need to be resolved with more specific performance criteria relevant to different areas of the site. For example, the Amended restoration area will contain a tree overstorey and thus the performance standard should be higher compared to the Amended extraction area where some time will be required for the tree overstorey cover to become established. Refined performance criteria are to be included in the Biodiversity and Rehabilitation Management Plan.

It is also noted that stochastic events such as flood or fire might affect the achievement of performance standards and criteria, and whilst the intent will still be to achieve restoration and rehabilitation of the River-flat Eucalypt Forest EEC in the long-term, such events will need to be taken into account on a case by case basis for specific performance standards.

Appendix 8 Incident Notification and Reporting Requirements

WRITTEN INCIDENT NOTIFICATION REQUIREMENTS

1. A written incident notification addressing the requirements set out below must be submitted to the Department via the Major Projects website within seven days after the Applicant becomes aware of an incident. Notification is required to be given under this condition even if the Applicant fails to give the notification required under condition D7 of Schedule 2 or, having given such notification, subsequently forms the view that an incident has not occurred.
2. Written notification of an incident must:
   a. identify the development and application number;
   b. provide details of the incident (date, time, location, a brief description of what occurred and why it is classified as an incident);
   c. identify how the incident was detected;
   d. identify when the applicant became aware of the incident;
   e. identify any actual or potential non-compliance with conditions of consent;
   f. describe what immediate steps were taken in relation to the incident;
   g. identify further action(s) that will be taken in relation to the incident; and
   h. identify a project contact for further communication regarding the incident.
3. Within 30 days of the date on which the incident occurred or as otherwise agreed to by the Planning Secretary, the Applicant must provide the Planning Secretary and any relevant public authorities (as determined by the Planning Secretary) with a detailed report on the incident addressing all requirements below, and such further reports as may be requested.
4. The Incident Report must include:
   a. a summary of the incident;
   b. outcomes of an incident investigation, including identification of the cause of the incident;
   c. details of the corrective and preventative actions that have been, or will be, implemented to address the incident and prevent recurrence; and
   d. details of any communication with other stakeholders regarding the incident.

Menangle Sand and Soil Quarry

Noise Compliance Assessment

Prepared for Menangle Sand and Soil Pty Ltd

October 2023

Menangle Sand and Soil Quarry

Noise Compliance Assessment

Menangle Sand and Soil Pty Ltd

E230944 RP1

October 2023

Version	Date	Prepared by	Reviewed by	Comments
1	30 October 2023	Jared Blackburn	Najah Ishac	
2	31 October 2023	Jared Blackburn	Najah Ishac	

Approved by

Najah Ishac
Director, National Acoustics Leader
31 October 2023

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Appendices

Tables

Figures

1 Introduction

1.1 Background

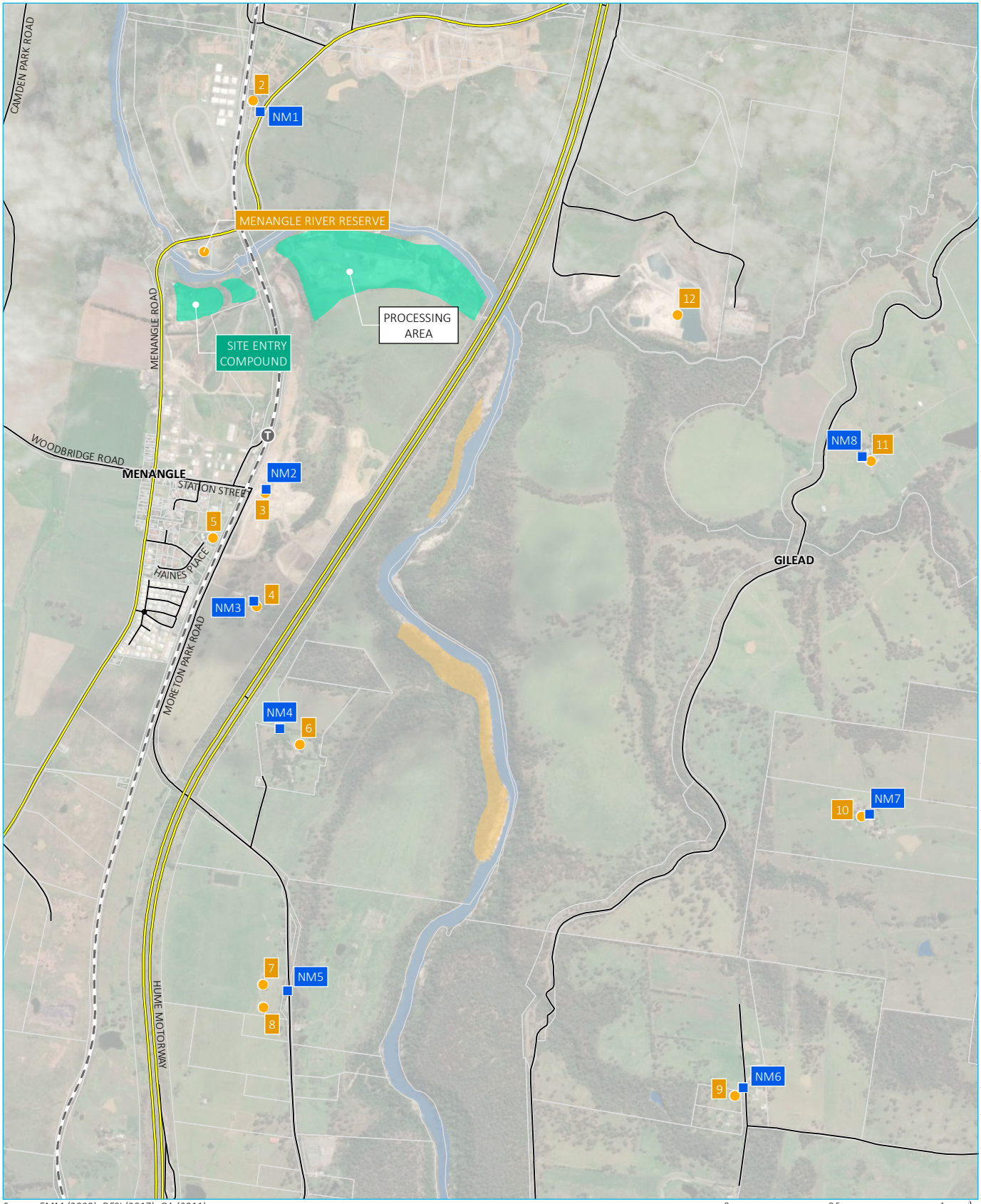
EMM Consulting Pty Ltd (EMM) was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at Menangle Sand and Soil (the site) located at 15 Menangle Road, Menangle NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits within the noise management plan. This is a requirement of the development consent LEC 2018/342158 for monitoring to occur within two months of commencing stage 8 at the site. Attended environmental noise monitoring described in this report was done during the shoulder period/day period(s) of 6 October 2023 at eight monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

ID	Representative residences	Description	Coordinates (MGA56)	
			Easting	Northing
NM1	R2	Menangle Road North	291937	6223124
NM2	R3, R5	Station Street North	291964	6221374
NM3	R4	Station Street East	291907	6220855
NM4	R6	Morton Park Road North	292028	6220262
NM5	R7, R8	Morton Park Road South	292064	6219045
NM6	R9	Bulli Appin Road South	294179	6218595
NM7	R10	Bulli Appin Road North	294766	6219863
NM8	R11	Appin Road	294732	6221523



Source: EMM (2020); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Monitoring location
- Assessment location
- Train station
- Rail line
- Main road
- Local road
- Nepean River
- Cadastral boundary
- Extractive operations
- Stage 8

Site boundary, sensitive receivers and noise monitoring locations

Menangle Sand and Soil Quarry
Environmental Noise Monitoring
Figure 1.1

EMM creating opportunities

\\emmsvr1\emm2\2023\E230944 - Menangle Quarry - Noise and AQ Monitoring\GIS\02_Maps\N002_AssessmentMonitoringLocations_20231025_01.mxd 25/10/2023

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1%of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

LEC 2018/342158 Appendix 4 states that:

> A noise compliance assessment must be undertaken within two months of commencement of Quarrying Operations in the Stage 8 Area. The assessment must be conducted by a suitably qualified and experienced acoustical practitioner and must assess compliance with noise criteria in this consent. A report must be provided to EPA within 1 month of the assessment.

Relevant sections of the development consent are reproduced in Appendix B.2.

2.2 Noise management plan

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 3.1 for the nearest residential receivers). Relevant sections of the NMP are reproduced in Appendix B.1.

2.3 Noise limits

Noise impact limits based on the approved NMP are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Day $L_{Aeq,15minute}$	Shoulder $L_{Aeq,15minute}$	Shoulder L_{Amax}
NM1	45	45	55
NM2	45	45	55
NM3	54	52	62
NM4	45	45	55
NM5	45	45	55
NM6	45	45	55
NM7	35	35	45
NM8	35	35	45

Notes:

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am-6 pm Sundays and Public Holidays.
2. Shoulder period is between 6 am–7 am Monday to Saturday.

2.4 Meteorological conditions

The meteorological conditions will be used to determine if the noise criteria (refer to Table 2.1) apply in accordance with the INP. Condition 1 of Appendix 4 of the development consent states that:

The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:

(a) where 3°C/100 metres (m) lapse rates have been assessed, then:

(i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;

(ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or

(iii) temperature inversion conditions greater than 3°C/100m.

(b) where Pasquill Stability Classes have been assessed, then:

(i) wind speeds greater than 3m/s at 10m above ground level;

(ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or

(iii) stability category G temperature inversion conditions.

2.5 Additional requirements

Monitoring and reporting have been done in accordance with the NSW EPA 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW requirements. Meteorological data was obtained from the site automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured site noise levels.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the shoulder and day period at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of site noise may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq}.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.4 Instrumentation

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Measurement equipment

Item	Serial number	Calibration due date	Relevant standard
Brüel & Kjær Type 2250 sound level meter	3008201	12 July 2025	IEC 61672-1:2002
Svantek V36 calibrator	138019	01 August 2024	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – October 2023 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
NM4	6/10/2023 6:43	83	73	67	65	64	62	59
NM1	6/10/2023 7:31	80	76	72	67	60	53	51
NM2	6/10/2023 7:54	87	70	60	61	55	51	49
NM3	6/10/2023 8:19	69	65	60	58	57	55	53
NM4	6/10/2023 8:40	80	62	55	55	52	49	46
NM5	6/10/2023 9:07	84	61	55	56	50	47	44
NM6	6/10/2023 10:36	81	71	64	61	55	47	41
NM7	6/10/2023 11:04	83	78	73	69	64	50	41
NM8	6/10/2023 11:55	76	72	67	63	60	50	42

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – October 2023

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north [1]	Cloud cover 1/8s
NM4	6/10/2023 6:43	9	0.2	216	-
NM1	6/10/2023 7:31	11	-	215	-
NM2	6/10/2023 7:54	12	-	-	-
NM3	6/10/2023 8:19	13	-	-	-
NM4	6/10/2023 8:40	14	0.9	208	-
NM5	6/10/2023 9:07	15	2.5	199	-
NM6	6/10/2023 10:36	19	1	189	2
NM7	6/10/2023 11:04	20	0.4	170	2
NM8	6/10/2023 11:55	20	1.3	228	7

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.2.2 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement.

Table 4.3 Site noise levels and limits – October 2023

Location	Start date and time	Wind		Stability class	Limits apply? [1]	Limits, dB		Site levels, dB		Exceedances, dB [1]	
		Speed m/s	Direction [3]			$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$ [2]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
NM4	6/10/2023 6:43	0.1	95	A	Y	45	55	IA	IA	Nil	Nil
NM1	6/10/2023 7:31	0.8	202	A	Y	45	N/A	IA	N/A	Nil	N/A
NM2	6/10/2023 7:54	0.9	228	A	Y	45	N/A	IA	N/A	Nil	N/A
NM3	6/10/2023 8:19	1	211	A	Y	54	N/A	IA	N/A	Nil	N/A
NM4	6/10/2023 8:40	2.5	246	A	Y	45	N/A	IA	N/A	Nil	N/A
NM5	6/10/2023 9:07	3.6	222	A	N	45	N/A	IA	N/A	Nil	N/A
NM6	6/10/2023 10:36	2.9	200	A	Y	45	N/A	IA	N/A	Nil	N/A
NM7	6/10/2023 11:04	2.9	226	A	Y	35	N/A	IA	N/A	Nil	N/A
NM8	6/10/2023 11:55	2.7	214	A	Y	35	N/A	IA	N/A	Nil	N/A

Notes: 1. Noise emission limits are applicable if weather conditions were within parameters specified in Section **Error! Reference source not found.**. NA in exceedance column indicates that limits were not applicable due to weather conditions.

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. Degrees magnetic north, "-" indicates calm conditions.

5 Summary

EMM was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified noise limits in the approved NMP.

Attended environmental noise monitoring described in this report was done during the shoulder or day period(s) of 6 October 2023 at eight monitoring locations.

Noise levels from site complied with all relevant limits and consent noise conditions.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

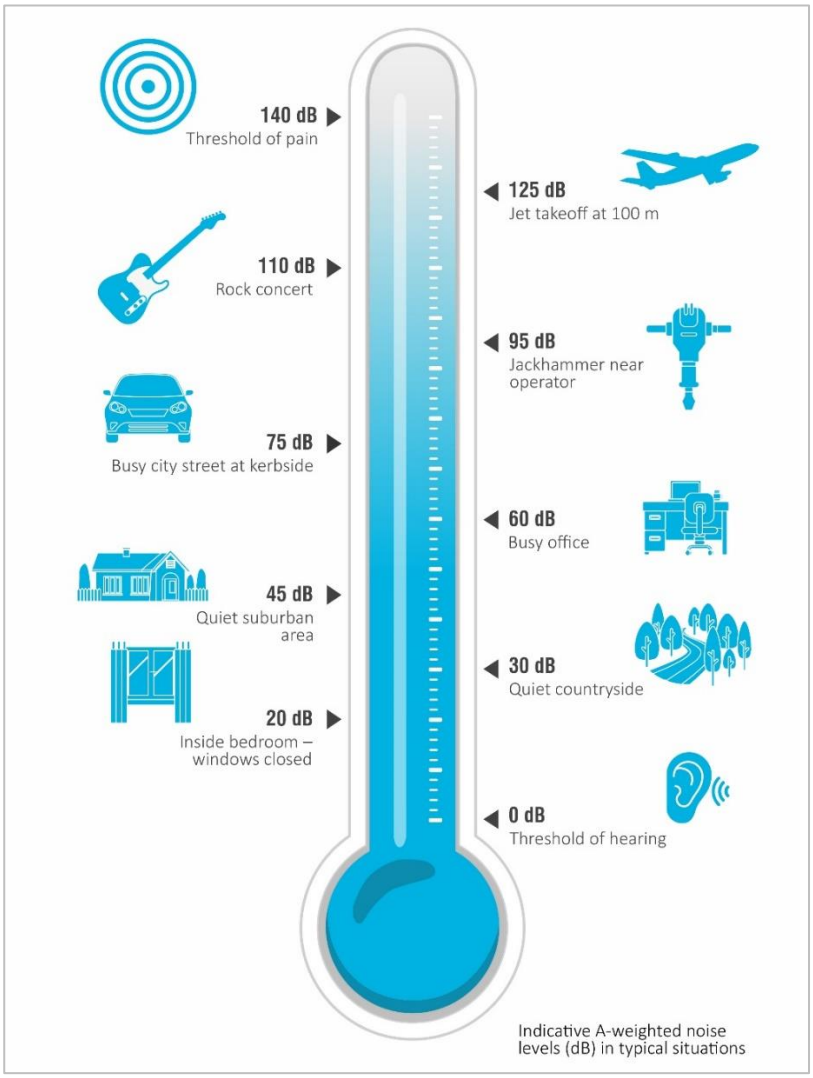

Figure A.1 Common noise levels

Appendix B
Regulator documents

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PART B SPECIFIC ENVIRONMENTAL CONDITIONS

EARLY WORKS

B1. The Applicant may prepare an Early Works Construction Environmental Management Plan for the Early Works, to the satisfaction of the Planning Secretary. This plan must:

(a) describe measures to be implemented to minimise construction-related impacts on biodiversity, including:

(i) specific measures to minimise impacts on tree hollows, termite mounds and fauna; and

(ii) detailed procedures for pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees within disturbance areas associated with the Early Works;

(b) describe measures to be implemented to manage sediment and erosion risks, including:

(i) a detailed description of the surface water management measures to be implemented in relation to the Early Works; and

(ii) appropriate clean water diversion systems and construction of appropriate erosion and sediment controls for the management of disturbed areas associated with the Early Works;

(c) include a Trigger Action Response Plan which outlines actions to be undertaken to rectify impacts associated with erosion and sedimentation during the Early Works (to the extent that these actions are not addressed by other management plans required to be in place prior to the commencement of Early Works); and

(d) describe detailed procedures to be implemented to receive, record, handle and respond to complaints associated with the Early Works construction.

B2. If the Applicant opts to seek approval for Early Works, the Applicant must not commence Early Works until the Early Works Construction Environmental Management Plan is approved by the Planning Secretary.

B3. If the Planning Secretary approves an Early Works Construction Environmental Management Plan, the Applicant must implement that plan as approved by the Planning Secretary.

NOISE

Operational Noise Criteria

B4. The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.

Table 2: Operational Noise Criteria dB(A)

Residences [a]	***Day***	***Shoulder Period*** *6.00 am to 7.00 am Monday to Saturday*	
	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (15\ minute)}$	$L_{A(max)}$
2, 3, 5[b], 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

[a] *Residence locations are shown as "Assessment Locations" in Figure 6 in Appendix 3.*

[b] *Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3.*

Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the *NSW Industrial Noise Policy* (EPA, 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

B5. The noise criteria in condition B4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Noise Operating Conditions

B6. The Applicant must:

(a) take all reasonable steps to minimise all noise from operational activities, including low frequency noise and other audible characteristics, as well as road noise associated with the development;

(b) take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions, particularly when the noise criteria in this consent do not apply (see Appendix 4);

(c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and

(d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

Noise Management Plan

B7. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:

(a) be prepared by a suitably qualified and experienced person/s;

(b) be prepared in consultation with the EPA;

(c) describe the measures to be implemented to ensure:

(i) compliance with the noise criteria and operating conditions in this consent;

(ii) best practice noise management is being employed; and

(iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions; under which the noise criteria in this consent do not apply (see Appendix 4); and

(d) include a monitoring program that:

(i) is capable of evaluating the performance of the development against the noise criteria;

(ii) monitors noise at the nearest and/or most affected residences; and

(iii) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.

B8. The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Noise Management Plan is approved by the Planning Secretary.

B9. The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

B10. The Applicant must ensure that no offensive odours (as defined under the POEO Act) are emitted by the development.

Air Quality Criteria

B11. The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Air Quality Criteria

Pollutant	***Averaging period***	***Criterion***	
Particulate matter < 10 µm (PM_{10})	Annual	[a, c] 25 µg/m^3	
	24 hour	[b] 50 µg/m^3	
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	[a, c] 8 µg/m^3	
	24 hour	[b] 25 µg/m^3	
Total suspended particulate (TSP) matter	Annual	[a, c] 90 µg/m^3	
[d] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes:

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

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

[d] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

B12. The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Air Quality Operating Conditions

B13. The Applicant must:

3 Noise criteria

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 3.1 for the nearest residential receivers). The noise criteria for the facility are reproduced in Table 3.1.

Table 3.1 Noise criteria

Residences[a]	Day	Shoulder period 6 am to 7 am Monday to Saturday	
	$L_{Aeq,15\ minute}$ dB(A)	$L_{Aeq,15\ minute}$ dB(A)	L_{Amax} dB(A)
2, 3, 5[b], 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

Notes:

a Residence locations are shown as "Assessment Locations" in Figure 6 in Appendix 3 [of the Consent].

b Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3 [of the consent].

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am-6 pm Sundays and Public Holidays.

2. Shoulder period is between 6 am–7 am Monday to Saturday.

Condition B4 also states:

> Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The noise criteria in Table 3.1 do not apply if Menangle Sand and Soil has negotiated an agreement with the owner/s of the relevant residence or land to exceed the noise criteria. As of the date of this report, Menangle Sand and Soil have not negotiated any agreements with any landowners or residents. As per Condition B5 of Schedule 2, Menangle Sand and Soil will advise the relevant authorities in writing of the terms of any negotiated agreements.

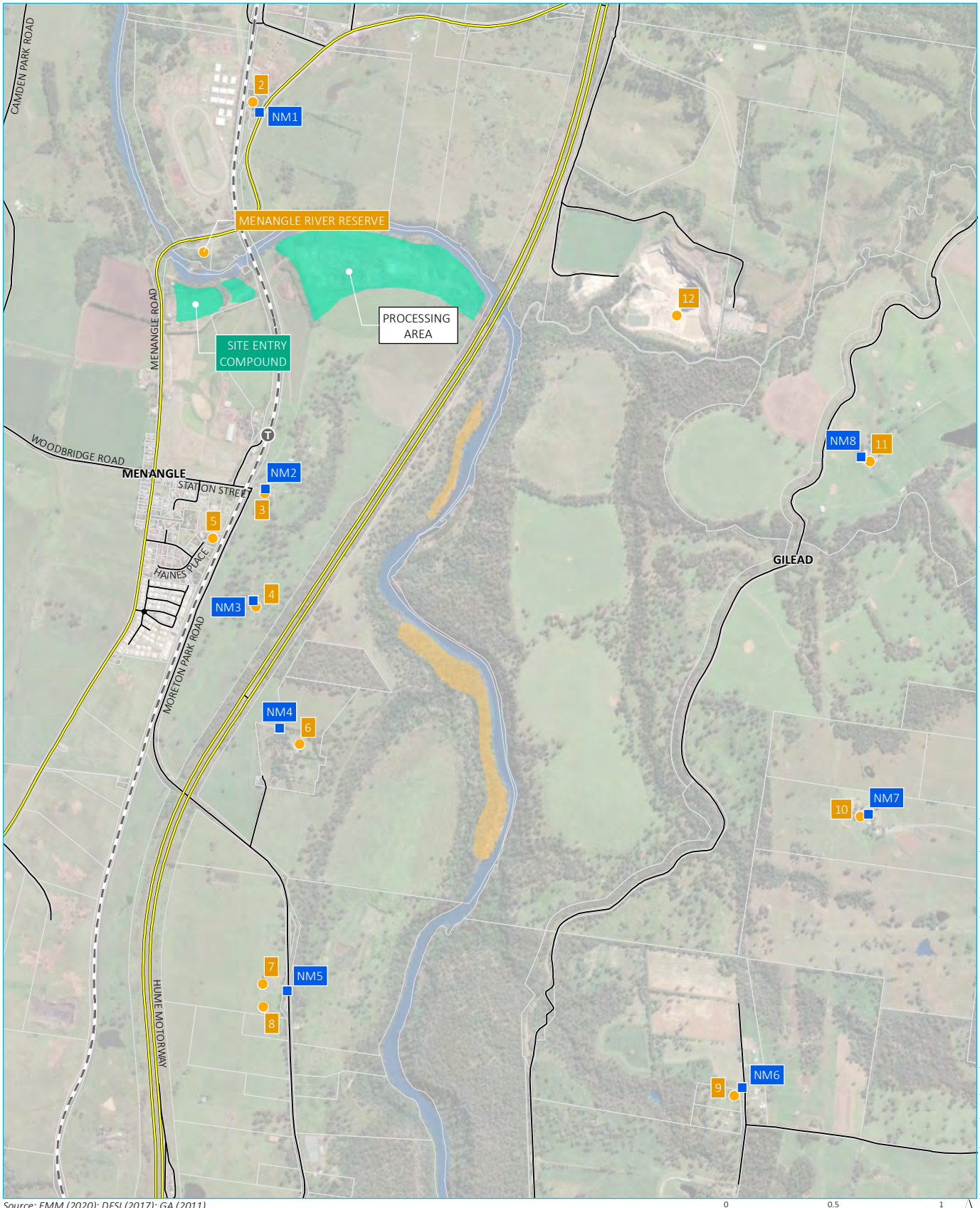
Compliance monitoring will adhere to the requirements of the EPA's policies and guidelines.

As per Condition 3 of Appendix 4, a noise compliance assessment will be undertaken within two months of commencement of Quarrying Operations in the Stage 8 Area, with a report provided to the EPA within 1 month of the assessment. The assessment will be conducted by a suitably qualified and experienced acoustical practitioner and will assess compliance with noise criteria outlined in Table 3.1.

3.1 Sensitive receivers

The nearest noise sensitive receivers most likely to be affected by operational noise from the site is long-term living accommodation approximately 700 m to the south-west/west of the Stage 8 extraction area. There are also surrounding industrial premises including the Camden Coal Seam Gas (CSG) plant (no longer operational) and the Hi-Quality Menangle Park Quarry, which is approximately 300 m to the north-east of Stage 8 operations. Menangle River Reserve is approximately 1.3 km west of Stage 8 operations.

Figure 3.1 shows the site boundary, the nearest sensitive receivers and the attended noise monitoring locations.



Source: EMM (2020); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Monitoring location
- Assessment location
- Train station
- Rail line
- Main road
- Local road
- Nepean River
- Cadastral boundary
- Extractive operations
- Stage 8

Site boundary, sensitive receivers and noise monitoring locations

Menangle Sand and Soil
Noise management plan
Figure 3.1

EMM creating opportunities

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5 Noise monitoring

5.1 Objective

The following conditions related to noise monitoring were included in the project consent under Condition B6 and have been reproduced below:

> B6. The Applicant must:
>
> (c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and
>
> (d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

The noise monitoring program is designed to verify that noise emissions from the quarry complies with the relevant noise criteria at the most affected residential receivers.

5.2 Noise monitoring standards

Noise monitoring will be undertaken in accordance with the relevant Australian standards and EPA guidelines including:

- AS 1055.1-2018 Acoustics – Description and Measurement of Environmental Noise – General Procedures;
- AS IEC 61672.1-2019 'Electroacoustics – Sound Level Meters – Specifications';
- INP (EPA 2000) and Application Notes; and
- NPfI (EPA 2017).

It is noted that the INP has been replaced by the NPfI. However, the INP continues to apply in accordance with the EPA's *Implementation and Transitional Arrangements for the Noise Policy for Industry* (EPA 2017) where the INP is referenced in existing statutory instruments, as is the case from Menangle Quarry).

Further, the INP Application Notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing potentially annoying characteristics of a noise source. Fact sheet C of the NpfI (EPA 2017) provides guidelines for applying corrections to account for annoying noise characteristics such as tonal noise and low frequency noise.

The INP and Fact Sheet C of the NpfI have been adopted for the purpose of this NMP.

All acoustic instrumentation proposed for monitoring under the noise monitoring program will have current NATA or manufacturer calibration certificates as per the relevant Australian standards.

5.3 Noise monitoring locations

Quarterly attended monitoring locations will be representative of the nearest privately owned receptors to active operations at the time of monitoring. The pool of attended monitoring locations are listed in Table 5.1 and shown on Figure 3.1. A selection of attended monitoring locations will be used each quarter from a pool of eight locations to represent the nearest affected privately-owned residences.

In order to satisfy Conditions B4 and B6, Menangle Sand and Soil will conduct quarterly attended noise monitoring at a representative sample of the points identified in Table 5.1 and shown in Figure 3.1. Data used for determining meteorological conditions will be sourced from the on-site meteorological station.

Table 5.1 Pool of attended noise monitoring locations

ID	Description	Easting (MGA)	Northing (MGA)	Representative residences	Representative direction
NM1	Menangle Road North	291937	6223124	R2	NW
NM2	Station Street North	291964	6221374	R3, R5	W
NM3	Station Street East	291907	6220855	R4	W
NM4	Morton Park Road North	292028	6220262	R6	SW
NM5	Morton Park Road South	292064	6219045	R7, R8	SW
NM6	Bulli Appin Road South	294179	6218595	R9	SE
NM7	Bulli Appin Road North	294766	6219863	R10	E
NM8	Appin Road	294732	6221523	R11	NE

5.4 Noise monitoring program

The attended noise monitoring will be completed on a quarterly basis to verify that noise emissions from the facility satisfy the relevant noise criteria at representative residential receivers. The attended noise monitoring program will be used to:

- estimate the site noise contribution from the measured noise levels;
- determine the individual noise sources contributing to the ambient noise environment wherever possible;
- determine whether a correction for annoying noise characteristics should be applied to the site noise level before comparison with the relevant noise criteria in accordance with the Npfl; and
- gain an understanding of the effects of meteorological conditions on the propagation of noise from site to surrounding residential receivers.

The attended noise monitoring will be completed during the morning shoulder (6 am–7 am) and day (7 am–6 pm) periods.

During the morning shoulder period, attended noise monitoring will only occur at NM4, as NM4 is the only assessment location with a more stringent morning shoulder noise criteria compared with daytime noise criteria.

During the day period, the noise monitoring locations selected for each monitoring event will be dependent on the location of quarrying operations and the meteorological conditions present on the day of the noise monitoring. As such, the quarterly noise monitoring events will target the worst affected noise monitoring locations from the pool detailed in Table 5.1.

In summary, each quarterly monitoring event will entail:

- attended noise monitoring at NM4 during the morning shoulder period (6 am–7 am); and

- attended noise monitoring at the predicted worst-case noise monitoring locations (selected based on quarry operations and meteorological conditions) during the day period (7 am–6 pm).

For each 15-minute attended noise measurement, the following information will be recorded:

- name of monitoring personnel;
- monitoring location;
- date(s) and time(s) at which the monitoring measurement started and ended at each location;
- height of the microphone above the ground and, if relevant, distances to building facades or property boundaries (if monitoring cannot be completed within the property boundary);
- quantitative meteorological data such as wind speed (including the height above ground at which the measurement was taken), wind direction, temperature and humidity;
- qualitative meteorological information such as cloud cover, fog or rainfall;
- instrument type and in-field calibration details before and after the monitoring period;
- the $L_{Aeq,15min}$ noise level for the 15-minute period;
- statistical noise level descriptors over the 15-minute interval: L_{Amin}, L_{A90}, L_{A10}, L_{A1} and L_{Amax};
- notes that identify the noise sources that contribute to the overall noise environment;
- an estimate of the noise contribution from the facility and from other identifiable noise sources;
- measurement in one-third octave bands from 10 Hz to 8 kHz inclusive (or a broader range of bands) for the 15-minute interval to assess if site noise exhibit tonal characteristics that may require the application of a correction for annoying noise characteristics in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for tonal noise is applicable is presented in Section 5.8.1;
- measurement of C-weighted and A-weighted site noise levels to identify the likely presence of low frequency noise in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for low frequency noise is applicable is presented in Section 5.8.2;
- data suitable for assessing the relative contribution of site noise to the overall noise level being measured by using a low-pass filter, which will be developed during the first round of monitoring (eg with a low-pass frequency of 630 Hz); and
- recommendations or comments where considered appropriate.

In accordance with the methodology outlined in Section 3 of the INP (EPA 2000), if any of the data in a 15-minute period is affected by rain or wind speeds in excess of 3 m/s, and where possible, another entire 15-minute period of data unaffected by rain or adverse wind conditions shall be undertaken.

5.5 Instrumentation

All noise monitoring instrumentation will meet the requirements of AS IEC 61672.1-2019 and carry current NATA or manufacturer calibration certificates. Instrument in-field calibration will be checked before and after each survey, with the variation in calibrated levels not exceeding ±0.5 dB.

The sound level meter will be programmed to record statistical noise level indices continuously for each 15-minute interval, including L_{A1}, L_{A10}, L_{A90}, L_{Amin}, L_{Aeq} and L_{Amax}, using 'fast' time response.

5.6 Meteorological monitoring

Condition B17 of the development consent relates to the establishment of a meteorological monitoring station in the vicinity of the quarry and states the following:

> Prior to the commencement of Quarrying Operations in the Stage 8 Area, and for the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in close proximity to the site that:
>
> (a) complies with the requirements in the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC 2007); and
>
> (b) is capable of measuring meteorological conditions in accordance with the NSW Industrial Noise Policy (EPA 2000),
>
> unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.

The meteorological station at the quarry will be located to the east of the site entry compound and will satisfy requirements of the NSW Industrial Noise Policy and Australian Standard AS 3580.14-2014 *Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications.*

5.7 Meteorological parameters

Consent Condition B4 states:

> Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The meteorological conditions during the noise monitoring will be recorded including wind speed (including the height above ground at which the measurement was taken), wind direction, temperature, humidity, cloud cover and the presence of fog and rain (if any).

The meteorological conditions will be used to determine if the noise criteria (refer to Table 3.1) apply in accordance with the INP. Condition 1 of Appendix 4 states that:

> The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:
>
> (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
>
> (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
>
> (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or

(iii) temperature inversion conditions greater than 3°C/100m.

(b) where Pasquill Stability Classes have been assessed, then:

(i) wind speeds greater than 3m/s at 10m above ground level;

(ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or

(iii) stability category G temperature inversion conditions.

5.8 Corrections for annoying noise characteristics

The INP application notes state that Section 4 of the INP has been withdrawn and the corrections outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source. The NPfI specifies corrections for noise with annoying characteristics such as tonal noise and low frequency noise. These are discussed in the following sections.

5.8.1 Tonal noise

Tonal noise can be defined as noise levels containing a prominent frequency and characterised by a definite pitch. Examples of tonal noise sources include ventilation fans, reversing beepers or alarms. The method for assessing the presence of tonal noise involves comparing differences in noise levels between neighbouring one-third octave centre frequency bands.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for tonal noise emissions. The NPfI specifies that a 5 dB positive adjustment is applicable where the level of any of the one-third octave bands exceeds the level of both adjacent bands by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz;
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz; or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

5.8.2 Low frequency noise

Low frequency noise can be characterised as noise containing dominant energy within the low frequency range (ie less than 200 Hz). Examples of low frequency noise sources can include screens and centrifuges in coal washeries, as well as pumps, fans, boilers, ventilation plant, electrical installations and wind turbines.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance. Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the measured one-third octave noise levels should be compared to the values in Table C2 of the NPfI, which has been reproduced in Table 5.2.

Table 5.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following correction is to be applied where the site 'C-weighted' minus site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 5.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 5.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured A-weighted levels applies for the evening/night period and a 2 dB positive adjustment to measured A-weighted levels applies for the day period.

Hence, where possible throughout each survey the difference between site 'C-weighted' and site 'A-weighted' noise emission levels will be estimated by the operator by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this is deemed to be 15 dB or greater, the measured one-third octave frequencies will be compared to the values in Table 5.2 to identify the relevant correction (if applicable). It is of note that the NPfI states that low frequency noise correction does not apply during adverse meteorological conditions, including during wind speeds above 3 m/s at 10 m above ground level, stability category F with wind speeds above 2 m/s at 10 m above ground level, or during stability category G.

5.9 Data analysis

The $L_{Aeq,15min}$ noise level contribution from the facility as well as the overall ambient noise levels together with the weather and site operating conditions will be reported on a quarterly basis.

The contributed noise emissions from operations at the facility will be evaluated and assessed against the noise level criteria given in Table 2 of development consent Condition B4 (refer to Table 3.1) during each quarterly noise monitoring event. Compliance may be determined by:

- post analysis of data (including through the review of audio recordings);
- direct measurement against the $L_{Aeq,15min}$ criteria;
- operator estimated $L_{Aeq,15min}$ contribution;
- by calculation from near field measurements;
- by measurement at a representative location; or
- a combination of any or all the above methods as approved by the EPA or in accordance with the INP or NPfI as relevant.

5.10 Noise exceedance protocol

If attended noise monitoring identifies that the noise criteria as per Table 3.1 have been exceeded, the person conducting the attended noise monitoring will follow the noise exceedance protocol presented in Figure 5.1.

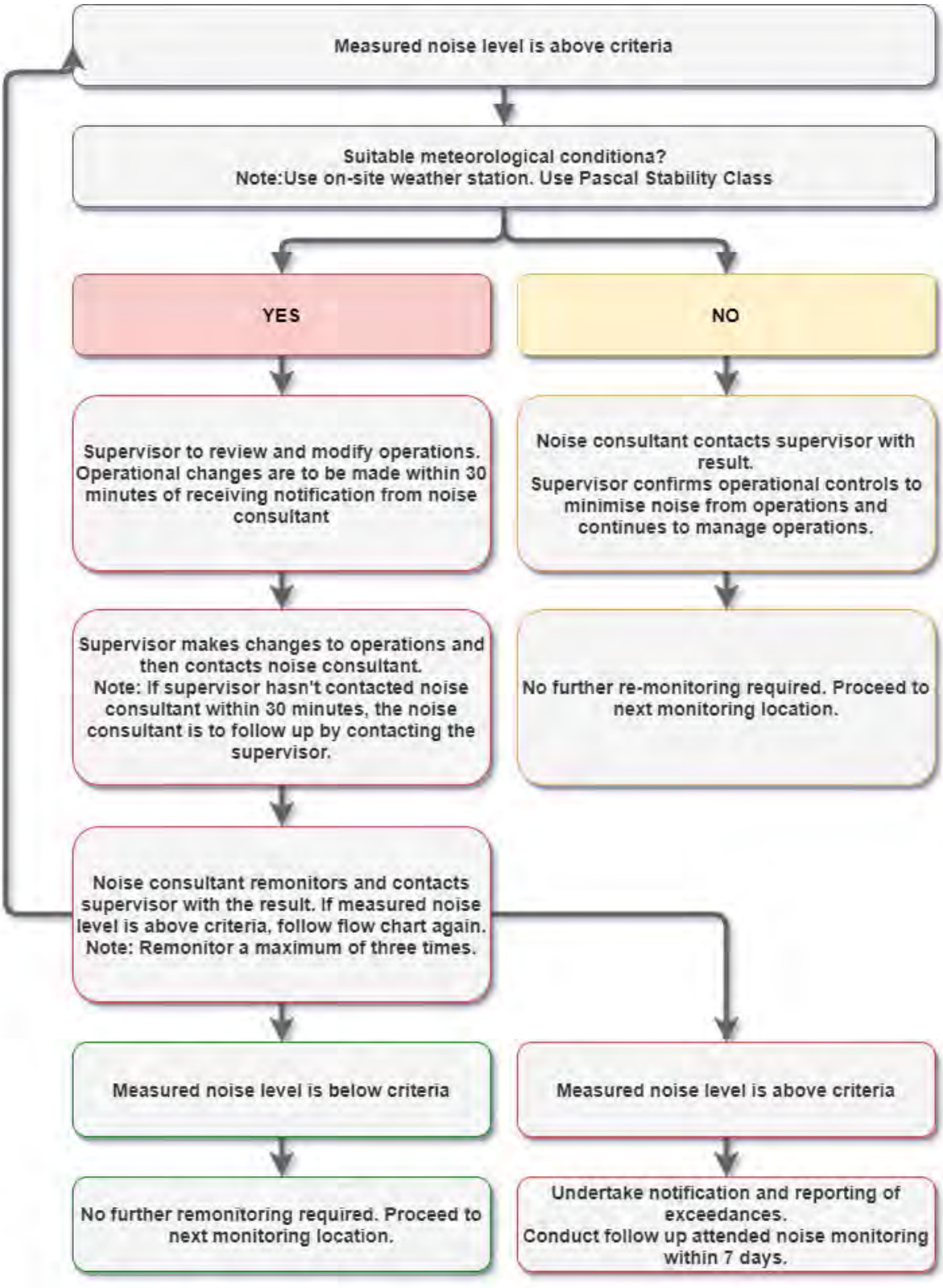

Figure 5.1 Noise exceedance protocol

The relevant supervisor will document and report to the Quarry Manager any actions implemented following the notification of the exceedance. The exceedance is required to be reported to DPE and EPA by the Quarry Manager (or delegate) immediately upon Menangle Sand and Soil becoming aware of the exceedance. An additional attended noise monitoring survey will be completed within one week if the exceedance could not be effectively reduced below the relevant criteria on the night of noise monitoring.

Within 7 days of detecting an exceedance of the noise criteria as per Table 3.1, Menangle Sand and Soil shall provide a written report of the exceedance to DPE. This report must:

- describe the date, time, and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

Any exceedance above the noise limits identified in Table 3.1 will be reported in the annual noise compliance assessment report required under Condition R4.3 of EPL and noise monitoring reports will be available upon request.

5.11 Noise monitoring report

All routine monitoring results will be documented and reported initially on a quarterly basis.

Quarterly reports will consist of the following information:

- summary of all attended noise monitoring results;
- measured, calculated and/or operator estimated site $L_{Aeq,15min}$ contributed noise levels for each monitoring location;
- statement of compliance/non-compliance; and
- details of any complaints relating to noise and their state of resolution.

The noise monitoring contractor undertaking the monitoring on behalf of Menangle Sand and Soil will provide the site representative with a monitoring report outlining the results and outcome of the survey.

The site representative will review the monitoring report provided by the contractor to assess compliance with the criteria outlined in Table 2 of development consent Condition B4 (refer to Table 3.1). A summary of quarterly noise monitoring results will be published on the Menangle Sand and Soil website, as per Condition D15.

Appendix C
Calibration certificates

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Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23471

Client Details	EMM Consulting Ground Floor Suite 01, 20 Chandos Street
Equipment Tested/ Model Number :	Type 2250
Instrument Serial Number :	3008201
Microphone Serial Number :	2888134
Pre-amplifier Serial Number :	16037
Firmware Version :	N/A

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.1 °C	**Ambient Temperature :**	24.3 °C
Relative Humidity :	44 %	**Relative Humidity :**	44.1 %
Barometric Pressure :	101.6 kPa	**Barometric Pressure :**	101.3 kPa

Calibration Technician :	Max Moore	**Secondary Check:**	Rhys Gravelle
Calibration Date :	12 Jul 2023	**Report Issue Date :**	17 Jul 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.014 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Level Meter
IEC 61672-3:2013
Calibration Test Report

Calibration Number C23471

Client Details	EMM Consulting Ground Floor Suite 01, 20 Chandos Street
Equipment Tested/ Model Number :	Type 2250
Instrument Serial Number :	3008201
Microphone Serial Number :	2888134
Pre-amplifier Serial Number :	16037
Firmware Version :	N/A

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.1 °C	**Ambient Temperature :**	24.3 °C
Relative Humidity :	44 %	**Relative Humidity :**	44.1 %
Barometric Pressure :	101.6 kPa	**Barometric Pressure :**	101.3 kPa

Calibration Technician :	Max Moore	**Secondary Check:**	Rhys Gravelle
Calibration Date :	12 Jul 2023	**Report Issue Date :**	17 Jul 2023

Approved Signatory :  Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.014 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C36957

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV36 **Serial No:** 138019
Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	93.94 dB	999.97 Hz	0.63 %
Level2:	NA	N	113.97 dB	999.97 Hz	0.40 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure 1012 hPa ±1 hPa
Temperature 23 °C ±1° C
Relative Humidity 40 % ±5%

Date of Receipt : 28/07/2023
Date of Calibration : 01/08/2023
Date of Issue : 01/08/2023

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: .....

AUTHORISED SIGNATURE: .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Menangle Sand and Soil Quarry

Noise Compliance Q1 Assessment

Prepared for Menangle Sand and Soil Pty Ltd

March 2024

Menangle Sand and Soil Quarry

Noise Compliance Q1 Assessment

Menangle Sand and Soil Pty Ltd

E240224 RP1

March 2024

Version	Date	Prepared by	Reviewed by	Comments
1	12 March 2024	Jared Blackburn	Najah Ishac	

Approved by

Najah Ishac
Director, Technical leader Acoustics
12 March 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
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St Leonards NSW 1590

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Appendices

Tables

Figures

1 Introduction

1.1 Background

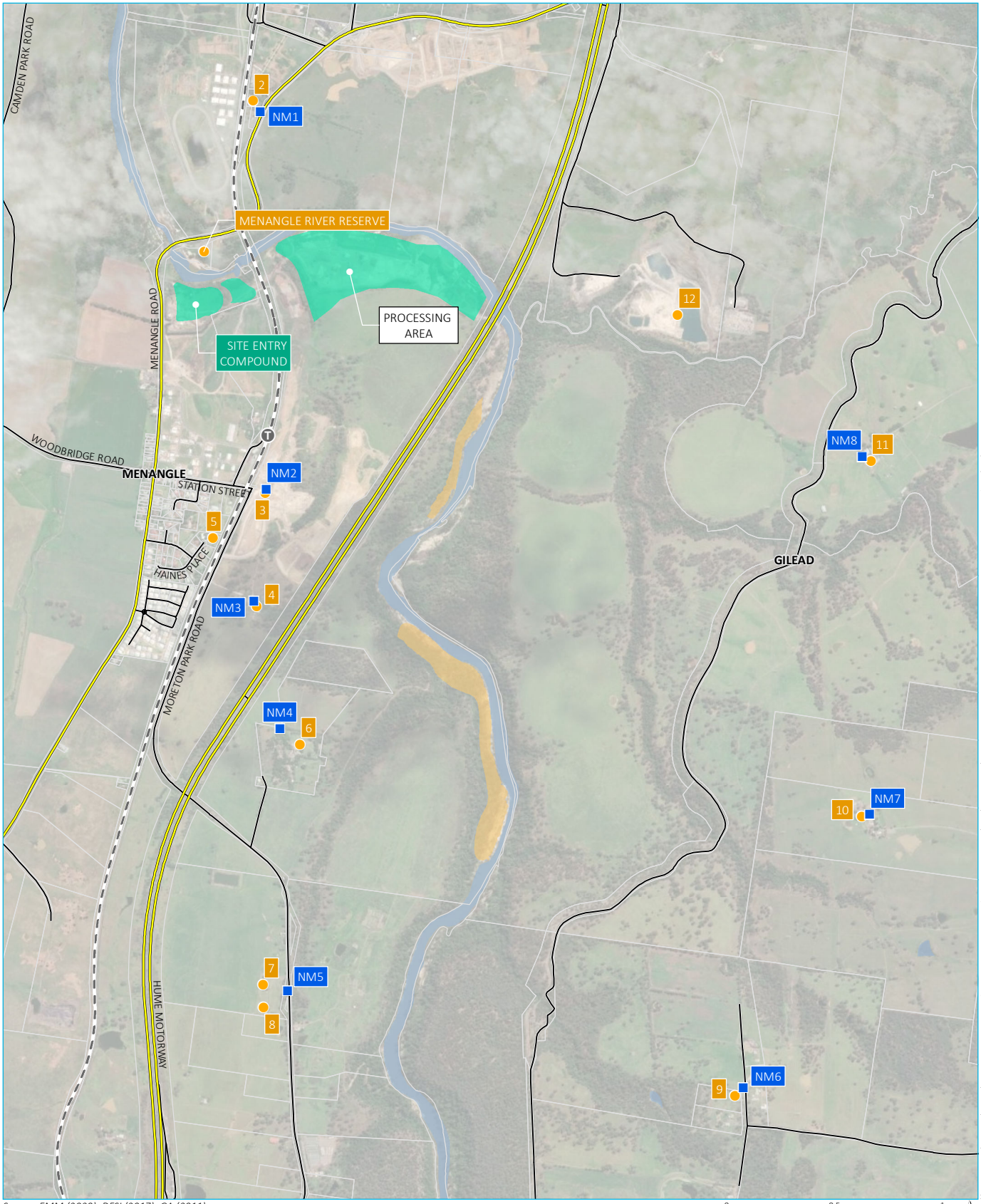
EMM Consulting Pty Ltd (EMM) was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at Menangle Sand and Soil (the site) located at 15 Menangle Road, Menangle NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits within the noise management plan. It is a requirement of the development consent LEC 2018/342158 for regular attended noise monitoring to be carried out every three months. Attended environmental noise monitoring described in this report was done during the shoulder and day periods of 28 February 2024 at five monitoring locations.

1.2 Assessment locations

The assessment locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences. The locations in bold in Table 1.1 were the adopted monitoring locations.

Table 1.1 Attended noise monitoring locations

ID	Representative residences	Description	Coordinates (MGA56)	
			Easting	Northing
NM1	R2	Menangle Road North	291937	6223124
NM2	R3, R5	Station Street North	291964	6221374
NM3	R4	Station Street East	291907	6220855
NM4	R6	Morton Park Road North	292028	6220262
NM5	R7, R8	Morton Park Road South	292064	6219045
NM6	R9	Bulli Appin Road South	294179	6218595
NM7	R10	Bulli Appin Road North	294766	6219863
NM8	R11	Appin Road	294732	6221523



Source: EMM (2020); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Monitoring location
- Assessment location
- Train station
- Rail line
- Main road
- Local road
- Nepean River
- Cadastral boundary
- Extractive operations
- Stage 8

Site boundary, sensitive receivers and noise monitoring locations

Menangle Sand and Soil Quarry
Environmental Noise Monitoring
Figure 1.1

EMM creating opportunities

\\emmsvr1\emm2\2023\E230944 - Menangle Quarry - Noise and AQ Monitoring\GIS\02_Maps\N002_AssessmentMonitoringLocations_20231025_01.mxd 25/10/2023

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1%of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

LEC 2018/342158 B6 states that:

> The applicant must carry out regular attended noise monitoring (every three months unless otherwise agreed with the planning secretary) to determine whether the development is complying with the relevant conditions of Schedule 2.

Relevant sections of the development consent are reproduced in Appendix B.2.

2.2 Noise management plan

Noise monitoring requirements are detailed in the site's Noise Management Plan (NMP), most recently approved in February 2022.

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4 and section 5 of the NMP. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 1.1 for the nearest residential receivers).

Relevant sections of the NMP are reproduced in Appendix B.1.

2.3 Environmental Protection Licence

The site's Environmental Protection Licence (EPL, 3991), version date 13 December 2023 does not contain any noise limits.

2.4 Noise limit summary

Noise impact limits based on the approved NMP and LEC are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Day $L_{Aeq,15minute}$	Shoulder $L_{Aeq,15minute}$	Shoulder L_{Amax}
NM1	45	45	55
NM2	45	45	55
NM3	54	52	62
NM4	45	45	55
NM5	45	45	55
NM6	45	45	55
NM7	35	35	45
NM8	35	35	45

Notes:

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am-6 pm Sundays and Public Holidays.
2. Shoulder period is between 6 am–7 am Monday to Saturday.

2.5 Meteorological conditions

The meteorological conditions will be used to determine if the noise criteria (refer to Table 2.1) apply in accordance with the INP. Condition 1 of Appendix 4 of the development consent states that:

> The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:
>
> (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
>
> (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
>
> (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or
>
> (iii) temperature inversion conditions greater than 3°C/100m.
>
> (b) where Pasquill Stability Classes have been assessed, then:
>
> (i) wind speeds greater than 3m/s at 10m above ground level;
>
> (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
>
> (iii) stability category G temperature inversion conditions.

2.6 Additional considerations

Monitoring and reporting have been done in accordance with the NSW EPA 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW government requirements. Meteorological data was obtained from the site automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured site noise levels.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted at NM4 during the shoulder period and NM1, NM2, NM3, NM4 and NM5 in the day period. These locations were selected as they are the worst affected noise monitoring locations from the pool detailed in the NMP. Due to meteorological and operational conditions on the day of monitoring, NM6, NM7 and NM8 would experience lesser noise levels than the locations selected. The duration of each measurement was 15 minutes. Atmospheric conditions were measured during noise surveys at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of site may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq}.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.4 Instrumentation and personnel

Attended noise monitoring was conducted by Jared Blackburn. Qualifications, experience, and competence is in accordance with the Approved methods and supportive documentation is available upon request.

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Measurement equipment

Item	Serial number	Calibration due date	Relevant standard
Brüel & Kjær Type 2250 sound level meter	3008201	12 July 2025	IEC 61672-1:2002
Svantek V36 calibrator	138019	01 August 2024	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – February 2024 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
NM4[3]	28/02/2024 6:36	63	57	56	54	54	51	49
NM4[3]	28/02/2024 7:00	67	58	56	53	53	49	47
NM3[2]	28/02/2024 7:20	76	72	59	59	55	52	49
NM2[2]	28/02/2024 7:41	65	56	52	50	49	47	45
NM1[3]	28/02/2024 8:04	84	76	73	70	68	57	45
NM5[3]	28/02/2024 8:27	85	67	49	58	42	40	38

Notes: 1. Levels in this table are not necessarily the result of activity at site.
2. Non site constant construction and traffic noise was present during measurement
3. Constant non site traffic noise was present during measurement

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height. This data was collected over a short duration of typically 5 minutes, however atmospheric conditions were observed to be relatively constant during the 15 minute measurement.

Table 4.2 Measured (hand held meter) atmospheric conditions – February 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north [1]	Cloud cover 1/8s
NM4	28/02/2024 6:36	19	<0.5	-	8
NM4	28/02/2024 7:00	20	<0.5	-	8
NM3	28/02/2024 7:20	20	<0.5	-	8
NM2	28/02/2024 7:41	21	<0.5	-	8
NM1	28/02/2024 8:04	22	<0.5	-	8
NM5	28/02/2024 8:27	22	<0.5	-	8

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.2.2 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement. The data shows that site was inaudible at all locations and confirms compliance with the site's consent conditions.

Table 4.3 Site noise levels and limits – February 2024

Location	Start date and time	Wind		Stability class	Limits apply? [1]	Limits, dB		Site levels, dB		Exceedances, dB [1]	
		Speed m/s	Direction [3]			$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$ [2]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
NM4	28/02/2024 6:36	0.2	209	A	Y	45	55	IA	IA	Nil	Nil
NM4	28/02/2024 7:00	-	-	A	Y	45	N/A	IA	N/A	Nil	N/A
NM3	28/02/2024 7:20	0.2	325	A	Y	54	N/A	IA	N/A	Nil	N/A
NM2	28/02/2024 7:41	0.2	350	A	Y	45	N/A	IA	N/A	Nil	N/A
NM1	28/02/2024 8:04	0.7	345	A	Y	45	N/A	IA	N/A	Nil	N/A
NM5	28/02/2024 8:27	1.1	98	A	Y	45	N/A	IA	N/A	Nil	N/A

Notes: 1. Noise emission limits are applicable if weather conditions were within parameters specified in Section 2.4. NA in exceedance column indicates that limits were not applicable due to weather conditions.

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. Degrees magnetic north, "-" indicates calm conditions.

5 Summary

EMM was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified noise limits in the approved NMP.

Attended environmental noise monitoring described in this report was done during the shoulder or day period(s) of 28 February 2024 at five monitoring locations.

Noise levels from site complied with all relevant limits and consent noise conditions.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

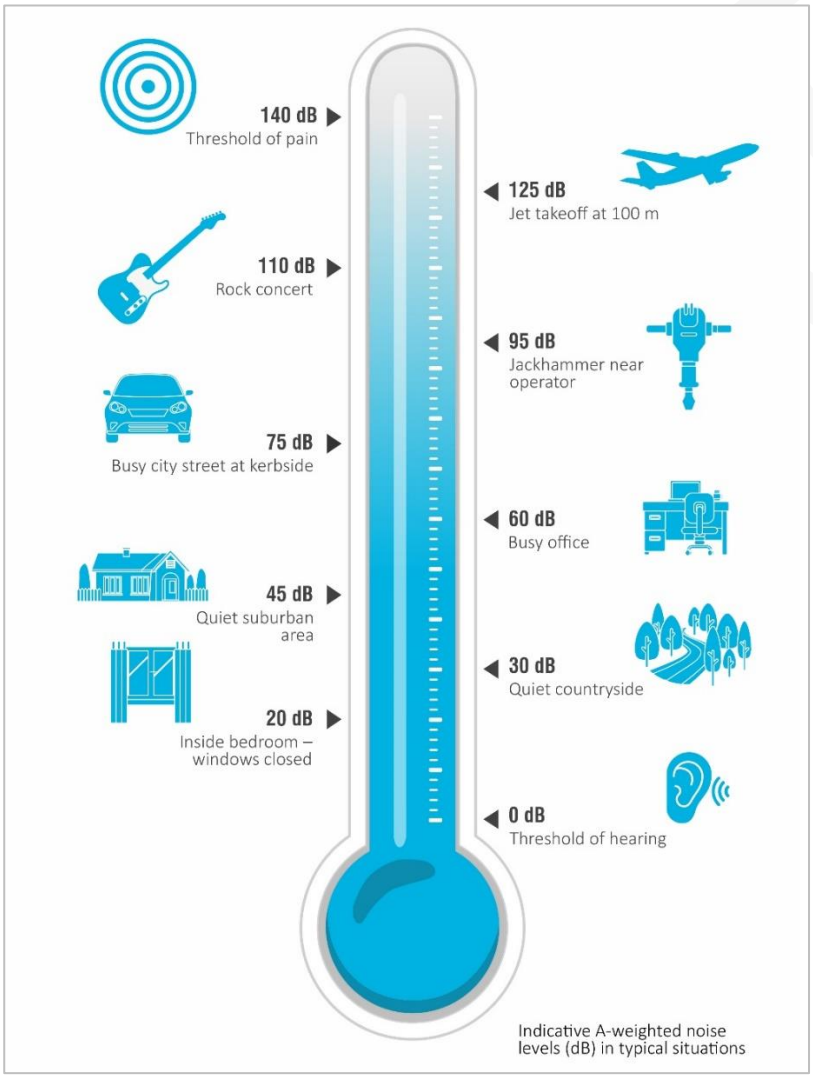

Figure A.1 Common noise levels

Appendix B
Regulator documents

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PART B SPECIFIC ENVIRONMENTAL CONDITIONS

EARLY WORKS

B1. The Applicant may prepare an Early Works Construction Environmental Management Plan for the Early Works, to the satisfaction of the Planning Secretary. This plan must:

(a) describe measures to be implemented to minimise construction-related impacts on biodiversity, including:

(i) specific measures to minimise impacts on tree hollows, termite mounds and fauna; and

(ii) detailed procedures for pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees within disturbance areas associated with the Early Works;

(b) describe measures to be implemented to manage sediment and erosion risks, including:

(i) a detailed description of the surface water management measures to be implemented in relation to the Early Works; and

(ii) appropriate clean water diversion systems and construction of appropriate erosion and sediment controls for the management of disturbed areas associated with the Early Works;

(c) include a Trigger Action Response Plan which outlines actions to be undertaken to rectify impacts associated with erosion and sedimentation during the Early Works (to the extent that these actions are not addressed by other management plans required to be in place prior to the commencement of Early Works); and

(d) describe detailed procedures to be implemented to receive, record, handle and respond to complaints associated with the Early Works construction.

B2. If the Applicant opts to seek approval for Early Works, the Applicant must not commence Early Works until the Early Works Construction Environmental Management Plan is approved by the Planning Secretary.

B3. If the Planning Secretary approves an Early Works Construction Environmental Management Plan, the Applicant must implement that plan as approved by the Planning Secretary.

NOISE

Operational Noise Criteria

B4. The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.

Table 2: Operational Noise Criteria dB(A)

Residences [a]	***Day***	***Shoulder Period*** *6.00 am to 7.00 am Monday to Saturday*	
	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (15\ minute)}$	$L_{A(max)}$
2, 3, 5[b], 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

[a] *Residence locations are shown as "Assessment Locations" in Figure 6 in Appendix 3.*

[b] *Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3.*

Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the *NSW Industrial Noise Policy* (EPA, 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

B5. The noise criteria in condition B4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Noise Operating Conditions

B6. The Applicant must:

(a) take all reasonable steps to minimise all noise from operational activities, including low frequency noise and other audible characteristics, as well as road noise associated with the development;

(b) take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions, particularly when the noise criteria in this consent do not apply (see Appendix 4);

(c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and

(d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

Noise Management Plan

B7. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:

(a) be prepared by a suitably qualified and experienced person/s;

(b) be prepared in consultation with the EPA;

(c) describe the measures to be implemented to ensure:

(i) compliance with the noise criteria and operating conditions in this consent;

(ii) best practice noise management is being employed; and

(iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions; under which the noise criteria in this consent do not apply (see Appendix 4); and

(d) include a monitoring program that:

(i) is capable of evaluating the performance of the development against the noise criteria;

(ii) monitors noise at the nearest and/or most affected residences; and

(iii) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.

B8. The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Noise Management Plan is approved by the Planning Secretary.

B9. The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

B10. The Applicant must ensure that no offensive odours (as defined under the POEO Act) are emitted by the development.

Air Quality Criteria

B11. The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Air Quality Criteria

Pollutant	***Averaging period***	***Criterion***	
Particulate matter < 10 µm (PM_{10})	Annual	[a, c] 25 µg/m^3	
	24 hour	[b] 50 µg/m^3	
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	[a, c] 8 µg/m^3	
	24 hour	[b] 25 µg/m^3	
Total suspended particulate (TSP) matter	Annual	[a, c] 90 µg/m^3	
[d] Deposited dust	Annual	[b] 2 g/m^2/month	[a] 4 g/m^2/month

Notes:

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

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

[d] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

B12. The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Air Quality Operating Conditions

B13. The Applicant must:

3 Noise criteria

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 3.1 for the nearest residential receivers). The noise criteria for the facility are reproduced in Table 3.1.

Table 3.1 Noise criteria

Residences[a]	Day	Shoulder period 6 am to 7 am Monday to Saturday	
	$L_{Aeq,15\ minute}$ dB(A)	$L_{Aeq,15\ minute}$ dB(A)	L_{Amax} dB(A)
2, 3, 5[b], 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

Notes:

a Residence locations are shown as "Assessment Locations" in Figure 6 in Appendix 3 [of the Consent].

b Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3 [of the consent].

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am-6 pm Sundays and Public Holidays.

2. Shoulder period is between 6 am–7 am Monday to Saturday.

Condition B4 also states:

> Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The noise criteria in Table 3.1 do not apply if Menangle Sand and Soil has negotiated an agreement with the owner/s of the relevant residence or land to exceed the noise criteria. As of the date of this report, Menangle Sand and Soil have not negotiated any agreements with any landowners or residents. As per Condition B5 of Schedule 2, Menangle Sand and Soil will advise the relevant authorities in writing of the terms of any negotiated agreements.

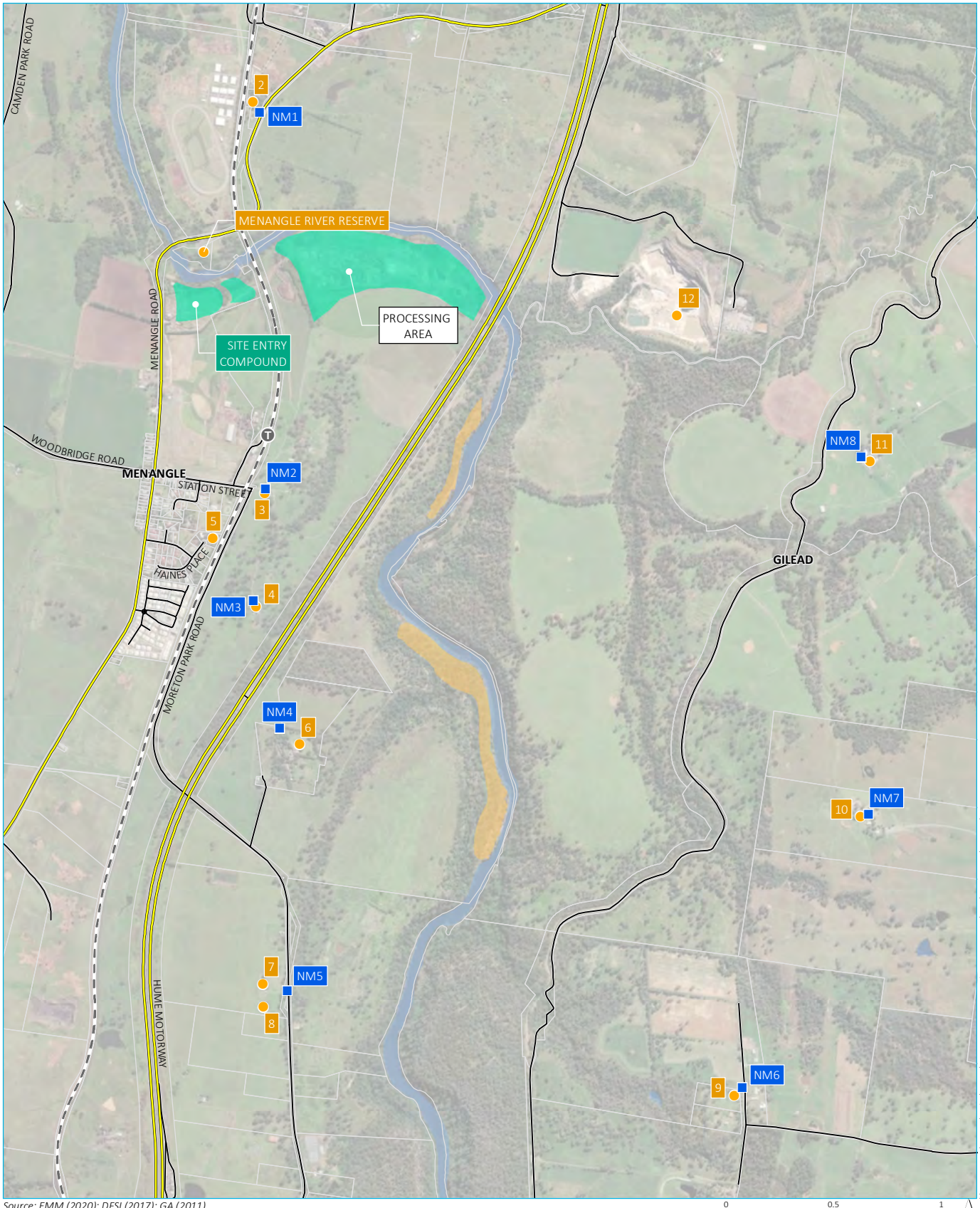
Compliance monitoring will adhere to the requirements of the EPA's policies and guidelines.

As per Condition 3 of Appendix 4, a noise compliance assessment will be undertaken within two months of commencement of Quarrying Operations in the Stage 8 Area, with a report provided to the EPA within 1 month of the assessment. The assessment will be conducted by a suitably qualified and experienced acoustical practitioner and will assess compliance with noise criteria outlined in Table 3.1.

3.1 Sensitive receivers

The nearest noise sensitive receivers most likely to be affected by operational noise from the site is long-term living accommodation approximately 700 m to the south-west/west of the Stage 8 extraction area. There are also surrounding industrial premises including the Camden Coal Seam Gas (CSG) plant (no longer operational) and the Hi-Quality Menangle Park Quarry, which is approximately 300 m to the north-east of Stage 8 operations. Menangle River Reserve is approximately 1.3 km west of Stage 8 operations.

Figure 3.1 shows the site boundary, the nearest sensitive receivers and the attended noise monitoring locations.



Source: EMM (2020); DFSI (2017); GA (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Monitoring location
- Assessment location
- Train station
- Rail line
- Main road
- Local road
- Nepean River
- Cadastral boundary
- Extractive operations
- Stage 8

Site boundary, sensitive receivers and noise monitoring locations

Menangle Sand and Soil
Noise management plan
Figure 3.1

EMM creating opportunities

\\emmsvr1\EMMJobs\2019\J190166 - Menangle Quarry LEC\GIS\02_Maps_NMP\N002_AssessmentMonitoringLocations_20201211_03.mxd 28/02/2022

5 Noise monitoring

5.1 Objective

The following conditions related to noise monitoring were included in the project consent under Condition B6 and have been reproduced below:

> B6. The Applicant must:
>
> (c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and
>
> (d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

The noise monitoring program is designed to verify that noise emissions from the quarry complies with the relevant noise criteria at the most affected residential receivers.

5.2 Noise monitoring standards

Noise monitoring will be undertaken in accordance with the relevant Australian standards and EPA guidelines including:

- AS 1055.1-2018 Acoustics – Description and Measurement of Environmental Noise – General Procedures;
- AS IEC 61672.1-2019 'Electroacoustics – Sound Level Meters – Specifications';
- INP (EPA 2000) and Application Notes; and
- NPfI (EPA 2017).

It is noted that the INP has been replaced by the NPfI. However, the INP continues to apply in accordance with the EPA's *Implementation and Transitional Arrangements for the Noise Policy for Industry* (EPA 2017) where the INP is referenced in existing statutory instruments, as is the case from Menangle Quarry).

Further, the INP Application Notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing potentially annoying characteristics of a noise source. Fact sheet C of the NpfI (EPA 2017) provides guidelines for applying corrections to account for annoying noise characteristics such as tonal noise and low frequency noise.

The INP and Fact Sheet C of the NpfI have been adopted for the purpose of this NMP.

All acoustic instrumentation proposed for monitoring under the noise monitoring program will have current NATA or manufacturer calibration certificates as per the relevant Australian standards.

5.3 Noise monitoring locations

Quarterly attended monitoring locations will be representative of the nearest privately owned receptors to active operations at the time of monitoring. The pool of attended monitoring locations are listed in Table 5.1 and shown on Figure 3.1. A selection of attended monitoring locations will be used each quarter from a pool of eight locations to represent the nearest affected privately-owned residences.

In order to satisfy Conditions B4 and B6, Menangle Sand and Soil will conduct quarterly attended noise monitoring at a representative sample of the points identified in Table 5.1 and shown in Figure 3.1. Data used for determining meteorological conditions will be sourced from the on-site meteorological station.

Table 5.1 Pool of attended noise monitoring locations

ID	Description	Easting (MGA)	Northing (MGA)	Representative residences	Representative direction
NM1	Menangle Road North	291937	6223124	R2	NW
NM2	Station Street North	291964	6221374	R3, R5	W
NM3	Station Street East	291907	6220855	R4	W
NM4	Morton Park Road North	292028	6220262	R6	SW
NM5	Morton Park Road South	292064	6219045	R7, R8	SW
NM6	Bulli Appin Road South	294179	6218595	R9	SE
NM7	Bulli Appin Road North	294766	6219863	R10	E
NM8	Appin Road	294732	6221523	R11	NE

5.4 Noise monitoring program

The attended noise monitoring will be completed on a quarterly basis to verify that noise emissions from the facility satisfy the relevant noise criteria at representative residential receivers. The attended noise monitoring program will be used to:

- estimate the site noise contribution from the measured noise levels;
- determine the individual noise sources contributing to the ambient noise environment wherever possible;
- determine whether a correction for annoying noise characteristics should be applied to the site noise level before comparison with the relevant noise criteria in accordance with the Npfl; and
- gain an understanding of the effects of meteorological conditions on the propagation of noise from site to surrounding residential receivers.

The attended noise monitoring will be completed during the morning shoulder (6 am–7 am) and day (7 am–6 pm) periods.

During the morning shoulder period, attended noise monitoring will only occur at NM4, as NM4 is the only assessment location with a more stringent morning shoulder noise criteria compared with daytime noise criteria.

During the day period, the noise monitoring locations selected for each monitoring event will be dependent on the location of quarrying operations and the meteorological conditions present on the day of the noise monitoring. As such, the quarterly noise monitoring events will target the worst affected noise monitoring locations from the pool detailed in Table 5.1.

In summary, each quarterly monitoring event will entail:

- attended noise monitoring at NM4 during the morning shoulder period (6 am–7 am); and

- attended noise monitoring at the predicted worst-case noise monitoring locations (selected based on quarry operations and meteorological conditions) during the day period (7 am–6 pm).

For each 15-minute attended noise measurement, the following information will be recorded:

- name of monitoring personnel;
- monitoring location;
- date(s) and time(s) at which the monitoring measurement started and ended at each location;
- height of the microphone above the ground and, if relevant, distances to building facades or property boundaries (if monitoring cannot be completed within the property boundary);
- quantitative meteorological data such as wind speed (including the height above ground at which the measurement was taken), wind direction, temperature and humidity;
- qualitative meteorological information such as cloud cover, fog or rainfall;
- instrument type and in-field calibration details before and after the monitoring period;
- the $L_{Aeq,15min}$ noise level for the 15-minute period;
- statistical noise level descriptors over the 15-minute interval: L_{Amin}, L_{A90}, L_{A10}, L_{A1} and L_{Amax};
- notes that identify the noise sources that contribute to the overall noise environment;
- an estimate of the noise contribution from the facility and from other identifiable noise sources;
- measurement in one-third octave bands from 10 Hz to 8 kHz inclusive (or a broader range of bands) for the 15-minute interval to assess if site noise exhibit tonal characteristics that may require the application of a correction for annoying noise characteristics in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for tonal noise is applicable is presented in Section 5.8.1;
- measurement of C-weighted and A-weighted site noise levels to identify the likely presence of low frequency noise in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for low frequency noise is applicable is presented in Section 5.8.2;
- data suitable for assessing the relative contribution of site noise to the overall noise level being measured by using a low-pass filter, which will be developed during the first round of monitoring (eg with a low-pass frequency of 630 Hz); and
- recommendations or comments where considered appropriate.

In accordance with the methodology outlined in Section 3 of the INP (EPA 2000), if any of the data in a 15-minute period is affected by rain or wind speeds in excess of 3 m/s, and where possible, another entire 15-minute period of data unaffected by rain or adverse wind conditions shall be undertaken.

5.5 Instrumentation

All noise monitoring instrumentation will meet the requirements of AS IEC 61672.1-2019 and carry current NATA or manufacturer calibration certificates. Instrument in-field calibration will be checked before and after each survey, with the variation in calibrated levels not exceeding ±0.5 dB.

The sound level meter will be programmed to record statistical noise level indices continuously for each 15-minute interval, including L_{A1}, L_{A10}, L_{A90}, L_{Amin}, L_{Aeq} and L_{Amax}, using 'fast' time response.

5.6 Meteorological monitoring

Condition B17 of the development consent relates to the establishment of a meteorological monitoring station in the vicinity of the quarry and states the following:

> Prior to the commencement of Quarrying Operations in the Stage 8 Area, and for the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in close proximity to the site that:
>
> (a) complies with the requirements in the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC 2007); and
>
> (b) is capable of measuring meteorological conditions in accordance with the NSW Industrial Noise Policy (EPA 2000),
>
> unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.

The meteorological station at the quarry will be located to the east of the site entry compound and will satisfy requirements of the NSW Industrial Noise Policy and Australian Standard AS 3580.14-2014 *Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications.*

5.7 Meteorological parameters

Consent Condition B4 states:

> Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The meteorological conditions during the noise monitoring will be recorded including wind speed (including the height above ground at which the measurement was taken), wind direction, temperature, humidity, cloud cover and the presence of fog and rain (if any).

The meteorological conditions will be used to determine if the noise criteria (refer to Table 3.1) apply in accordance with the INP. Condition 1 of Appendix 4 states that:

> The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:
>
> (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
>
> (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
>
> (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or

(iii) temperature inversion conditions greater than 3°C/100m.

(b) where Pasquill Stability Classes have been assessed, then:

(i) wind speeds greater than 3m/s at 10m above ground level;

(ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or

(iii) stability category G temperature inversion conditions.

5.8 Corrections for annoying noise characteristics

The INP application notes state that Section 4 of the INP has been withdrawn and the corrections outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source. The NPfI specifies corrections for noise with annoying characteristics such as tonal noise and low frequency noise. These are discussed in the following sections.

5.8.1 Tonal noise

Tonal noise can be defined as noise levels containing a prominent frequency and characterised by a definite pitch. Examples of tonal noise sources include ventilation fans, reversing beepers or alarms. The method for assessing the presence of tonal noise involves comparing differences in noise levels between neighbouring one-third octave centre frequency bands.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for tonal noise emissions. The NPfI specifies that a 5 dB positive adjustment is applicable where the level of any of the one-third octave bands exceeds the level of both adjacent bands by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz;
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz; or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

5.8.2 Low frequency noise

Low frequency noise can be characterised as noise containing dominant energy within the low frequency range (ie less than 200 Hz). Examples of low frequency noise sources can include screens and centrifuges in coal washeries, as well as pumps, fans, boilers, ventilation plant, electrical installations and wind turbines.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance. Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the measured one-third octave noise levels should be compared to the values in Table C2 of the NPfI, which has been reproduced in Table 5.2.

Table 5.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following correction is to be applied where the site 'C-weighted' minus site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 5.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 5.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured A-weighted levels applies for the evening/night period and a 2 dB positive adjustment to measured A-weighted levels applies for the day period.

Hence, where possible throughout each survey the difference between site 'C-weighted' and site 'A-weighted' noise emission levels will be estimated by the operator by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this is deemed to be 15 dB or greater, the measured one-third octave frequencies will be compared to the values in Table 5.2 to identify the relevant correction (if applicable). It is of note that the NPfI states that low frequency noise correction does not apply during adverse meteorological conditions, including during wind speeds above 3 m/s at 10 m above ground level, stability category F with wind speeds above 2 m/s at 10 m above ground level, or during stability category G.

5.9 Data analysis

The $L_{Aeq,15min}$ noise level contribution from the facility as well as the overall ambient noise levels together with the weather and site operating conditions will be reported on a quarterly basis.

The contributed noise emissions from operations at the facility will be evaluated and assessed against the noise level criteria given in Table 2 of development consent Condition B4 (refer to Table 3.1) during each quarterly noise monitoring event. Compliance may be determined by:

- post analysis of data (including through the review of audio recordings);
- direct measurement against the $L_{Aeq,15min}$ criteria;
- operator estimated $L_{Aeq,15min}$ contribution;
- by calculation from near field measurements;
- by measurement at a representative location; or
- a combination of any or all the above methods as approved by the EPA or in accordance with the INP or NPfI as relevant.

5.10 Noise exceedance protocol

If attended noise monitoring identifies that the noise criteria as per Table 3.1 have been exceeded, the person conducting the attended noise monitoring will follow the noise exceedance protocol presented in Figure 5.1.

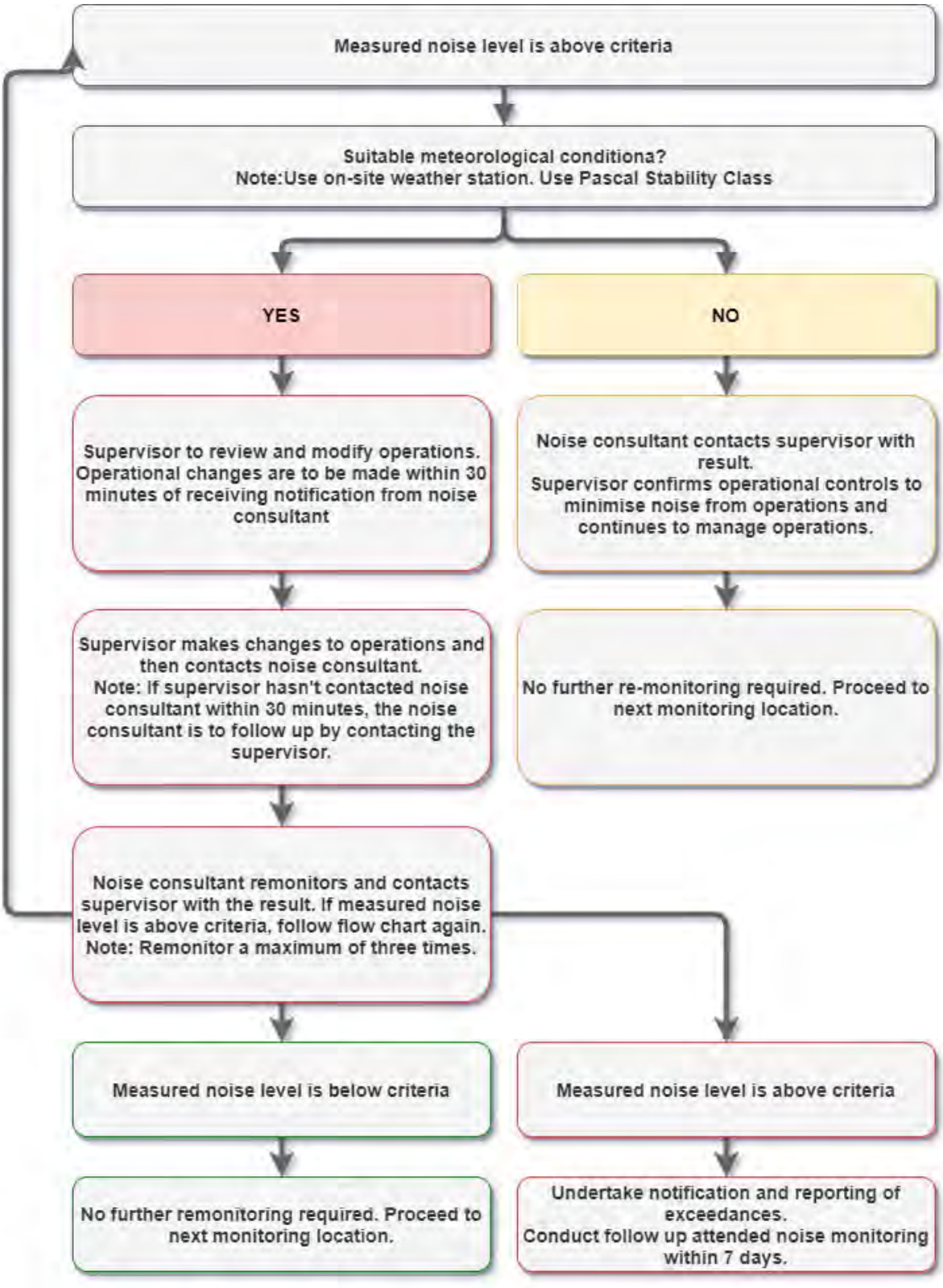


Figure 5.1 Noise exceedance protocol

The relevant supervisor will document and report to the Quarry Manager any actions implemented following the notification of the exceedance. The exceedance is required to be reported to DPE and EPA by the Quarry Manager (or delegate) immediately upon Menangle Sand and Soil becoming aware of the exceedance. An additional attended noise monitoring survey will be completed within one week if the exceedance could not be effectively reduced below the relevant criteria on the night of noise monitoring.

Within 7 days of detecting an exceedance of the noise criteria as per Table 3.1, Menangle Sand and Soil shall provide a written report of the exceedance to DPE. This report must:

- describe the date, time, and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

Any exceedance above the noise limits identified in Table 3.1 will be reported in the annual noise compliance assessment report required under Condition R4.3 of EPL and noise monitoring reports will be available upon request.

5.11 Noise monitoring report

All routine monitoring results will be documented and reported initially on a quarterly basis.

Quarterly reports will consist of the following information:

- summary of all attended noise monitoring results;
- measured, calculated and/or operator estimated site $L_{Aeq,15min}$ contributed noise levels for each monitoring location;
- statement of compliance/non-compliance; and
- details of any complaints relating to noise and their state of resolution.

The noise monitoring contractor undertaking the monitoring on behalf of Menangle Sand and Soil will provide the site representative with a monitoring report outlining the results and outcome of the survey.

The site representative will review the monitoring report provided by the contractor to assess compliance with the criteria outlined in Table 2 of development consent Condition B4 (refer to Table 3.1). A summary of quarterly noise monitoring results will be published on the Menangle Sand and Soil website, as per Condition D15.

Appendix C
Calibration certificates

EMM
creating opportunities

Acoustic Research Labs Pty Ltd
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North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23471

Client Details	EMM Consulting Ground Floor Suite 01, 20 Chandos Street
Equipment Tested/ Model Number :	Type 2250
Instrument Serial Number :	3008201
Microphone Serial Number :	2888134
Pre-amplifier Serial Number :	16037
Firmware Version :	N/A

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.1 °C	**Ambient Temperature :**	24.3 °C
Relative Humidity :	44 %	**Relative Humidity :**	44.1 %
Barometric Pressure :	101.6 kPa	**Barometric Pressure :**	101.3 kPa

Calibration Technician :	Max Moore	**Secondary Check:**	Rhys Gravelle
Calibration Date :	12 Jul 2023	**Report Issue Date :**	17 Jul 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.014 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C36957

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV36 **Serial No:** 138019
Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	93.94 dB	999.97 Hz	0.63 %
Level2:	NA	N	113.97 dB	999.97 Hz	0.40 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure 1012 hPa ±1 hPa
Temperature 23 °C ±1° C
Relative Humidity 40 % ±5%

Date of Receipt : 28/07/2023
Date of Calibration : 01/08/2023
Date of Issue : 01/08/2023

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: .....

AUTHORISED SIGNATURE: .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

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Menangle Sand and Soil Quarry

Sep-23

15 Menangle Rd, Menangle

DA Consent 85/2865, EPA Licence No: 3132

Location of Monitoring Points:

DDG1: to the east of the site entry compound

DDG2: near groundwater monitoring location BH2

DDG3: near groundwater monitoring location BH4

Summary of Results:

Particulates	Unit of Measure	Lowest sample value	Highest sample value	Mean of samples
Ash Content	g/m^2	0.3	2.8	1.4
Combustable Matter	g/m^2	0.2	2.4	1.2

Individual Results:

DDG1:

Sample Date	Particulate	Unit of Measure	Test Result
31/09/2023	Ash Content	g/m^2	2.8
	Combustible Matter	g/m^2	2.4
	TOTAL	g/m^2	5.2

DDG2:

Sample Date	Pollutant	Unit of Measure	Test Result
31/09/2023	Ash Content	g/m^2	1.2
	Combustible Matter	g/m^2	0.9
	TOTAL	g/m^2	2.1

DDG3:

Sample Date	Pollutant	Unit of Measure	Test Result
31/09/2023	Ash Content	g/m^2	0.3
	Combustible Matter	g/m^2	0.2
	TOTAL	g/m^2	0.5

Menangle Sand and Soil Quarry

Oct-23

15 Menangle Rd, Menangle

DA Consent 85/2865, EPA Licence No: 3132

Location of Monitoring Points:

DDG1: to the east of the site entry compound

DDG2: near groundwater monitoring location BH2

DDG3: near groundwater monitoring location BH4

Summary of Results:

Particulates	Unit of Measure	Lowest sample value	Highest sample value	Mean of samples
Ash Content	g/m^2	0.3	1.8	1.0
Combustable Matter	g/m^2	0.3	1.6	0.9

Individual Results:

DDG1:

Sample Date	Particulate	Unit of Measure	Test Result
31/10/2023	Ash Content	g/m^2	1.8
	Combustible Matter	g/m^2	1.6
	TOTAL	g/m^2	3.4

DDG2:

Sample Date	Pollutant	Unit of Measure	Test Result
31/10/2023	Ash Content	g/m^2	1.0
	Combustible Matter	g/m^2	0.8
	TOTAL	g/m^2	1.8

DDG3:

Sample Date	Pollutant	Unit of Measure	Test Result
31/10/2023	Ash Content	g/m^2	0.3
	Combustible Matter	g/m^2	0.3
	TOTAL	g/m^2	0.6

Menangle Sand and Soil Quarry

Nov-23

15 Menangle Rd, Menangle

DA Consent 85/2865, EPA Licence No: 3132

Location of Monitoring Points:

DDG1: to the east of the site entry compound

DDG2: near groundwater monitoring location BH2

DDG3: near groundwater monitoring location BH4

Summary of Results:

Particulates	Unit of Measure	Lowest sample value	Highest sample value	Mean of samples
Ash Content	g/m^2	0.4	7.7	3.0
Combustable Matter	g/m^2	0.3	6.0	2.4

Individual Results:

DDG1:

Sample Date	Particulate	Unit of Measure	Test Result
30/11/2023	Ash Content	g/m^2	7.7
	Combustible Matter	g/m^2	6.0
	TOTAL	g/m^2	13.7

DDG2:

Sample Date	Pollutant	Unit of Measure	Test Result
30/11/2023	Ash Content	g/m^2	1.0
	Combustible Matter	g/m^2	0.9
	TOTAL	g/m^2	1.9

DDG3:

Sample Date	Pollutant	Unit of Measure	Test Result
30/11/2023	Ash Content	g/m^2	0.4
	Combustible Matter	g/m^2	0.3
	TOTAL	g/m^2	0.7

Menangle Sand and Soil Quarry

Dec-23

15 Menangle Rd, Menangle

DA Consent 85/2865, EPA Licence No: 3132

Location of Monitoring Points:

DDG1: to the east of the site entry compound

DDG2: near groundwater monitoring location BH2

DDG3: near groundwater monitoring location BH4

Summary of Results:

Particulates	Unit of Measure	Lowest sample value	Highest sample value	Mean of samples
Ash Content	g/m^2	1.1	4.4	2.4
Combustable Matter	g/m^2	0.8	3.4	1.9

Individual Results:

DDG1:

Sample Date	Particulate	Unit of Measure	Test Result
31/12/2023	Ash Content	g/m^2	4.4
	Combustible Matter	g/m^2	3.4
	TOTAL	g/m^2	7.8

DDG2:

Sample Date	Pollutant	Unit of Measure	Test Result
31/12/2023	Ash Content	g/m^2	1.6
	Combustible Matter	g/m^2	1.4
	TOTAL	g/m^2	3.0

DDG3:

Sample Date	Pollutant	Unit of Measure	Test Result
31/12/2023	Ash Content	g/m^2	1.1
	Combustible Matter	g/m^2	0.8
	TOTAL	g/m^2	1.9

Menangle Sand and Soil Quarry

Air quality monitoring campaign

Prepared for Menangle Sand and Soil Pty Ltd

February 2024

Menangle Sand and Soil Quarry

Air quality monitoring campaign

Menangle Sand and Soil Pty Ltd

E230944 RP2

February 2024

Version	Date	Prepared by	Approved by	Comments
V1	7 February 2024	Amie Gilbert	Scott Fishwick	Draft for client review
V2	16 February 2024	Amie Gilbert	Scott Fishwick	Final

Approved by

Scott Fishwick
National technical lead – air quality and climate
16 February 2024

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1 Introduction

1.1 Background

Menangle Sand and Soil Pty Ltd (Menangle Sand and Soil) operates the Menangle Sand and Soil Quarry (the quarry) at 15 Menangle Road, Menangle (the site), located within the Wollondilly and Campbelltown local government area (LGA). The quarry extracts sand and soil along the Nepean River as approved by Development Consent 85/2865, granted by the Minister for Planning on 15 November 1989.

To date, sand and soil has been extracted from Stages 1 to 2 and 4 to 7. Stage 8 extraction commenced in September 2023 and is occurring in Substage 8A and 8B. While previously approved, sand and soil will not be extracted from Stage 3.

On 10 September 2020, the NSW Land and Environment Court (LEC) approved the Menangle Quarry Extension – Modification 1 (MOD1) to Development Consent 85/2865. Consent Conditions are provided in the Notice of Orders for LEC 2018/342158.

On 5 November 2021, the minister for Planning and Public Spaces approved the Menangle Quarry Extension – Modification 2 (MOD2). Changes to the Consent conditions are provided in the Notice of Modification for Development Consent DA 85/2865.

1.2 Air quality management plan and monitoring program

Condition B14 (Schedule 2) of the development consent (as modified) requires the preparation of an air quality management plan (AQMP). The AQMP was completed in March 2022 (EMM 2022). As identified in Section 6 of the AQMP, the requirements for ambient air quality monitoring at the quarry are outlined in Condition B14 (Schedule 2) as follows:

> carry out regular air quality monitoring to determine whether the development is complying with the relevant conditions of Schedule 2.

The specific AQMP requirements outlined in Condition B14 (Schedule 2) requires a monitoring program that:

i) is capable of evaluating the performance of the development against the air quality criteria; and

ii) includes a protocol for identifying any air quality-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.

1.3 Ambient air quality monitoring (this report)

Section 6.2 of the AQMP relates to ambient air quality monitoring and relevant portions for this study are reproduced in this section.

To supplement the DDG monitoring network, Menangle Sand and Soil will use two real-time particulate matter monitoring units at the quarry, initially for two separate four-week campaigns. Each monitoring unit will feature the following specifications:

- laser particle counter style continuous monitoring
- ability to record multiple particulate matter size fractions (i.e. PM_{10} and $PM_{2.5}$, see Section 2) at the same time
- powered by solar panels to accommodate limited mains power supply

- have the ability to be relocated as required.

It is envisioned that the real-time particulate matter monitoring will be completed at the site of DDG1 and DDG2 (as shown in Figure 1.1), however the monitoring locations will be finalised following the confirmation of the monitoring unit and land access.

The closest sensitive residential properties are located to the west of the quarry and would therefore be downwind of the quarry emission sources during period of easterly winds. As illustrated in Appendix A (figure A1.2) of the AQIA (Ramboll Environ 2016), winds from the east typically only occur at the quarry during spring and summer months. Real-time monitoring would therefore initially be conducted on two separate four-week campaigns between September and November and between December and February.

Data from the real-time particulate matter monitoring equipment will be compared with concurrent real-time meteorological monitoring data from the quarry (see below) to assist to determine the source of recorded concentrations, further, real-time particulate matter monitoring data will be compared with regional resources (DPE[1] air quality monitoring stations at Campbelltown West and Camden) to determine if regional scale events (e.g. bushfires, dust storms) are influencing ambient concentrations.

The need to continue the real-time particulate matter monitoring campaigns will be reviewed in conjunction with DPE after the completion of two monitoring campaigns.

The meteorological station at the quarry will be located to the east of the site entry compound (see Figure 6.1 of AQMP) and will be in compliance with the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC 2007), specifically:

- AS/NZS 3580.1.1:2016: *Methods for sampling and analysis of ambient air - Part 1.1: Guide to siting air monitoring equipment*
- Australian Standard AS 3580.14-2014 *Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications.*

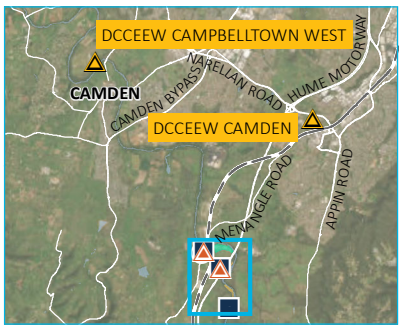
[1] Formerly the Department of Planning and Environment (DPE) - Now NSW Department of Climate Change, Energy, the Environment and Water (DCCEW)

Source: EMM (2024); DCCEEW (2024); DFSI (2017); GA (2011)

0 250 500 m

GDA 1994 MGA Zone 56

N



KEY

- DCCEEW air quality monitor
- On site air quality monitor
- Dust deposit gauge
- Meteorological station
- Extractive operations
- Stage 8
- Train station

Existing environment

- Rail line
- Main road
- Local road
- Nepean River
- Cadastral boundary

Menangle Sand and Soil Quarry monitoring network

Menangle Sand and Soil Quarry
Air Quality Monitoring Report
Figure 1.1

EMM
creating opportunities

\\emm.local\xdrive\2023\E230944 - Menangle Quarry - Noise and AQ Monitoring\GIS\02_Maps_AQM\AQ001_DustGaugeAndMeteorologicalLocations_20240205_01.mxd 6/02/2024

2 Air quality criteria

Condition B11 of Schedule 2 lists the relevant air quality criteria for the development (replicated below in Table 2.1), and states that the Applicant (Menangle Sand and Soil) must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in the given table (Table 2.1) at any residence on privately-owned land.

Table 2.1 Air quality criteria for particulate matter

Pollutant	Averaging period	Criterion
Particulate matter < 10 µm (PM_{10})	Annual	25 µg/m^3 [(a) (c)]
	24 hour	50 µg/m^3 [(b)]
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	8 µg/m^3 [(a) (c)]
	24 hour	25 µg/m^3 [(b)]
Total suspended particulate (TSP) matter	Annual	90 µg/m^3 [(a) (c)]
Deposited dust[(d)]	Annual	2 g/m^2/month [(b)]
		4 g/m^2/month [(a)]

Notes:

[(a)] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

[(b)] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

[(c)] Excludes extraordinary events such as bushfires, prescribed burning, dust storms or fire incidents.

[(d)] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

3 Monitoring network and methodology

3.1 Monitoring network

In accordance with Section 6.2 of the AQMP, the real-time monitoring network installed at the site for two separate four-week campaigns consists of two real-time particulate matter monitoring units. The two campaign periods were conducted over the following time frames, noting that the time frame for Period 2 was extended to account for missing data due to particulate matter monitoring instrument outages:

- Period 1 – from 12:00 am 3 November to 11:00 pm 3 December 2023
- Period 2 – from 12:00 am 4 December 2023 to 11:00 pm 10 January 2024.

Meteorological measurements recorded during the two monitoring periods were sourced from the onsite automatic weather station (Menangle AWS), located to the east of the quarry entry compound (see Figure 1.1). The data analysis identified a dominance of winds from the north-east, east and south-west (as recognised in the AQMP). Consequently, to record upwind and downwind particulate matter concentrations at the quarry, the two real-time monitoring units co-located alongside two of the existing dust deposition gauges.

For each of the four-week campaign periods, concurrent meteorological monitoring data from the Menangle AWS was collated. Further, to provide an understanding of potential regional-scale air quality events, concurrent measurements from the NSW DCCEEW air quality monitoring stations (AQMS) at Campbeltown West (located approximately 8 km north-east to the quarry) and Camden (located approximately 10 km north-west to the quarry) were collated.

The monitoring resources adopted in the campaign are summarised in Table 3.1, and the monitoring locations are shown in Figure 1.1.

Table 3.1 Summary of monitoring network adopted in monitoring campaign at Menangle Quarry

	Location ID	Description	Coordinates (MGA 56)	
			Easting (m)	Northing (m)
Onsite air quality	AQM01	Co-located with DDG1 to the east of the site entry	291664	6222248
	AQM02	Co-located with DDG2 south of the processing area	292403	6221500
Reference air quality and meteorology	NSW DCCEEW Campbeltown West	Campbeltown West AQMS	296561	6228259
	NSW DCCEEW Camden	Camden AQMS	286772	6230813
Meteorology	Onsite met	Menangle AWS	291575	6222156

3.2 Monitoring methodology

The Menangle AWS continuously records wind speed, wind direction, temperature, relative humidity, pressure and accumulated rainfall. The measurements are reported as 1-hour averages calculated from 5-minute average data.

The real-time particulate matter monitoring was completed by Ektimo Pty Ltd, a NATA accredited monitoring specialist. Ektimo installed two FDS-17 continuous particulate matter monitoring units at the site. The monitoring was conducted at ground level, with the inlet at approximately 1.5 m above ground level. During the monitoring periods the PM_{10} and $PM_{2.5}$ measurements were recorded continuously as both 1-minute and 1-hour mean values in micrograms per cubic metre ($\mu g/m^3$). Daily average concentrations were also calculated from the collected data. The real-time particulate matter monitor installations are shown in Photograph 3.1 and Photograph 3.2.

Photograph 3.1 AQM01 monitoring location – co-located with DDG1

Photograph 3.2 AQM02 monitoring location – co-located with DDG2

3.3 Quality control

The raw data from the two real-time monitors were supplied to EMM by Ektimo following the completion of the two campaign periods. Some further processing steps were applied by EMM on receipt of the data. For example, any large negative concentrations were taken to be erroneous and were removed, and 1-minute mean values were converted to 1-hour and 24-hour mean values using a minimum data capture of 75%. These are described in the following sections, were relevant.

As an additional level of quality control, the air quality and meteorological data from the DCCEEW monitoring stations at Campbelltown West and Camden were compared with data from the quarry.

4 Meteorological data

4.1 Overview of data for campaign period

This section of the report presents a summary and analysis of the meteorological data that were collected by the Menangle AWS during the two campaign periods.

An overview of the continuous data from the Menangle AWS for Period 1 and Period 2 are provided in Figure 4.1 and Figure 4.2 respectively. The panel on the left shows the time series of 1-hour values for each parameter, with the grey bars indicating the presence of data and any red bards indicating missing data. Some summary statistics for the reporting period are also give, including the mean median, 95th percentile, minimum, maximum and number of missing points. The panel on the right shows the frequency distribution of the values for each parameter.

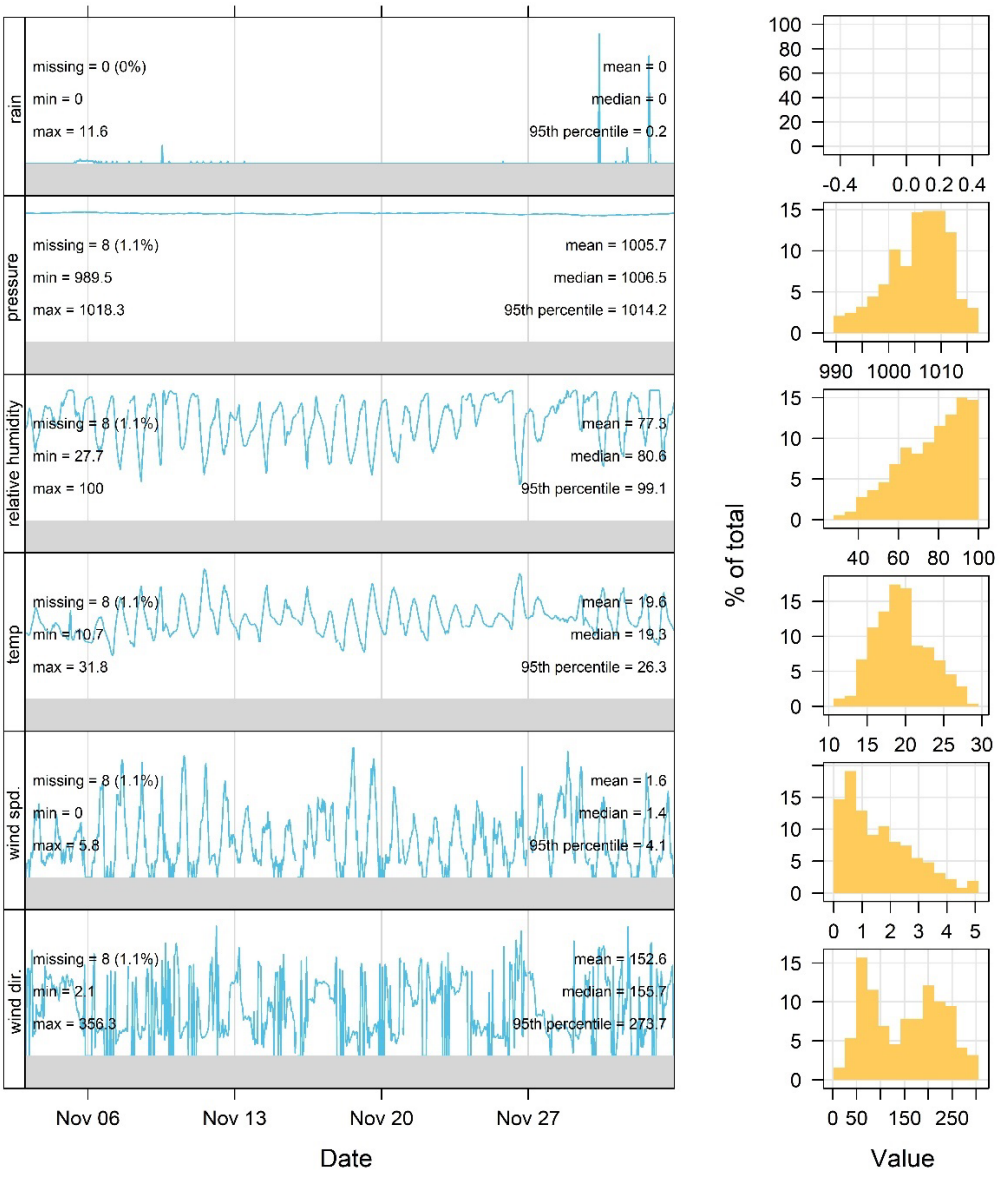


Figure 4.1 Meteorological data summary – Menangle AWS – Period 1

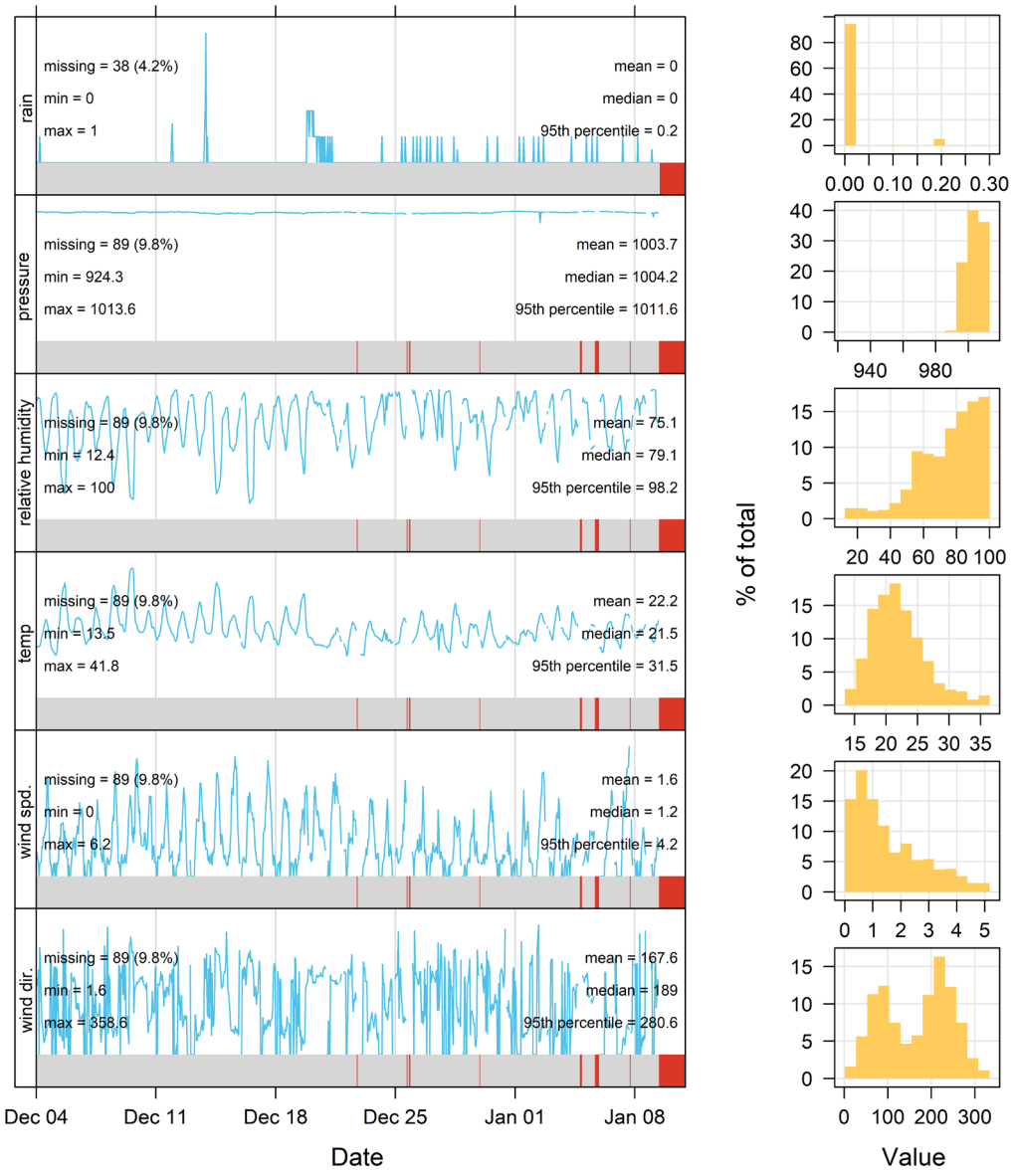


Figure 4.2 Meteorological data summary – Menangle AWS – Period 2

For all meteorological parameters, the data capture rate was approximately 98% for Period 1 and approximately 90% for Period 2.

Key descriptive statistics and time series plots for the meteorological parameters collected at the Menangle AWS and the DCCEEW Campbelltown West and Camden stations during the two campaign periods are provided in the following sections.

4.2 Wind speed and wind direction

The key descriptive statistics for the wind speed data collected at Menangle Quarry during the two campaign periods are provided in Table 4.1. The statistics are calculated from the 1-hour values and are shown for each campaign period, as well as for the period as a whole.

Table 4.1 Statistics for wind speed at Menangle Quarry (1-hour values)

	Mean (m/s)	Median (m/s)	Maximum (m/s)	Standard deviation (m/s)
Period 1	1.7	1.4	5.8	1.2
Period 2	1.6	1.2	6.2	1.3
Total Period	**1.7**	**1.3**	**6.2**	**1.2**

The percentage of calm wind conditions – defined as wind less than or equal to 0.5 m/s – was also determined for each campaign period and for the total of both periods at Menangle Quarry. The resulting values are provided in Table 4.2.

Table 4.2 Statistics for calm winds and Menangle quarry

	Calm winds (%)
Period 1	15.1
Period 2	15.8
Total Period	**15.5**

The wind roses for each of the campaign periods at Menangle Quarry are shown in Figure 4.3. Winds across the two periods were influenced by prevailing winds from the north-east, east and south-westerly directions.

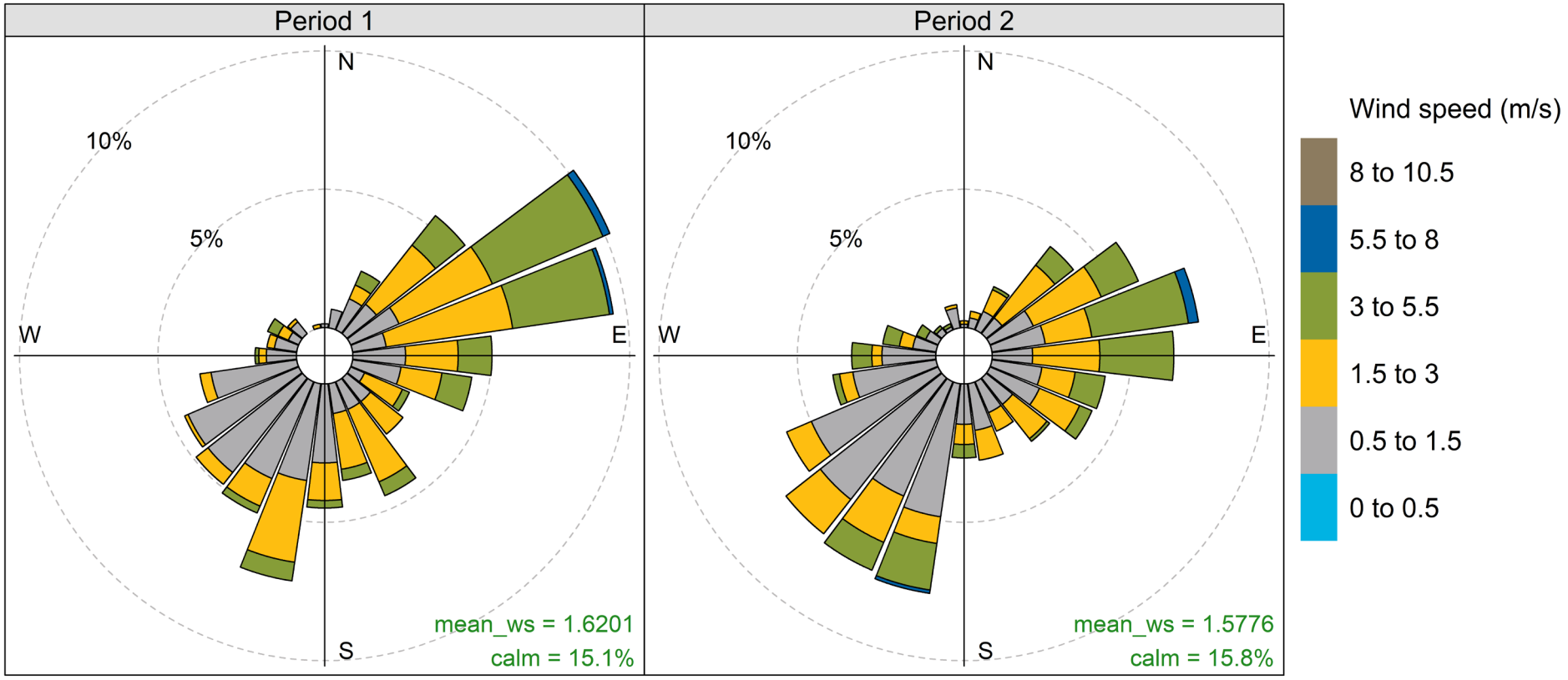


Figure 4.3 **Wind roses at Menangle Quarry – Period 1 and 2**

4.3 Temperature

The key descriptive statistics for temperature at the Menangle Quarry during the two campaign periods are provided in Table 4.3. The time series of mean daily temperatures at Menangle Quarry are show – along with those from Campbelltown West and Camden in Figure 4.4 and Figure 4.5 respectively. The mean diurnal temperature profiles are presented in Figure 4.6 and Figure 4.7 respectively. Similar temperature values were recorded at both Campbelltown West and Camden.

Table 4.3 Statistics for temperature at Menangle Quarry (1-hour values)

	Mean (°C)	Median (°C)	Maximum (°C)	Standard deviation (°C)
Period 1	19.6	19.3	31.8	3.7
Period 2	22.3	21.5	41.8	4.9
Total Period	**21.0**	**20.3**	**41.8**	**4.5**

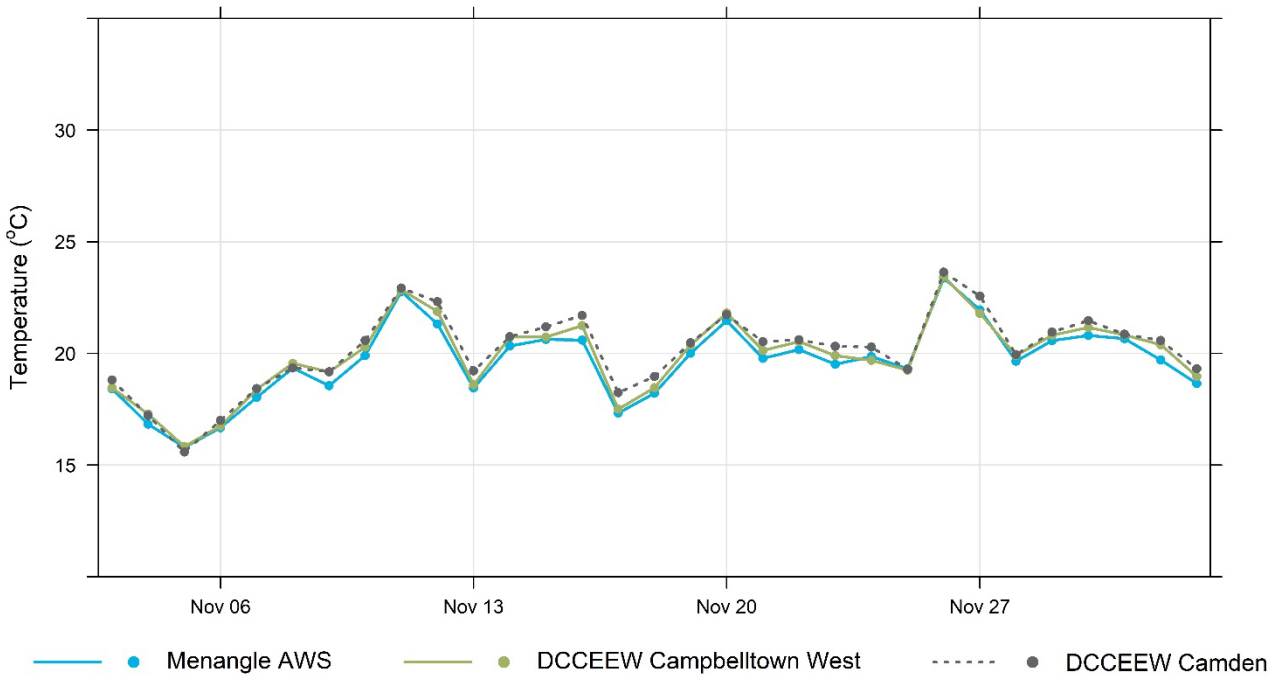


Figure 4.4 Daily mean temperature – Period 1

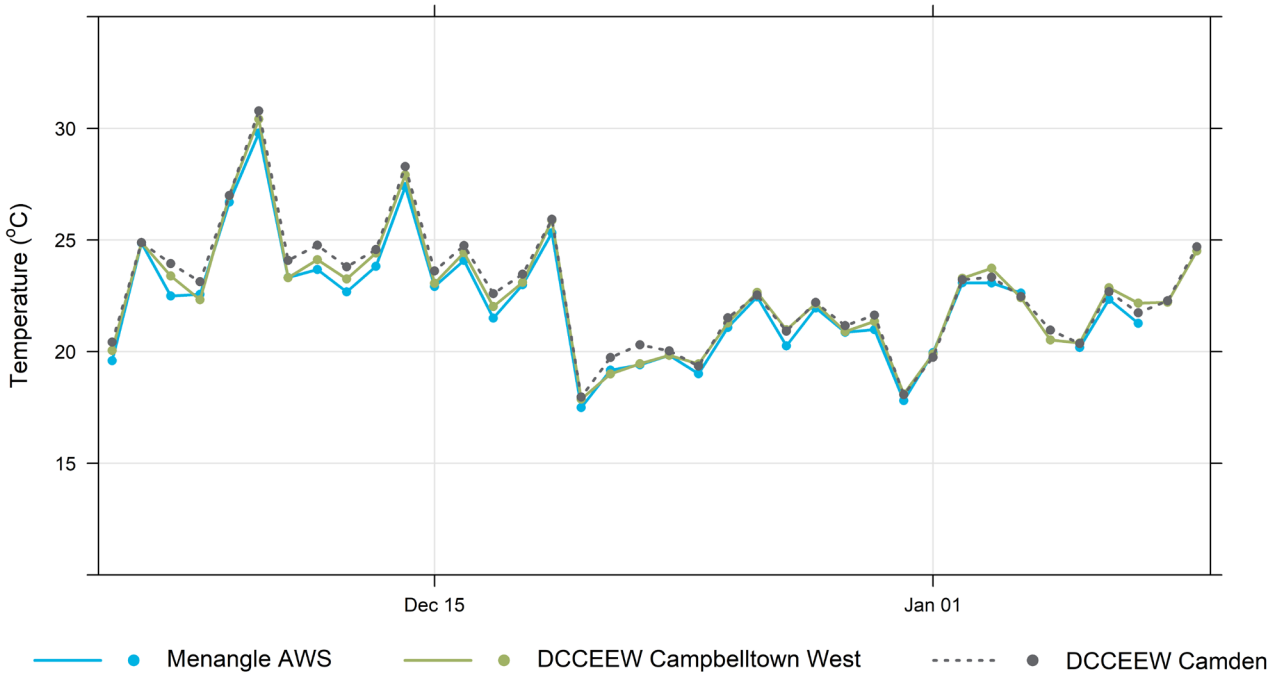


Figure 4.5 **Daily mean temperature – Period 2**

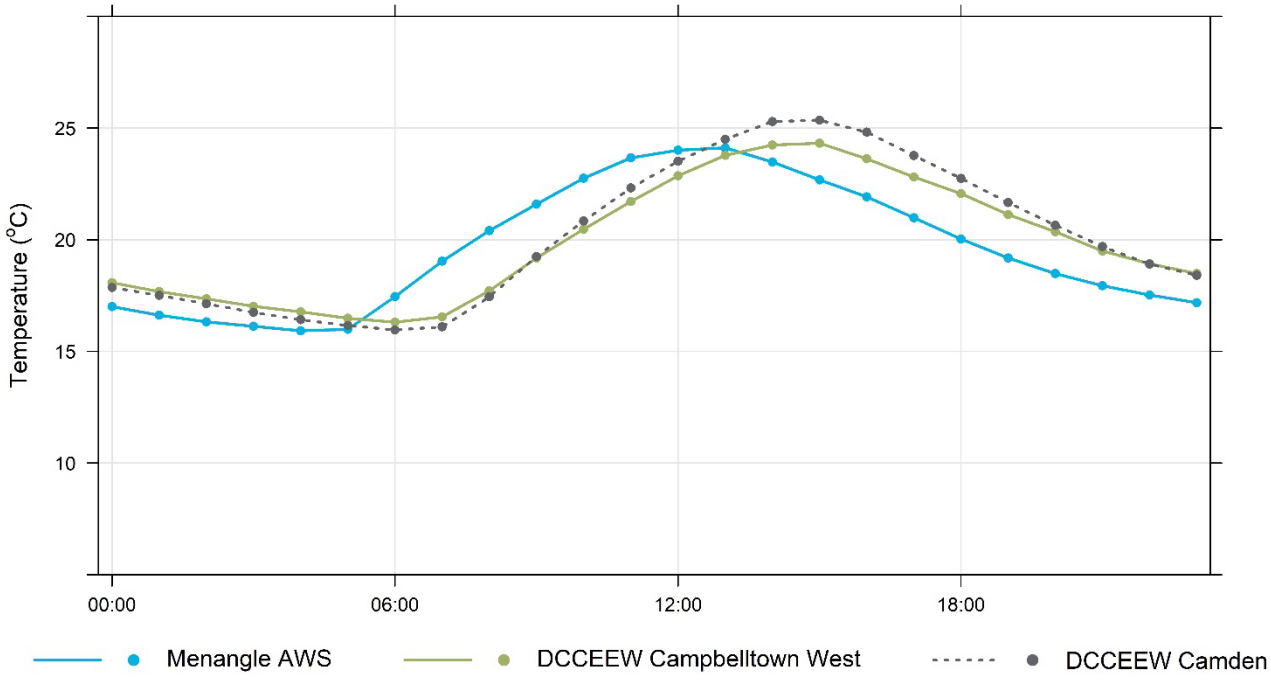


Figure 4.6 **Mean temperature by hour of the day – Period 1**

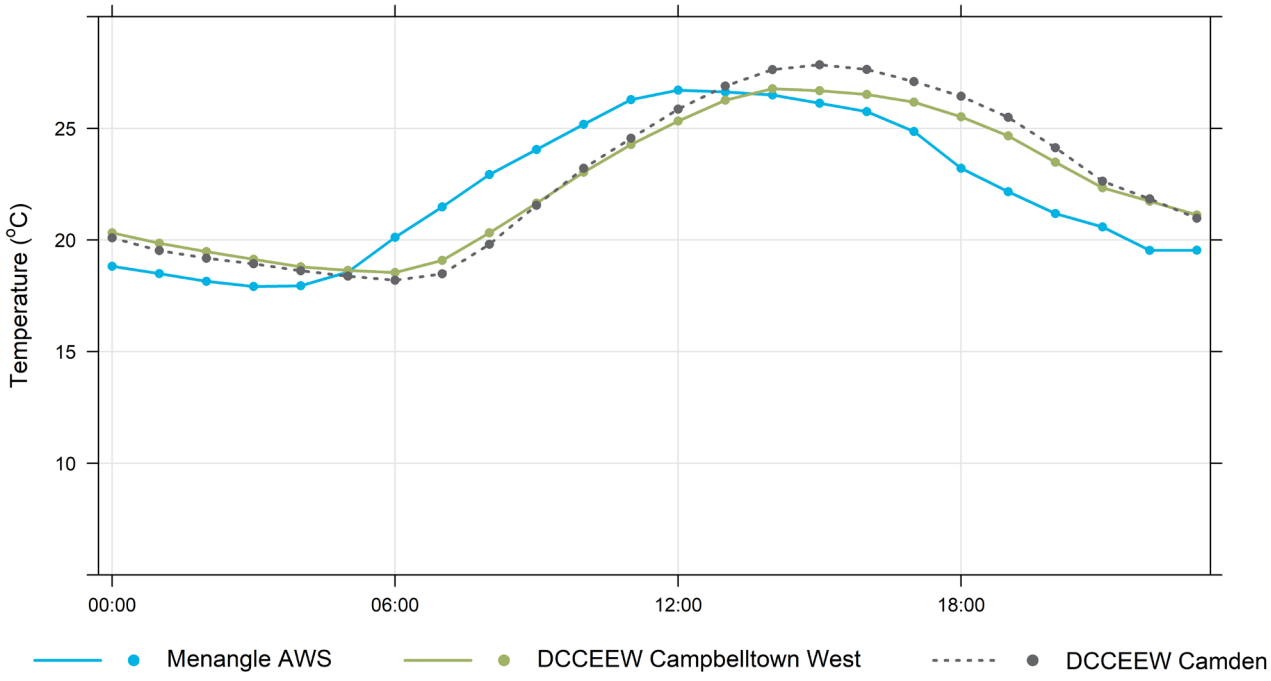


Figure 4.7 Mean temperature by hour of the day – Period 2

4.4 Relative humidity

Descriptive statistics for relative humidity at Menangle Quarry are provided in Table 4.4 The time series of mean daily values for the two campaign periods at Menangle Quarry, Campbelltown West and Camden are shown in Figure 4.8 and Figure 4.9 respectively. Mean diurnal profiles for the two periods are presented in Figure 4.10 and Figure 4.11 respectively. The relative humidity at Campbelltown West and Camden for the two periods are comparable with Menangle Quarry.

Table 4.4 Statistics for relative humidity at Menangle quarry (1-hour values)

	Mean (%)	Median (%)	Maximum (%)	Standard deviation (%)
Period 1	77.3	80.6	100.0	16.8
Period 2	75.1	79.1	100.0	19.1
Total Period	**76.1**	**79.8**	**100.0**	**18.1**

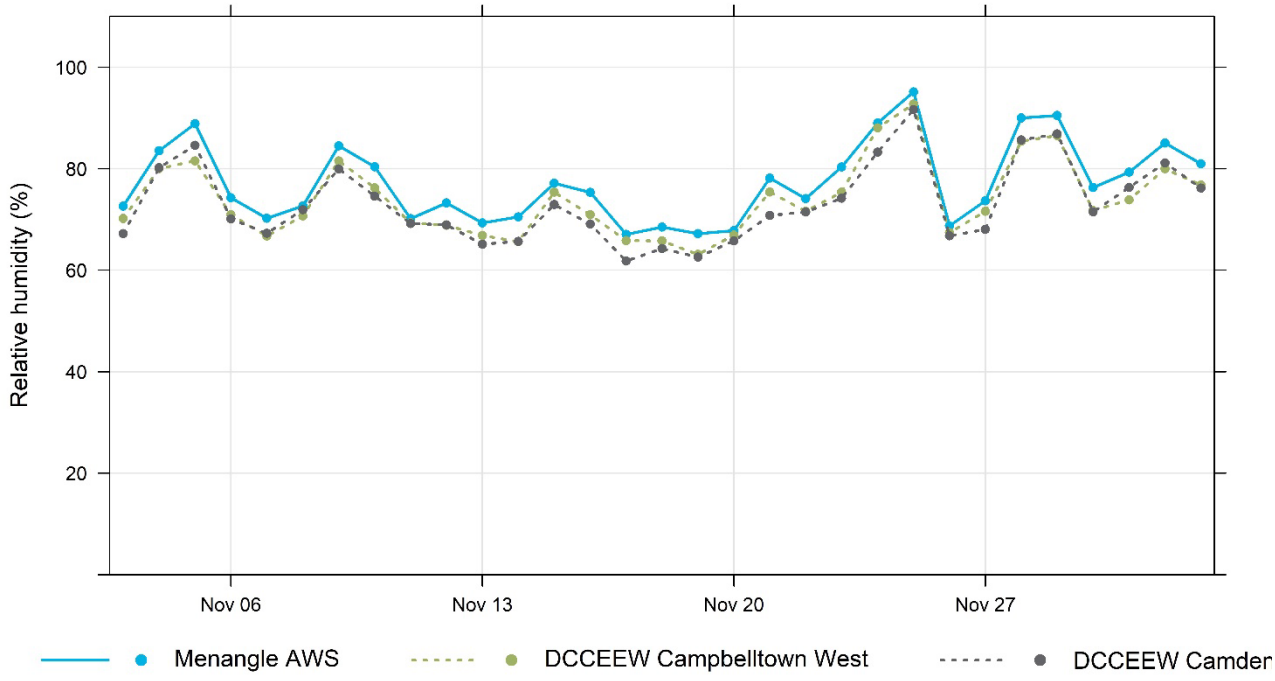


Figure 4.8 **Daily mean relative humidity – Period 1**

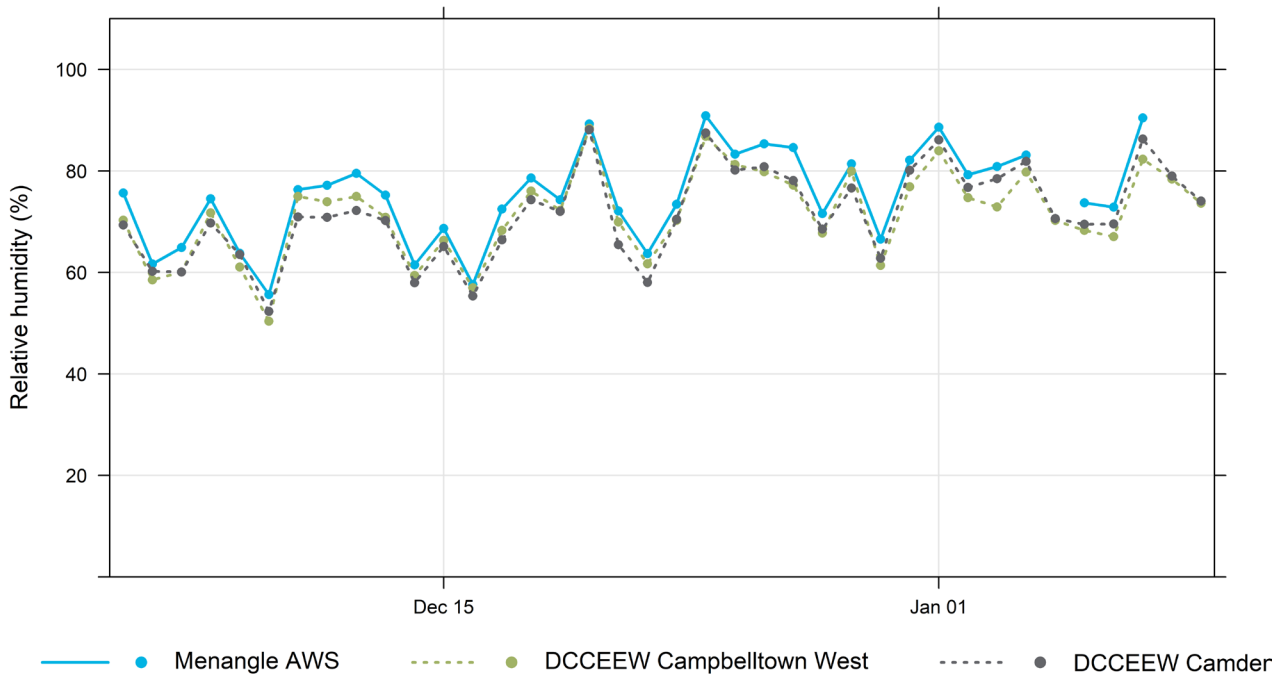


Figure 4.9 **Daily mean relative humidity – Period 2**

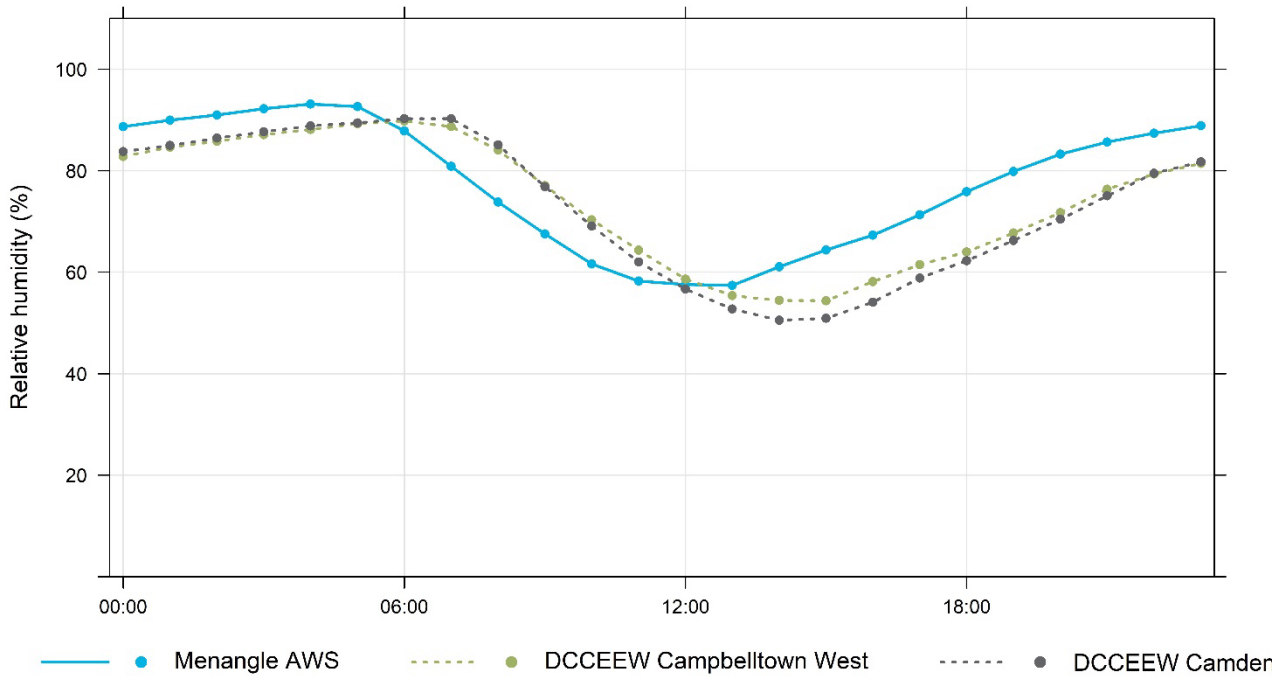


Figure 4.10 **Mean relative humidity by hour of the day – Period 1**

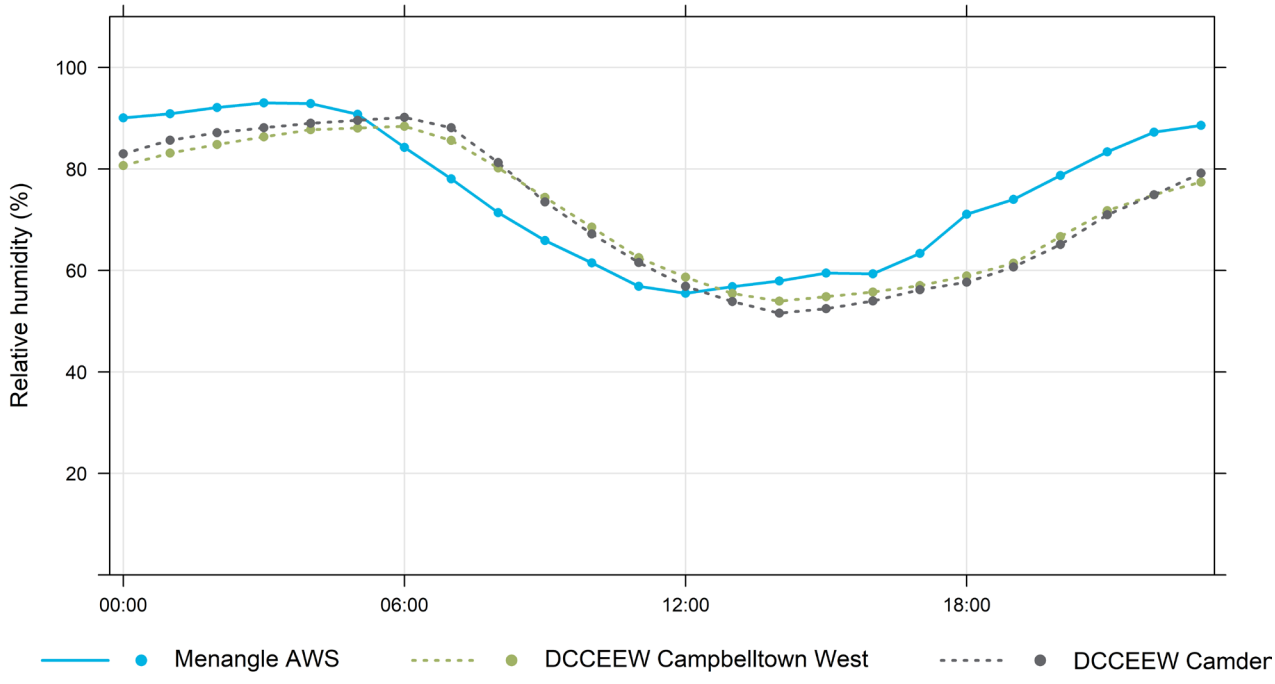


Figure 4.11 **Mean relative humidity by hour of the day – Period 2**

4.5 Rainfall

The total rainfall at Menangle Quarry for each campaign period and the reporting period as a whole is given in Table 4.5. The time series of the daily total rainfall at Menangle Quarry, Campbelltown West and Camden for the two campaign periods are shown in Figure 4.12 and Figure 4.13 respectively.

Table 4.5 Statistics for rainfall at Menangle Quarry

	Total rainfall (mm)
Period 1	34.5
Period 2	13.9
Total Period	**48.4**
DCCEEW Campbelltown West	**251.2**
DCCEEW Camden	**213.4**

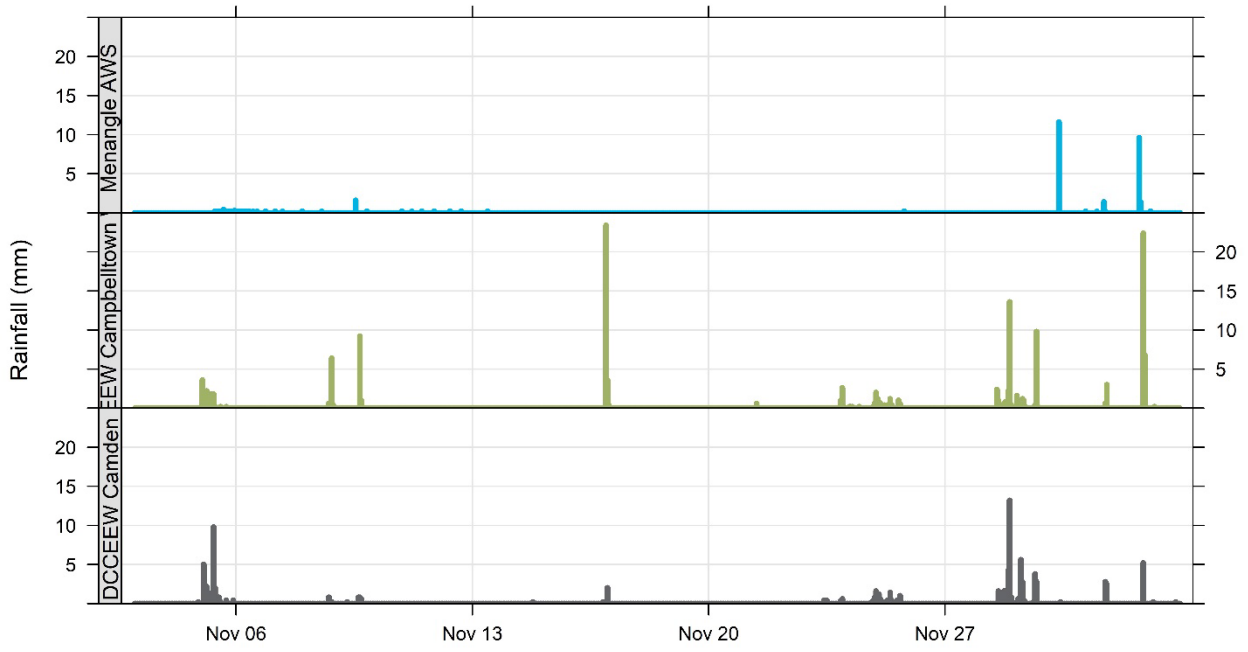


Figure 4.12 Daily rainfall – Period 1

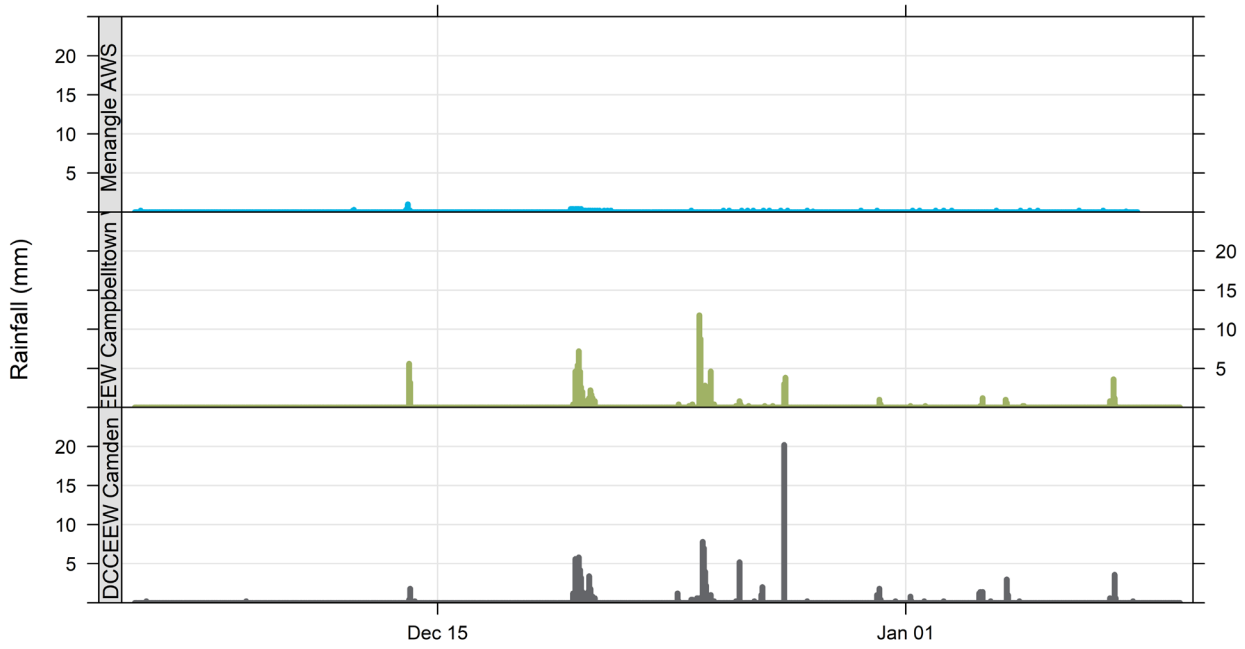


Figure 4.13 Daily rainfall – Period 2

5 Air quality data

This section of the report presents a summary and analysis of the air quality (PM_{10} and $PM_{2.5}$) data that was collected from the onsite monitors during the two campaign periods. Data from the DCCEEW Campbelltown and Camden AQMSs are included for comparison.

As overview of the continuous (1-hourly) data for the two campaign periods from the two PM_{10}/$PM_{2.5}$ monitors at Menangle Quarry is provided in Figure 5.1 and Figure 5.2 respectively. As stated previously, measurements for Period 1 were collected starting from 12:00 am on 3 November to 11:00 pm on 3 December 2023. Measurements for Period 2 were collected starting from 12:00 am on 4 December 2023 to 11 pm 10 January 2024.

Data capture for Period 1 for each pollutant was above 98% across the four sites. Data capture for Period 2 for each pollutant were approximately 98% at the two DCCEEW AQMS, the capture rate for AQM02 was approximately 93% and approximately 63% at AQM01.

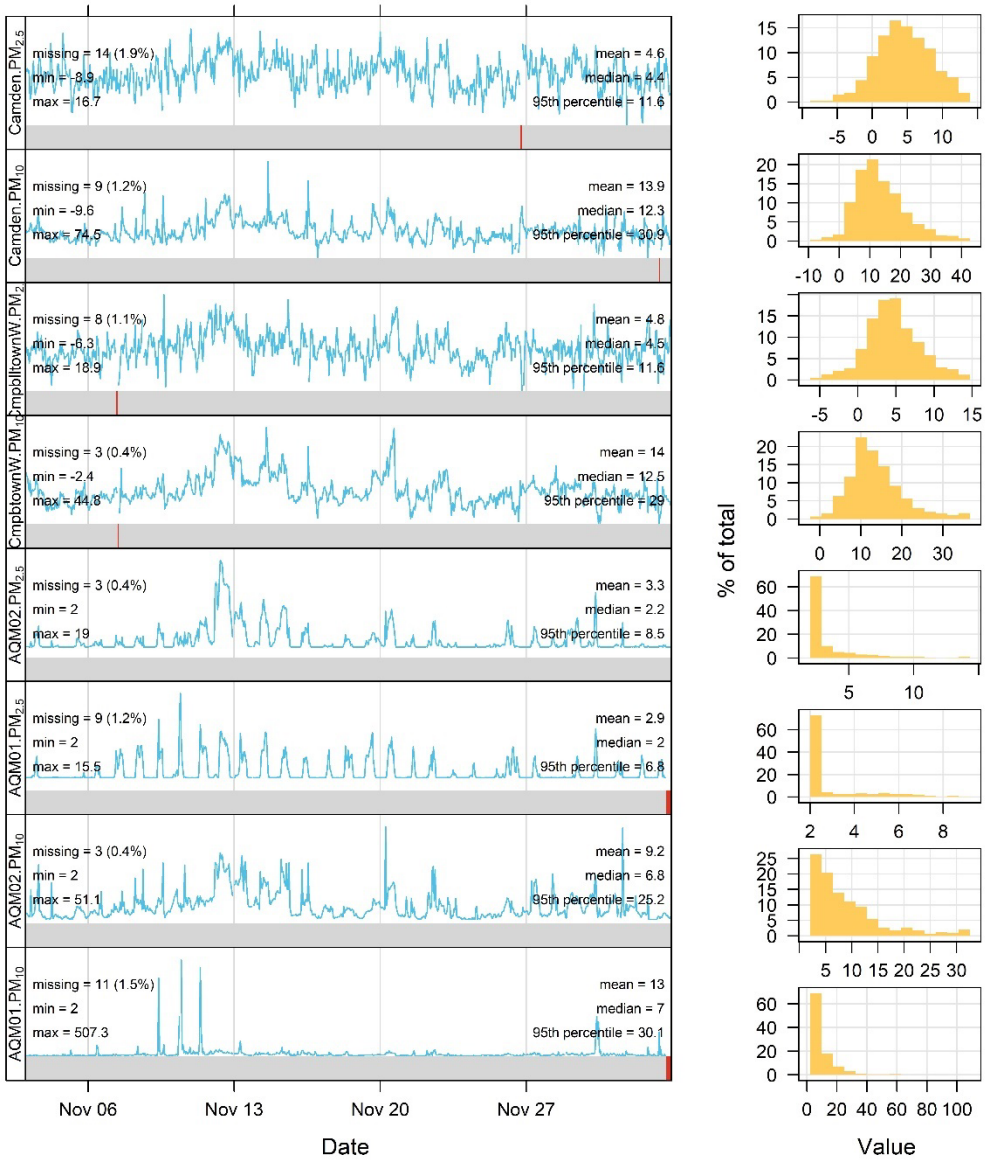


Figure 5.1 **All air quality monitoring data – onsite monitors and DCCEEW Campbelltown West and Camden AQMS – Period 1**

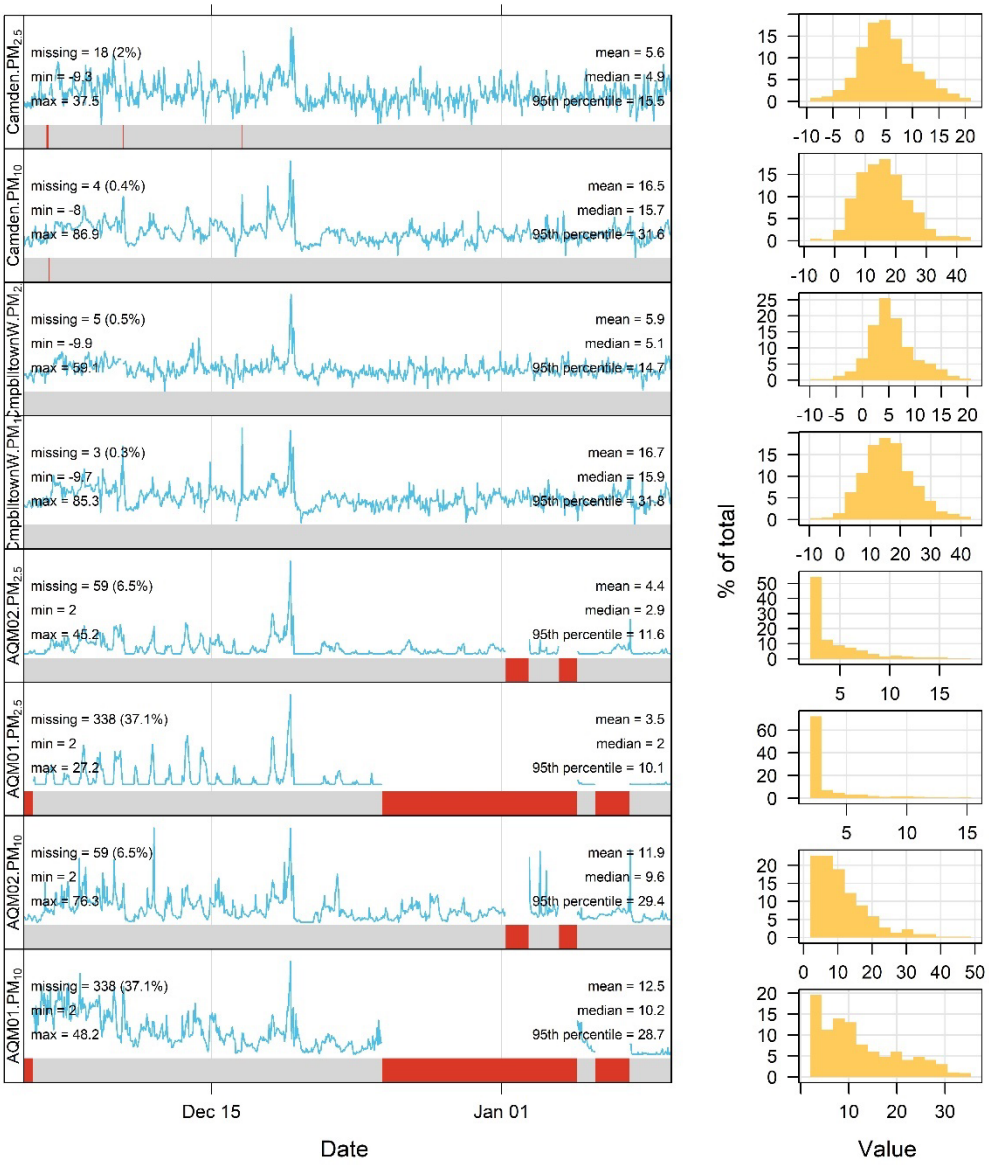


Figure 5.2 **All air quality monitoring data – onsite monitors and DCCEEW Campbelltown West and Camden AQMS – Period 2**

5.1 PM_{10} concentrations

PM_{10} concentrations are reported here as 24-hour mean values (midnight to midnight). A statistical summary of the 24-hour PM_{10} concentrations during the two campaign periods is provided in Table 5.1. The corresponding values from the DCCEEW monitoring stations are included for comparison.

The PM_{10} concentrations at the two quarry monitoring locations and the two referenced DCCEEW AQMS locations were generally comparable over the two monitoring campaign periods.

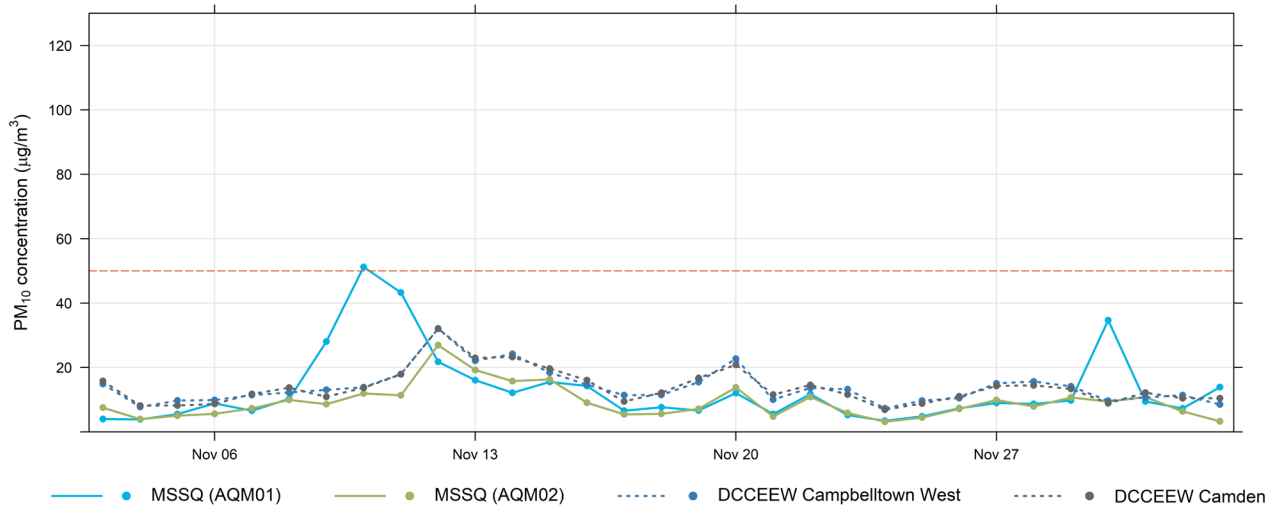
There was however one exceedance of the 24-hour PM_{10} criterion (50 µg/m³) recorded at the AQM01 monitoring location, no exceedances were recorded at the AQM02 monitoring location monitoring location, or at the two referenced DCCEEW AQMS locations.

The date of the recorded exceedance at AQM01 was 10 November 2023. Menangle Sand and Soil have advised that lawn mowing activities occurred in the vicinity of AQM01 between 9 November 2023 and 11 November 2023, and is likely to have influenced the PM_{10} concentrations recorded by AQM01.

Table 5.1 Statistics for PM_{10} concentration (24-hour average concentrations)

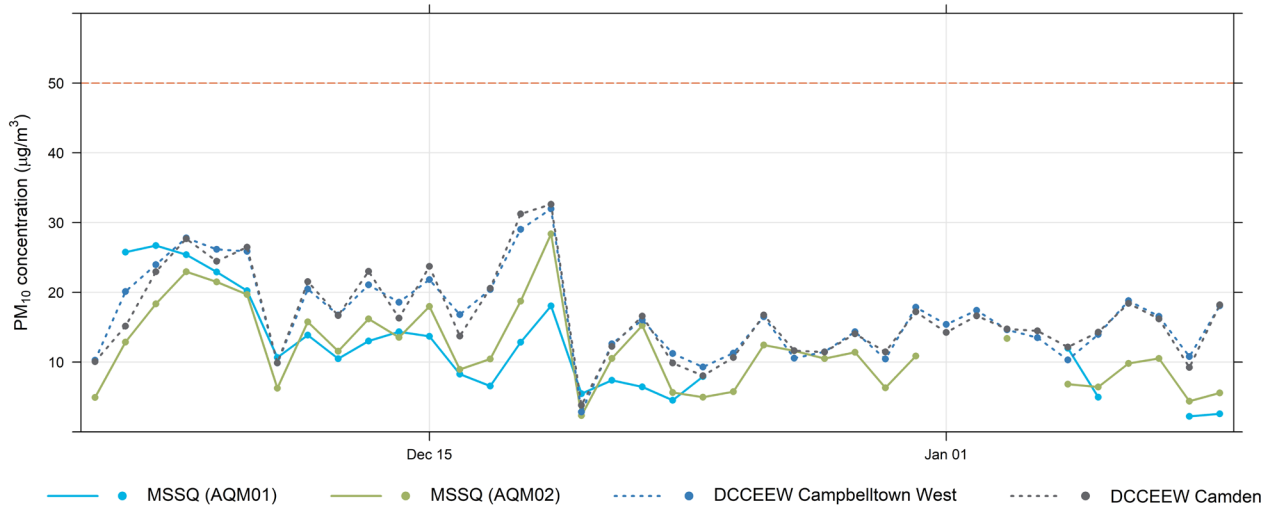
Monitoring location	Period	Mean (µg/m³)	Median (µg/m³)	Maximum (µg/m³)	Standard deviation (µg/m³)	Days above 50 µg/m³
AQM01	Period 1	13.0	8.9	51.2	11.7	**1**
	Period 2	12.3	11.3	26.7	7.5	0
AQM02	Period 1	9.2	7.9	26.9	5.1	0
	Period 2	12.7	11.6	28.4	6.1	0
DCCEEW Campbelltown West	Period 1	14.0	13.1	32.1	5.4	0
	Period 2	17.2	16.8	32.0	6.7	0
DCCEEW Camden	Period 1	13.9	12.2	32.1	5.4	0
	Period 2	17.0	16.3	32.6	7.0	0

The time series of 24-hour PM_{10} concentrations recorded from the two onsite monitoring locations and the DCCEEW Campbelltown and Camden AQMS for the two campaigns are plotted in Figure 5.3 and Figure 5.4 respectively. The concentrations at the four sites were generally similar across the two campaign periods, with exception of two notable concentration spikes recorded at AQM01 during Period 1 which were not recorded at the other three locations.



Note: red broken line marks 24-hour average PM_{10} criterion of 50 µg/m³

Figure 5.3 Daily-varying 24-hour average PM_{10} concentration – Period 1



Note: red broken line marks 24-hour average PM_{10} criterion of 50 µg/m³

Figure 5.4 Daily-varying 24-hour average PM_{10} concentration – Period 2

Further analysis of the measured PM_{10} concentrations from the two onsite monitors at Menangle Quarry and concentrations recorded by the DCCEEW Campbelltown West and Camden AQMS is presented below using bivariate polar plots and polar annulus plots.

The bivariate plots (Figure 5.5 to Figure 5.8) show how PM_{10} concentrations vary by wind speed and wind direction over the two campaign periods. The plots illustrate the potential source(s) influencing the recorded PM_{10} concentrations at each monitoring location. The following points are noted from the bivariate polar plots (Figure 5.5 to Figure 5.8):

- The bivariate plots for AQM01 (Figure 5.5) during Period 1 show a slight signal from the west to north-west. This signal is not seen in the bivariate plot for AQM02 (Figure 5.6) during Period 1, this would indicate that the signal recorded by AQM01 are likely isolated local influences external to quarry operations.

- For AQM01, quarry operational emission sources are located to the east (processing area) and south-east (Stage 8 extraction areas). For AQM02, quarry operational emission sources are located to the north (processing area) and east to south-east (Stage 8 extraction areas).
- During either monitoring period, there are no clear signals from the quarry emission sources illustrated in the bivariate plots for AQM01 and AQM02.
- The bivariate plots for AQM01 and AQM02 (Figure 5.5 and Figure 5.6, respectively) during Period 2 both show signals when the winds are from north-east and south. The bivariate plots for DCCEEW Campbelltown West and Camden AQMS (Figure 5.7 and Figure 5.8, respectively) during Period 2 show signals when winds are from the north-east, would indicate regional scale emission sources are influencing recorded concentrations across the four sites.

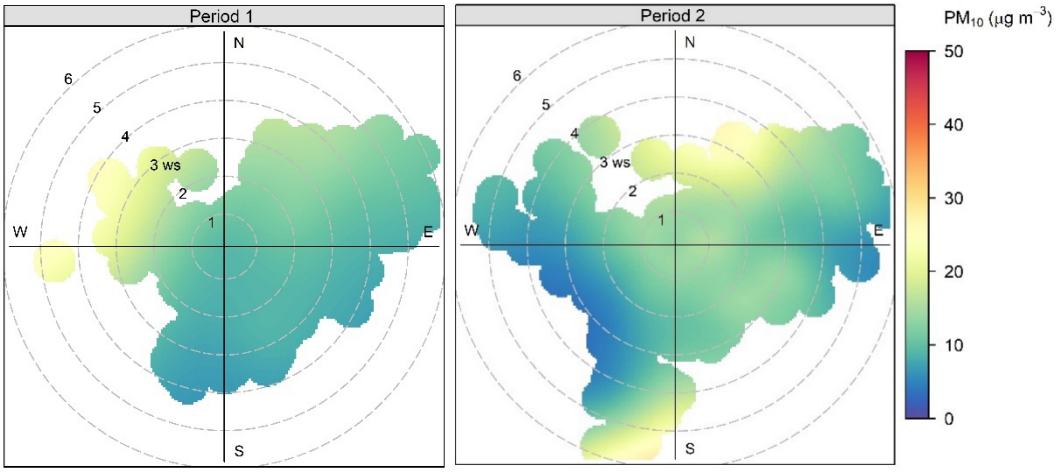


Figure 5.5 Bivariate polar plots for PM_{10} at AQM01 – Period 1 and 2

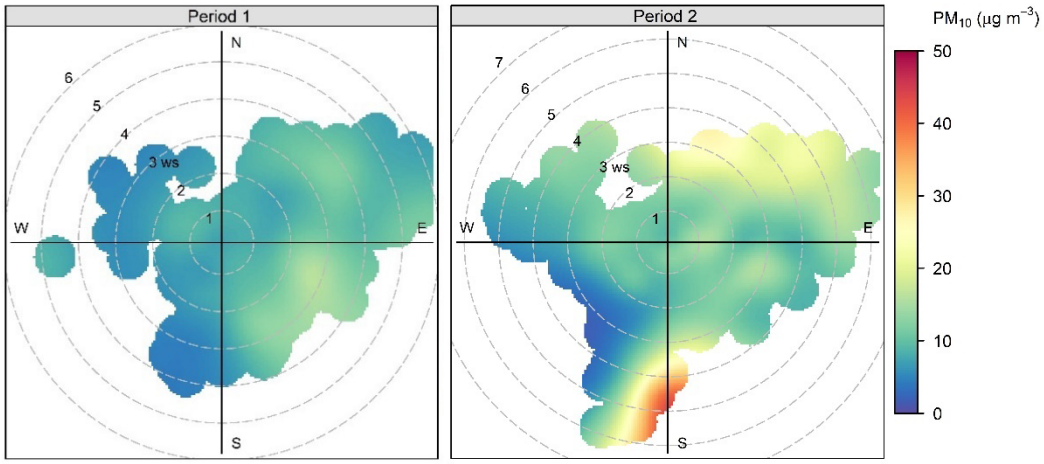


Figure 5.6 Bivariate polar plots for PM_{10} at AQM02 – Period 1 and 2

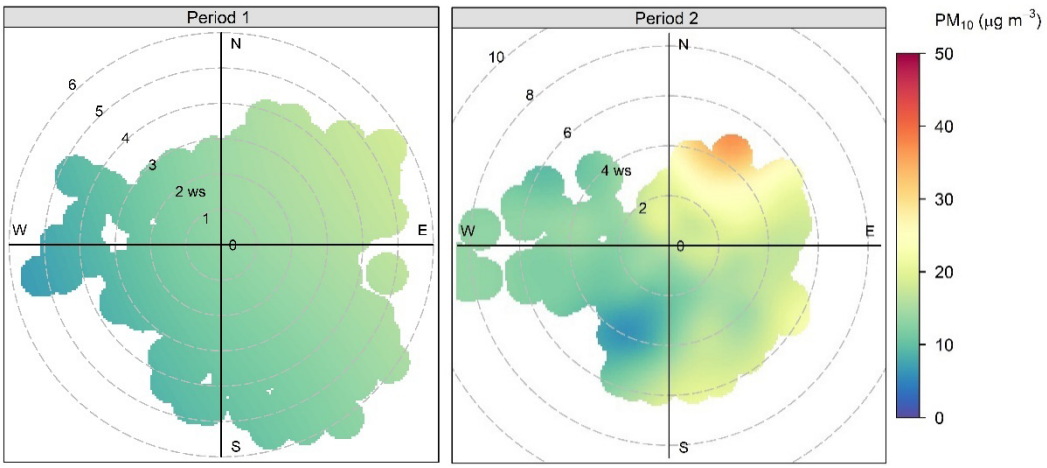


Figure 5.7 Bivariate polar plots for PM_{10} at DCCEEW Campbelltown West – Period 1 and 2

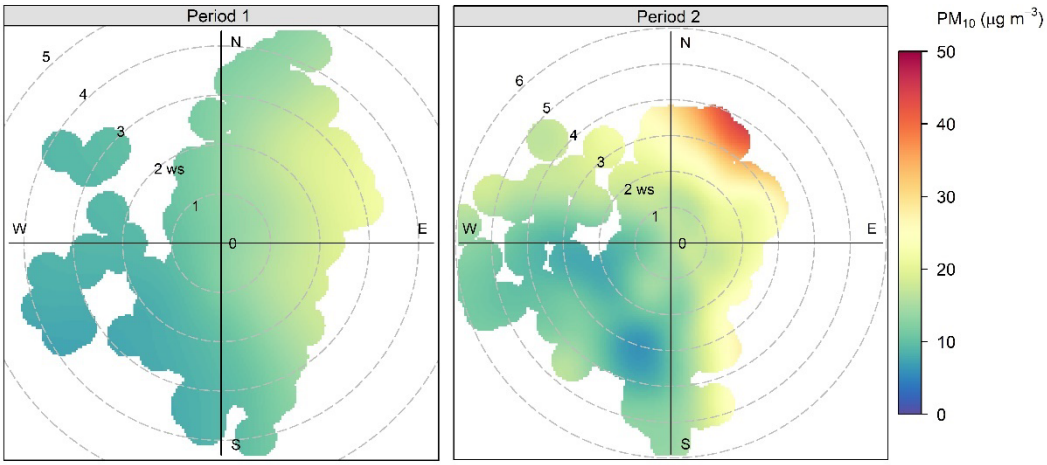


Figure 5.8 Bivariate polar plots for PM_{10} at DCCEEW Camden – Period 1 and 2

The polar annulus plots (Figure 5.9 to Figure 5.12) show the temporal variation in the PM_{10} concentration by wind direction during the two campaign periods. In this case, the temporal variation is by hour of the day (0 to 23). The following points are noted:

- The polar annulus plot for AQM01 (Figure 5.9) during Period 1 show that the highest concentrations occur during the morning (between 8:00 am to 12:00 pm) and are likely to be associated with operations at the site

- The polar annulus plots for AQM01 and AQM02 (Figure 5.9 and Figure 5.10, respectively) during Period 2 show that the highest concentrations occur between 12:00 pm to 4:00 pm. The polar annulus plots for DCCEEW Campbelltown West and Camden AQMS (Figure 5.11 and Figure 5.12, respectively) during Period 2 show that the highest concentrations occur between 12:00 pm to 4:00 pm, would indicate regional scale influences across the four sites.

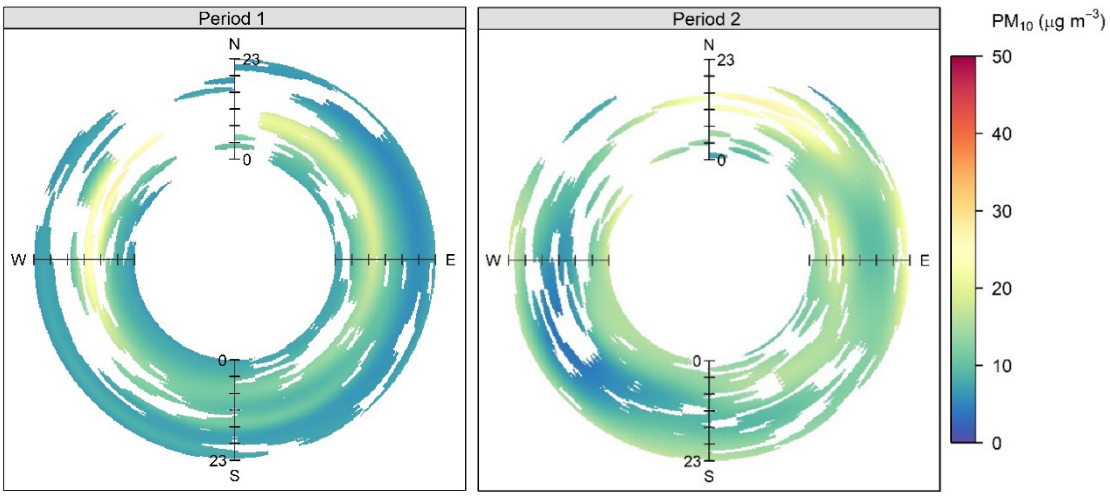


Figure 5.9 Polar annulus plots for PM_{10} at AQM01 – Period 1 and 2

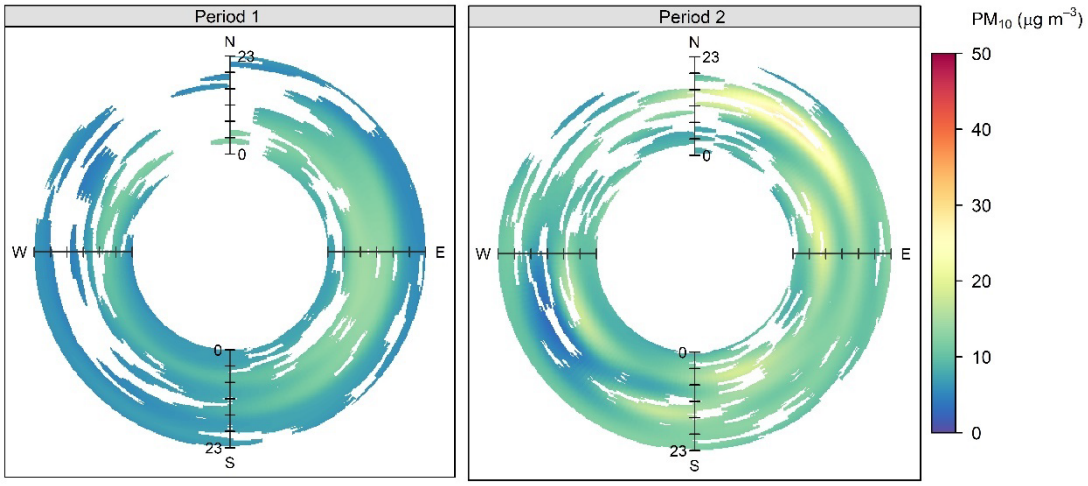


Figure 5.10 Polar annulus plots for PM_{10} at AQM02 – Period 1 and 2

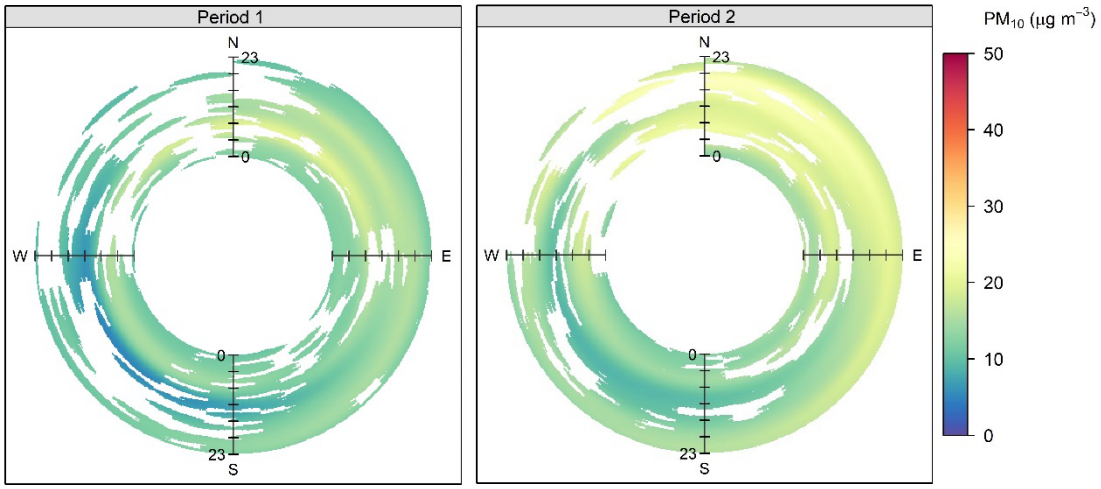


Figure 5.11 Polar annulus plots for PM_{10} at DCCEEW Campbelltown West – Period 1 and 2

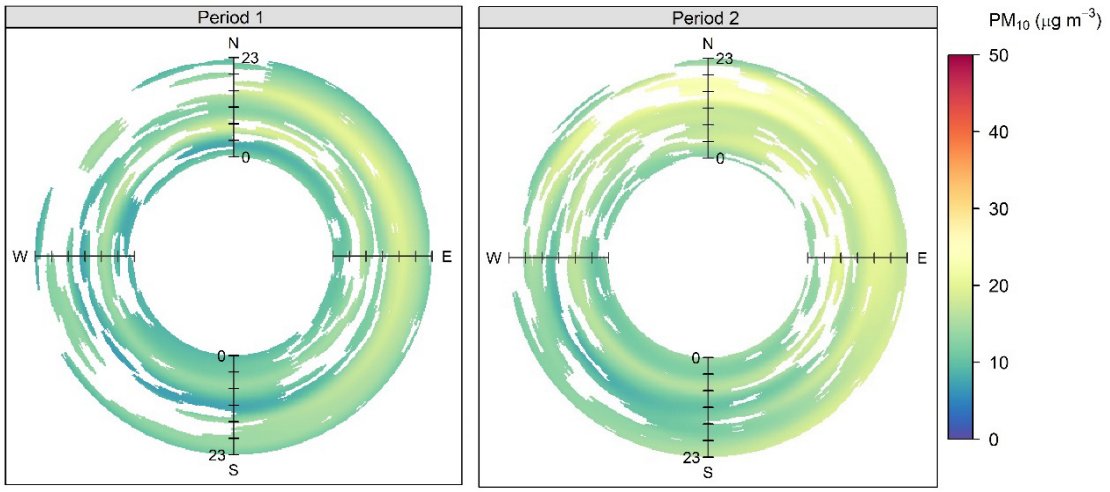


Figure 5.12 Polar annulus plots for PM_{10} at DCCEEW Camden – Period 1 and 2

5.2 $PM_{2.5}$ concentrations

The presentation of the $PM_{2.5}$ data follows the same format as that for PM_{10}.

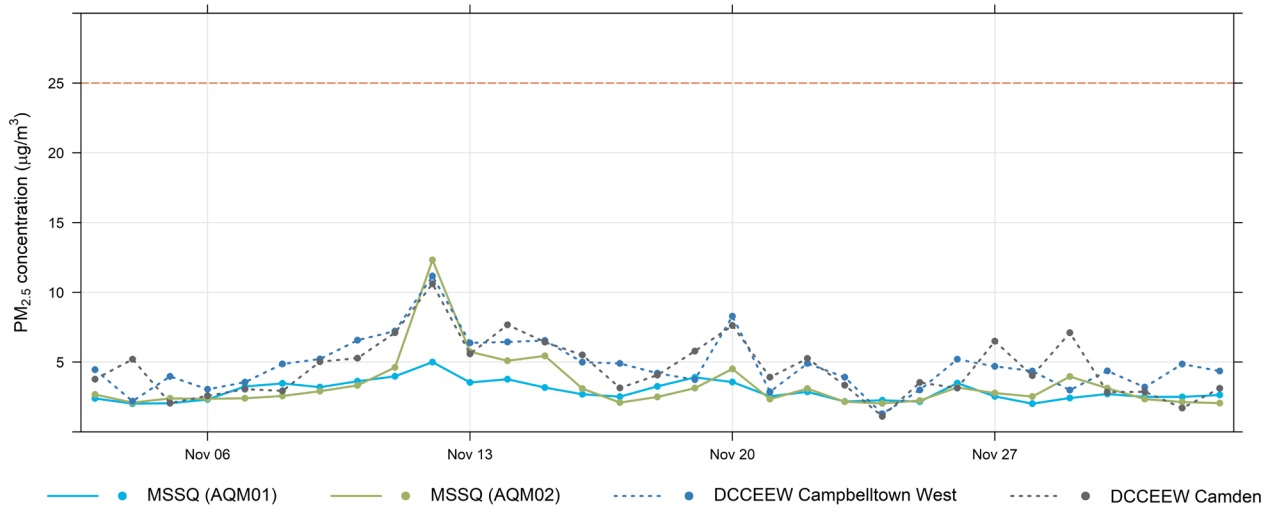
A statistical summary of the 24-hour $PM_{2.5}$ concentrations during the two campaign periods is provided in Table 5.2. The corresponding values from the DCCEEW monitoring stations are included for comparison. For the two monitoring campaign periods, the $PM_{2.5}$ concentrations were generally comparable between the four locations.

No exceedance of the 24-hour average $PM_{2.5}$ criterion (25 µg/m³) were recorded at any of the monitoring locations.

Table 5.2 Statistics for $PM_{2.5}$ concentration (24-hour mean)

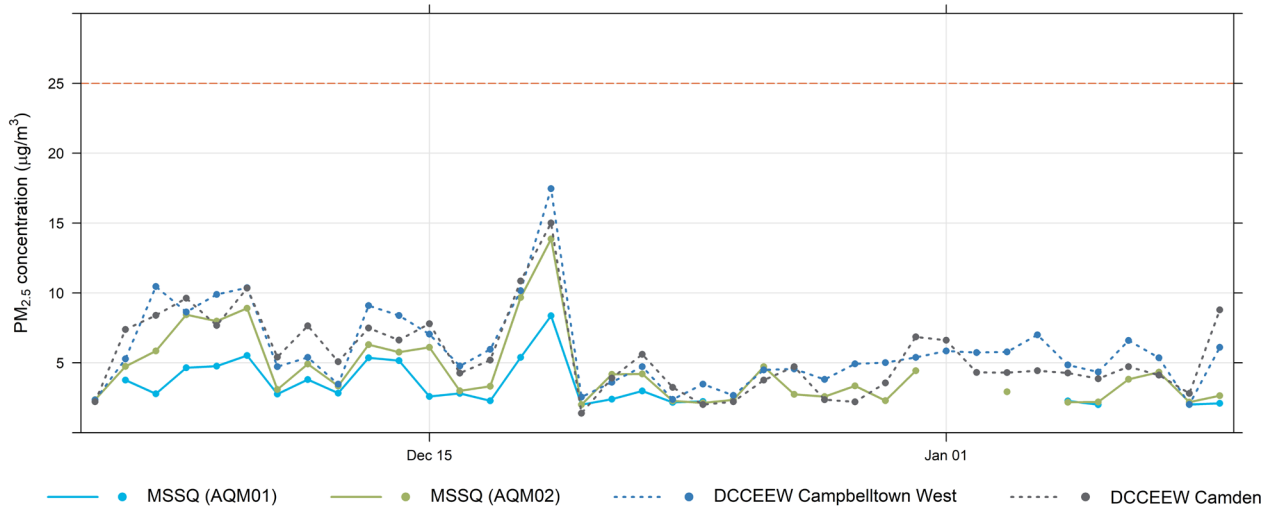
Monitoring location	Period	Mean (m/s)	Median (m/s)	Maximum (m/s)	Standard deviation (m/s)	Days above 50 µg/m³
AQM01	Period 1	2.9	2.7	5.0	0.7	0
	Period 2	3.5	2.8	8.4	1.6	0
AQM02	Period 1	3.3	2.7	12.3	2.0	0
	Period 2	4.4	3.4	13.9	2.7	0
DCCEEW Campbelltown West	Period 1	4.8	4.5	11.2	1.9	0
	Period 2	5.9	5.3	17.5	3.0	0
DCCEEW Camden	Period 1	4.6	4.0	10.6	2.1	0
	Period 2	5.6	4.7	15.0	2.9	0

The time series of 24-hour $PM_{2.5}$ concentrations recorded from the onsite monitors and DCCEEW Campbelltown and Camden AQMS for the two campaigns are plotted in Figure 5.13 and Figure 5.14 respectively. For both periods $PM_{2.5}$ concentrations across the four locations generally followed a similar trend.



Note: red broken line marks 24-hour average $PM_{2.5}$ criterion of 25 µg/m³

Figure 5.13 Daily mean $PM_{2.5}$ concentration – Period 1



Note: red broken line marks 24-hour average $PM_{2.5}$ criterion of 25 µg/m³

Figure 5.14 Daily mean $PM_{2.5}$ concentration – Period 2

The bivariate polar plots for $PM_{2.5}$ are shown in Figure 5.15 to Figure 5.18, and the polar annulus plots are shown in Figure 5.19 to Figure 5.22.

The following points are noted from the bivariate polar plots (Figure 5.15 to Figure 5.18):

- The bivariate polar plots for AQM01 and AQM02 (Figure 5.15 and Figure 5.16, respectively) during Period 1 show generally low concentrations in all directions.
- Similar to the PM_{10} analysis, there are no clear concentration signals from the direction of quarry emission sources at either onsite monitoring location.

- The bivariate polar plots for the four monitoring locations (Figure 5.15 to Figure 5.18) during Period 2, show signals when winds are from the north-east and south, this is likely to be associated with regional scale emissions.

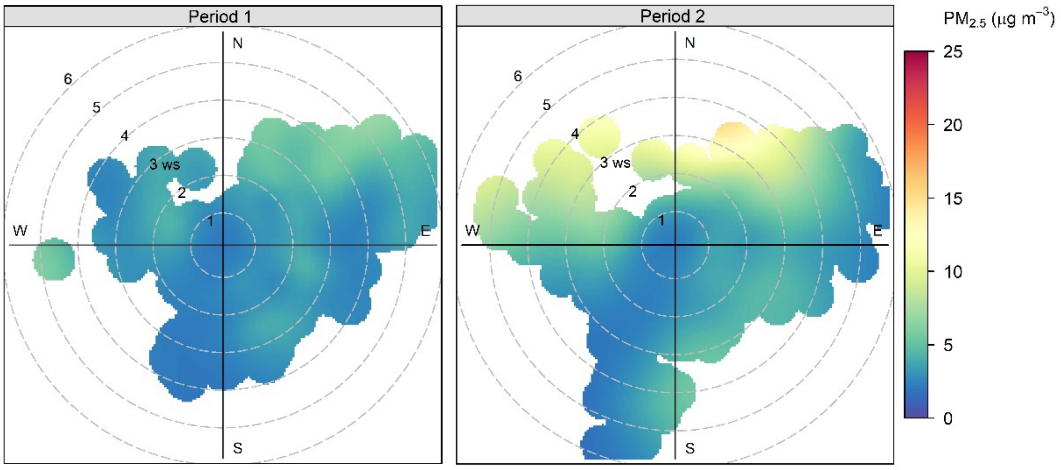


Figure 5.15 Bivariate polar plot for $PM_{2.5}$ at AQM01 – Period 1 and 2

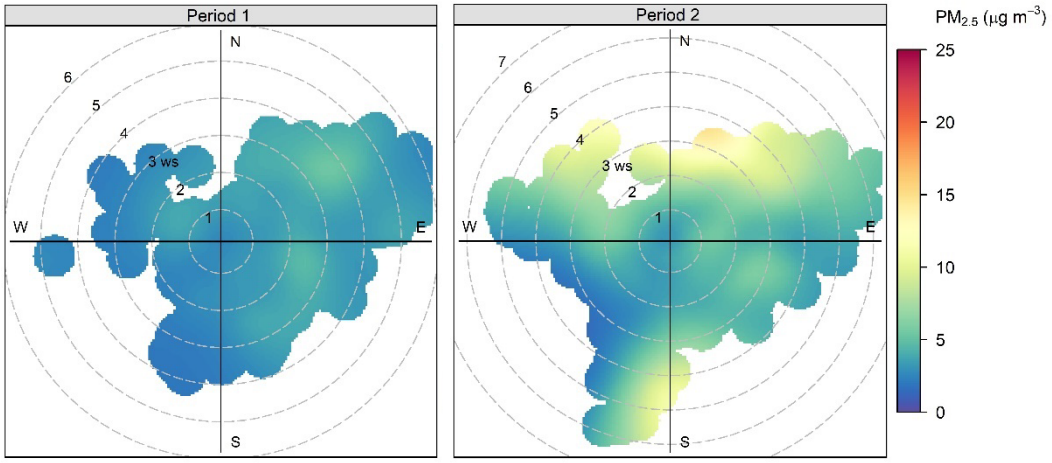


Figure 5.16 Bivariate polar plots for $PM_{2.5}$ at AQM02 – Period 1 and 2

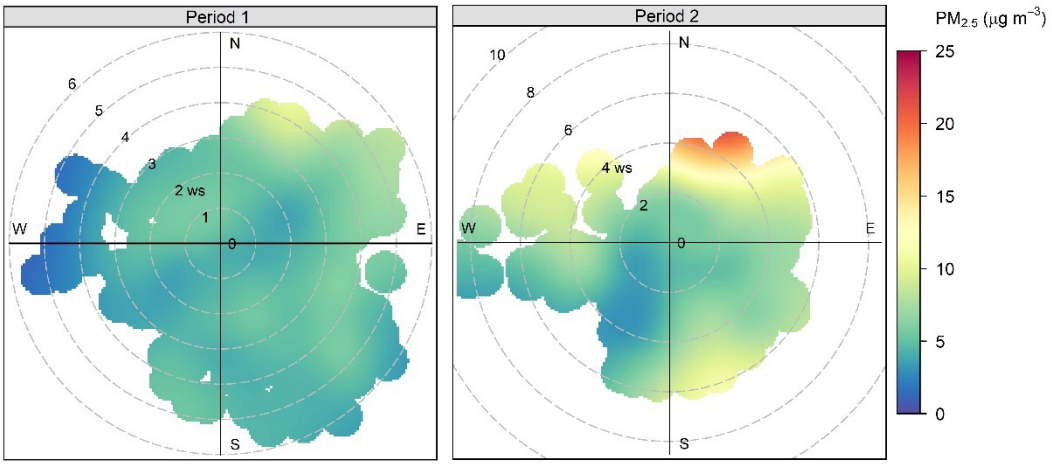


Figure 5.17 Bivariate polar plots for $PM_{2.5}$ at DCCEEW Campbelltown West – Period 1 and 2

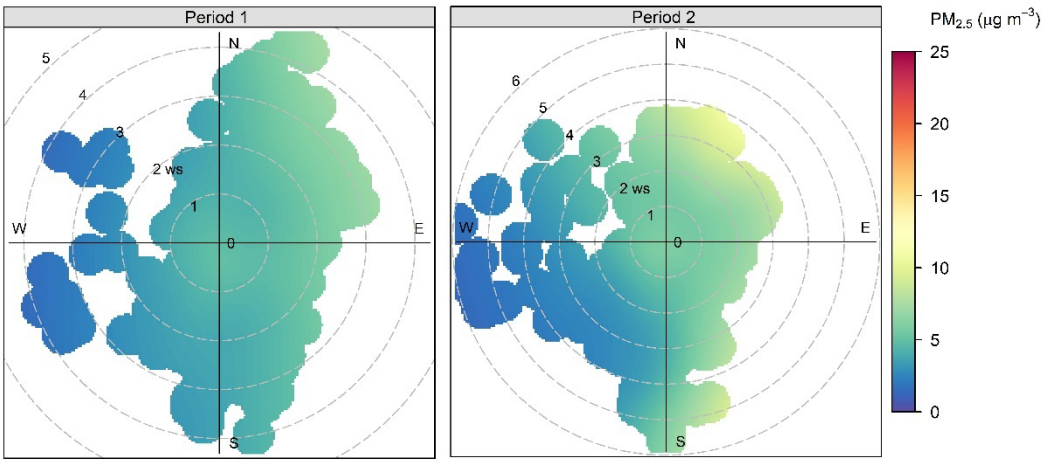


Figure 5.18 Bivariate polar plots for $PM_{2.5}$ at DCCEEW Camden – Period 1 and 2

The polar annulus plots (Figure 5.19 to Figure 5.22) show the temporal variation in the $PM_{2.5}$ concentration by wind direction during the two campaign periods. In this case, the temporal variation is by hour of the day (0 to 23).

- The polar annulus plots for AQM01 (Figure 5.19) show that during Period 1 and 2 the highest concentrations occur between 8:00 am and 4:00 pm and are likely to be associated with site wide and regional scale activities.

- The polar annulus plots for AQM02 (Figure 5.20) show that during Period 1 and 2 the highest concentrations occur between 4:00 am and 4:00 pm and are likely associated with site activities and road traffic.

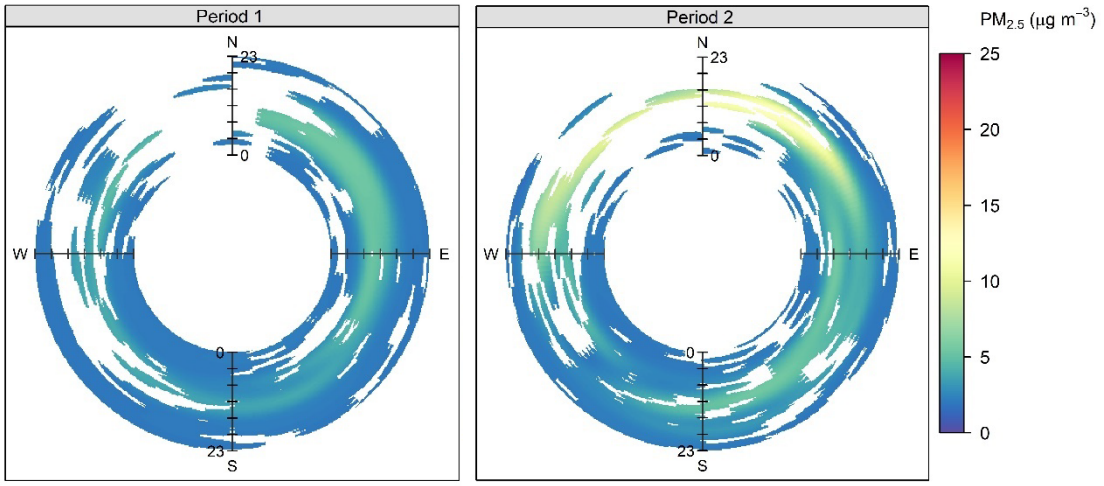


Figure 5.19 Polar annulus plots for $PM_{2.5}$ at AQM01 – Period 1 and 2

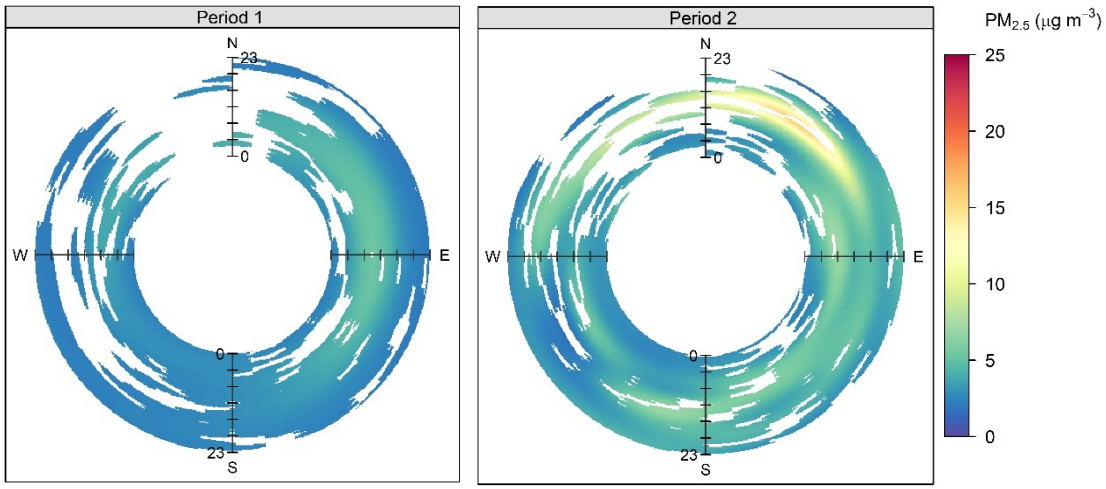


Figure 5.20 Polar annulus plots for $PM_{2.5}$ at AQM02 – Period 1 and 2

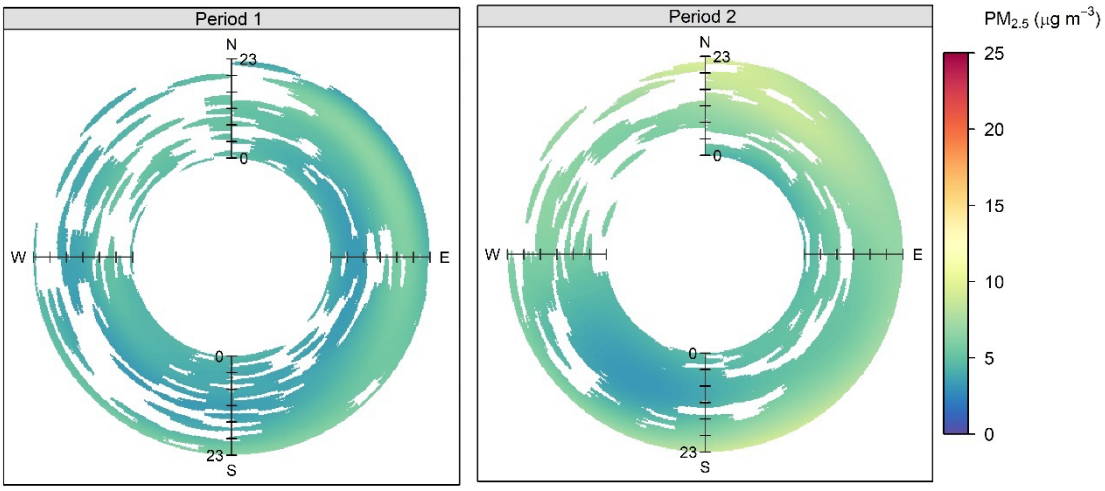


Figure 5.21 Polar annulus plots for $PM_{2.5}$ at DCCEEW Campbelltown West – Period 1 and 2

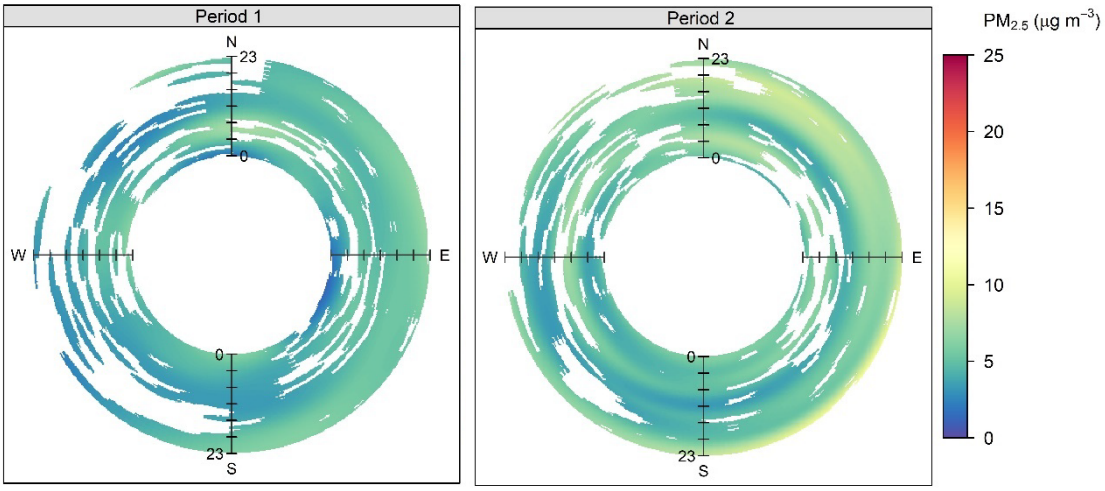


Figure 5.22 Polar annulus plots for $PM_{2.5}$ at DCCEEW Camden – Period 1 and 2

6 Conclusion

EMM was commissioned to manage two short-term ambient air quality monitoring campaigns at Menangle Quarry.

Two four-week monitoring campaigns were completed during November to December 2023 and December 2023 to January 2024 using two continuous PM monitoring units (FDS PM monitoring system) to record concentrations of PM_{10} and $PM_{2.5}$. Meteorological measurements for the monitoring periods were sourced from the Menangle AWS. The onsite PM monitoring data was also compared with monitoring data for the same periods from the DCCEEW Campbelltown West and Camden AQMS.

The monitoring equipment was deployed co-located with dust deposition gauges (DGG1 – east of the site entry, and DDG2 – south of the processing area).

A summary of the monitoring results are as follows:

- one exceedance of the 24-hour PM_{10} criterion (50 µg/m³) was recorded at the AQM01 monitoring location due to the influence of local lawn mowing emissions, no exceedances were recorded at the 3 other monitoring locations
- no exceedances of the 24-hour average $PM_{2.5}$ criterion (25 µg/m³) were recorded at any of the monitoring locations
- the PM_{10} and $PM_{2.5}$ concentrations recorded at the quarry were generally comparable with the concurrent measurements at the DCCEEW Campbelltown West and Camden AQMS for the two campaign periods, indicating that regional emissions sources are the primary driver of ambient particulate matter concentrations.

References

EMM 2022, *Menangle Sand and Soil Quarry Air Quality Management Plan*. Report prepared by EMM Consulting Pty Limited for Menangle Sand and Soil Pty Ltd.

Ramboll Environ 2016, *Menangle Quarry Extension Project Air Quality Impact Assessment*. Report prepared by Ramboll Environ Pty Limited for Menangle Sand and Soil Pty Ltd.

Appendix A

Summary of 24-hour average concentrations recorded on site

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A.1 Daily average PM_{10} and $PM_{2.5}$ data

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m³) – Period 1

Date	PM_{10} concentration (µg/m³)		$PM_{2.5}$ concentration (µg/m³)	
	AQM01	AQM02	AQM01	AQM02
3/11/2023	4.0	7.5	2.4	2.7
4/11/2023	3.8	3.9	2.0	2.1
5/11/2023	5.5	5.0	2.1	2.4
6/11/2023	8.8	5.6	2.3	2.4
7/11/2023	6.6	7.3	3.3	2.4
8/11/2023	10.3	10.0	3.5	2.6
9/11/2023	28.1	8.6	3.2	2.9
10/11/2023	51.2	12.0	3.6	3.3
11/11/2023	43.3	11.3	4.0	4.6
12/11/2023	21.8	26.9	5.0	12.3
13/11/2023	16.1	19.2	3.5	5.7
14/11/2023	12.2	15.8	3.8	5.1
15/11/2023	15.5	16.3	3.2	5.5
16/11/2023	14.3	9.1	2.7	3.1
17/11/2023	6.6	5.5	2.5	2.1
18/11/2023	7.7	5.6	3.3	2.5
19/11/2023	6.7	7.2	3.9	3.1
20/11/2023	12.1	13.8	3.6	4.5
21/11/2023	5.5	4.8	2.6	2.4
22/11/2023	11.7	10.9	2.9	3.1
23/11/2023	5.2	5.9	2.2	2.2
24/11/2023	3.4	3.2	2.3	2.0
25/11/2023	4.8	4.4	2.2	2.2
26/11/2023	7.3	7.2	3.5	3.2
27/11/2023	9.0	9.9	2.5	2.8
28/11/2023	8.7	7.9	2.0	2.5
29/11/2023	9.8	10.7	2.4	4.0
30/11/2023	34.7	9.4	2.7	3.1
1/12/2023	9.4	10.8	2.5	2.4

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m³) – Period 1

Date	PM_{10} concentration (µg/m³)		$PM_{2.5}$ concentration (µg/m³)	
	AQM01	AQM02	AQM01	AQM02
2/12/2023	7.3	6.4	2.5	2.1
3/12/2023	Less than 24-hours of data	3.3	Less than 24-hours of data	2.1

Table A.2 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m³) – Period 2

Date	PM_{10} concentration (µg/m³)		$PM_{2.5}$ concentration (µg/m³)	
	AQM01	AQM02	AQM01	AQM02
4/12/2023	Less than 24-hours of data	4.9	Less than 24-hours of data	2.4
5/12/2023	25.8	12.9	3.8	4.7
6/12/2023	26.7	18.3	2.8	5.8
7/12/2023	25.4	23.0	4.7	8.4
8/12/2023	22.9	21.5	4.8	8.0
9/12/2023	20.2	19.7	5.5	8.9
10/12/2023	10.7	6.3	2.8	3.1
11/12/2023	13.9	15.8	3.8	4.9
12/12/2023	10.5	11.6	2.8	3.3
13/12/2023	13.0	16.2	5.4	6.3
14/12/2023	14.4	13.5	5.2	5.8
15/12/2023	13.7	18.0	2.6	6.1
16/12/2023	8.3	8.9	2.8	3.0
17/12/2023	6.6	10.5	2.3	3.3
18/12/2023	12.9	18.7	5.4	9.7
19/12/2023	18.1	28.4	8.4	13.9
20/12/2023	5.5	2.4	2.0	2.0
21/12/2023	7.4	10.5	2.4	4.2
22/12/2023	6.5	15.3	3.0	4.2
23/12/2023	4.5	5.6	2.2	2.3
24/12/2023	7.9	5.0	2.2	2.1
25/12/2023	Less than 24-hours of data	5.8	Less than 24-hours of data	2.3
26/12/2023	Less than 24-hours of data	12.5	Less than 24-hours of data	4.7

Table A.2 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m³) – Period 2

Date	PM_{10} concentration (µg/m³)		$PM_{2.5}$ concentration (µg/m³)	
	AQM01	AQM02	AQM01	AQM02
27/12/2023	Less than 24-hours of data	11.6	Less than 24-hours of data	2.7
28/12/2023	Less than 24-hours of data	10.5	Less than 24-hours of data	2.6
29/12/2023	Less than 24-hours of data	11.4	Less than 24-hours of data	3.4
30/12/2023	Less than 24-hours of data	6.3	Less than 24-hours of data	2.3
31/12/2023	Less than 24-hours of data	10.9	Less than 24-hours of data	4.4
1/01/2024	Less than 24-hours of data			
2/01/2024	Less than 24-hours of data			
3/01/2024	Less than 24-hours of data	13.4	Less than 24-hours of data	2.9
4/01/2024	Less than 24-hours of data			
5/01/2024	12.0	6.8	2.3	2.2
6/01/2024	Less than 24-hours of data	6.4	Less than 24-hours of data	2.2
7/01/2024	Less than 24-hours of data	9.8	Less than 24-hours of data	3.8
8/01/2024	3.0	10.5	2.0	4.3
9/01/2024	2.2	4.4	2.0	2.2
10/01/2024	2.6	5.6	2.1	2.7

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Memorandum

27 February 2023

To: Ernest Dupere
Director
Benedict Industries Pty Ltd

From: Kaitlyn Brodie

Subject: Menangle Groundwater Monitoring Report - January 2023

Dear Ernest,

1 Introduction

Menangle Sand and Soil Quarry (the quarry) is located at 15 Menangle Road, Menangle NSW (refer Figure 2.1). The quarry extracts sand and soil along the Nepean River as approved by Development Consent 85/2865 (the Consent), granted by the Minister for Planning on 15 November 1989, and as modified (Modification 1) by the NSW Land and Environment Court in September 2020. Extraction has not yet commenced in Stage 8.

This memorandum presents the January 2023 groundwater monitoring results. It has been prepared for Menangle Sand and Soil Pty Ltd by EMM Consulting Pty Limited (EMM) in line with the requirements of Section 6.4 within the Soil and Water Management Plan (SWMP), (EMM, 2021a).

2 Monitoring

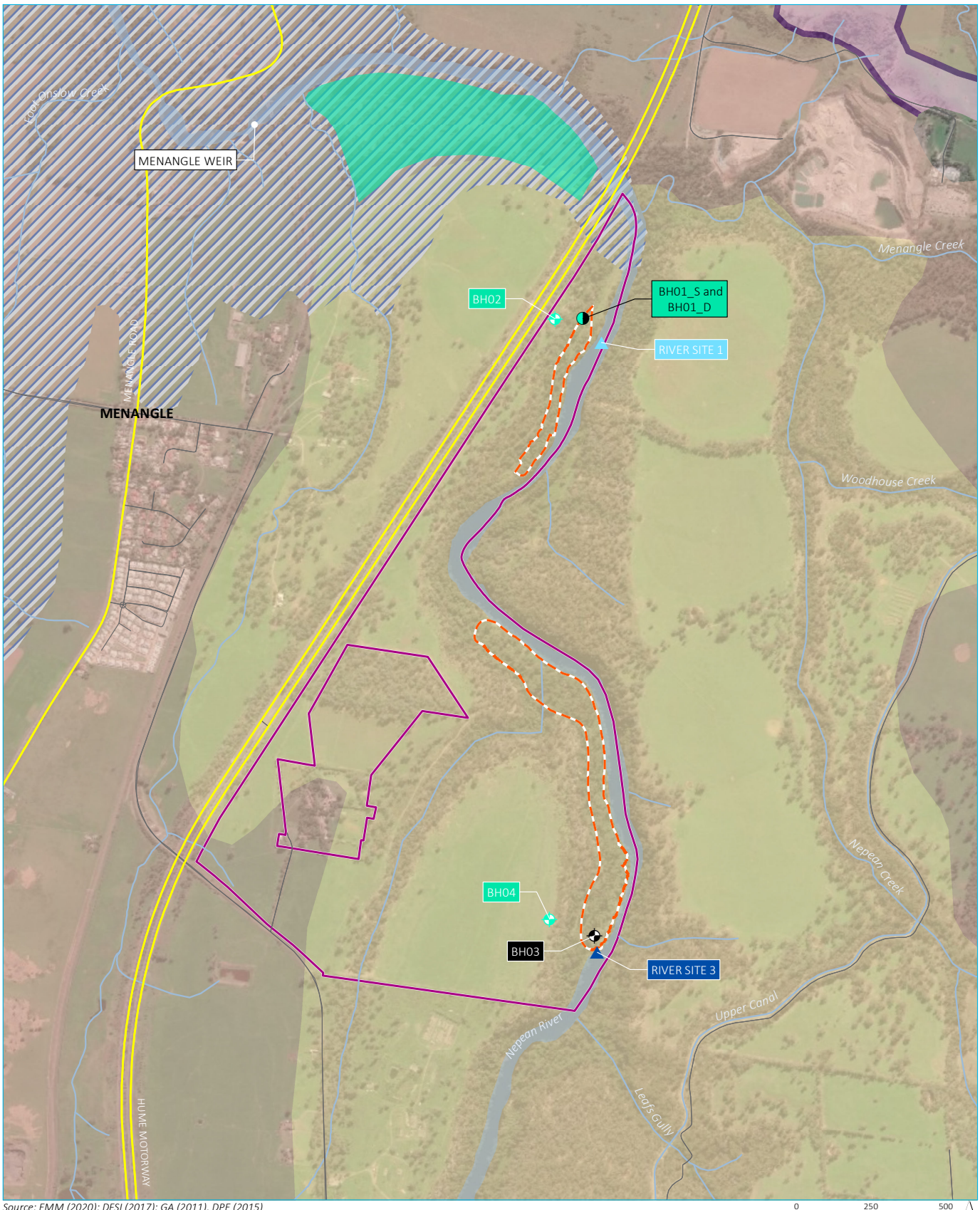
2.1 Fieldwork

Two EMM hydrogeologists attended the quarry on Friday 20 January 2023 to undertake groundwater monitoring at five bores, in accordance with Section 6.4 of the SWMP (EMM, 2021a). The locations of the five bores (BH01_S, BH01_D, BH02, BH03 and BH04) are shown in Figure 2.1. The monitoring event included:

- manual groundwater level measurement (dip) and download of automated groundwater leveloggers at the five bores.
- collection of water samples in the five bores and one surface water site, within the adjacent Nepean River (River site 1, shown in Figure 2.1) to:
  - assess physico-chemical parameters (temperature, pH, electrical conductivity, total dissolved solids, reduction potential and dissolved oxygen) using a calibrated YSI water quality meter

- submit to a NATA accredited laboratory for analytical testing suites, comprising:
    - general water quality (pH, electrical conductivity [EC], total dissolved solids, hardness and alkalinity)
    - major ions (calcium, chloride, fluoride, sodium, magnesium, potassium, sulphate, and an ionic balance)
    - dissolved metals (arsenic, cadmium, chromium, copper, nickel, lead, and zinc).

At the time of the fieldworks (20 January 2023), quarrying activities were not observed within the Stage 8 extraction area (refer Figure 2.1).



Source: EMM (2020); DFSI (2017); GA (2011), DPE (2015)

0 250 500 m

GDA 1994 MGA Zone 56

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KEY

- Study area
- Menangle Quarry - Stage 7
- Proposed extraction area
- Main road
- Local road
- Watercourse/drainage line
- Named waterbody

Location Type

- Borehole - alluvium
- Borehole - sandstone
- Borehole - alluvium & sandstone
- Surface water quality
- Surface water quality and level

Surface geology

- Alluvium
- Ashfield shale
- Bringelly shale
- Hawkesbury sandstone
- Minchinbury sandstone

Monitoring bore locations

Menangle Quarry Extension
Groundwater monitoring and modelling update - July 2021
Figure 2.1

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2.2 Groundwater level

A summary of groundwater dips and groundwater level trigger values (EMM, 2021a) is provided in Table 2.1. Time series data of the groundwater level in each bore is provided in Figure 2.2 and Figure 2.3.

Table 2.1 Groundwater levels

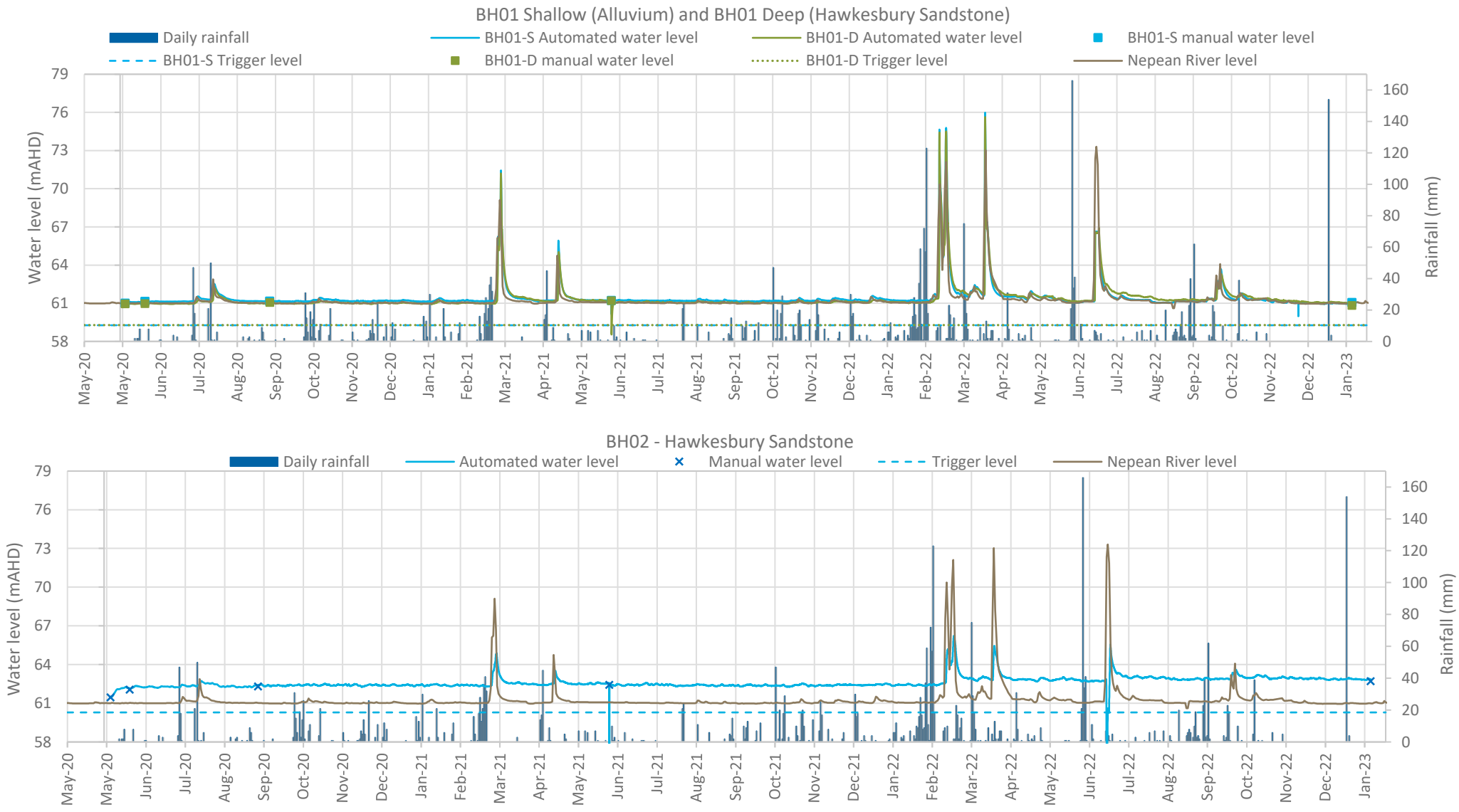
Bore ID	Screened lithology	Groundwater level (20 January 2023)		[3]Groundwater low level trigger value	Exceedance
		[1]mbtoc	[2]mAHD	[2]mAHD	
BH01_S	Alluvium	6.32	61.06	59.27	No
BH01_D	Hawkesbury Sandstone	6.70	60.83	59.29	No
BH02	Hawkesbury Sandstone	25.58	62.72	60.29	No
BH03	Alluvium	5.28	61.04	59.2	No
BH04	Hawkesbury Sandstone	43.47	63.22	60.7	No

1. metres below top of casing (mbtoc);
2. metres above Australian Height Datum;
3. (EMM, 2021b)

There was a flood event on 23 March 2021 (to a maximum level of 71.12 m at Menangle Weir). It appears that the barometric data logger (barologger) was inundated from 22 to 24 March 2021. Evidence of flooding above the barologger was noted by field staff (flood debris, fallen timber, rubbish, sediment build-up and broken foliage). Barometric data during this period is considered unreliable and has been inferred from historical data. The barologger appears to be fully functioning following 24 March 2021.

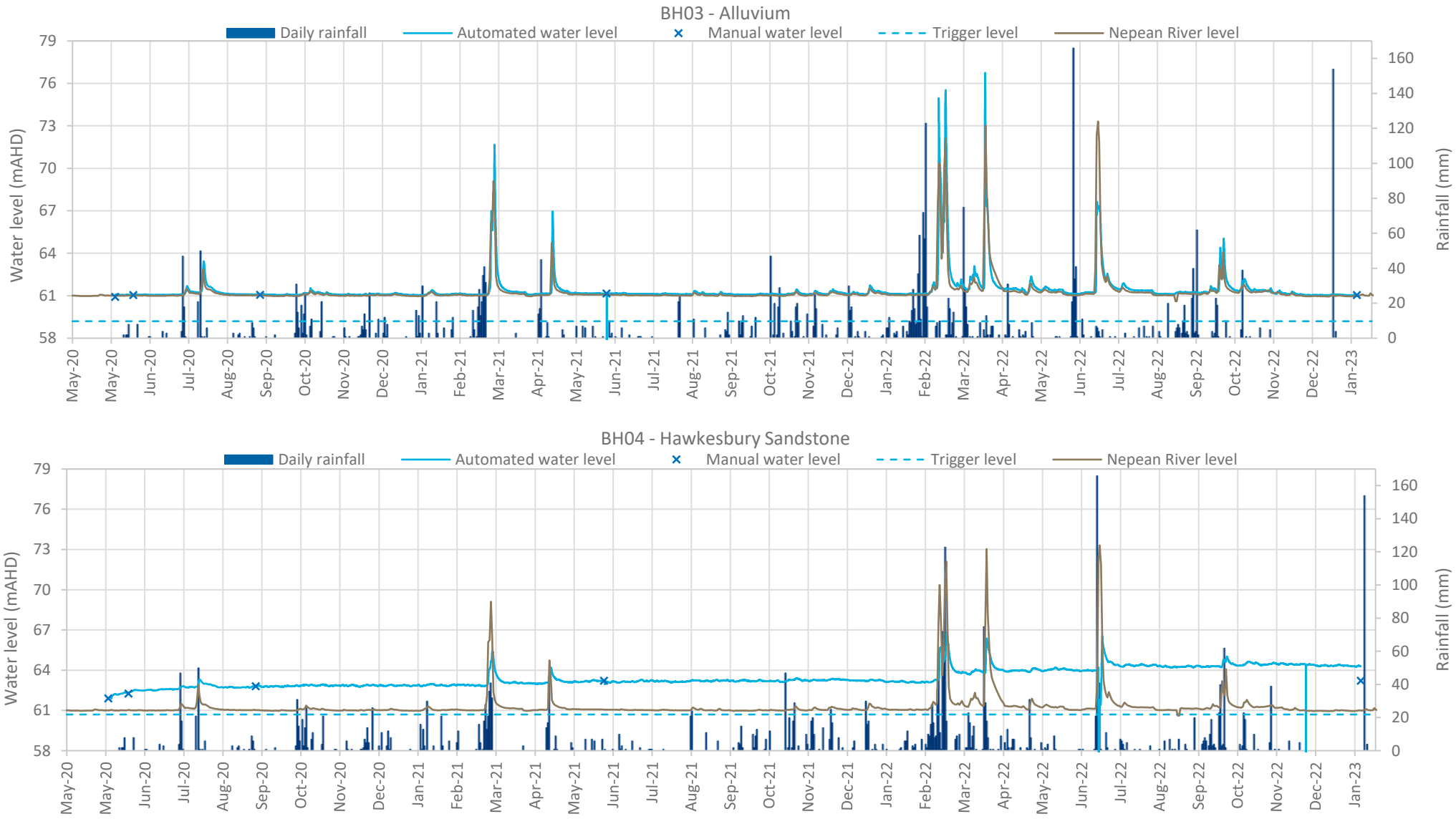
Subsequent flooding occurred three times between March and April 2022, as well as July 2022. From 2 March to 4 March 2022 the barologger was inundated and the flood event reached a maximum level of 76.27 m at Menangle Weir. From 7 March to 9 March 2022 the barologger was again inundated and the flood event reached a maximum level of 76.54 m at Menangle Weir. From 7 April to 9 April 2022 the barologger was again inundated reaching a maximum flood level of 77.44 m at Menangle Weir. From 3 July to 5 July 2022 the barologger was inundated and the maximum flood level was 73.31 m at Menangle Weir. After each flooding event the barologger appears to be fully functioning.

No groundwater level exceedances were observed over the monitoring period (18 June 2021 – 20 January 2023).



Daily rainfall data accessed from Menangle Bridge monitoring station, BoM reference 68216. (http://www.bom.gov.au/climate/data/)
Average daily river height data accessed from Menangle Weir gauging station, WaterNSW station reference 212238 (https://realtimedata.waternsw.com.au/)

Figure 2.2 Time series data – BH01_S, BH01_D and BH02



Daily rainfall data accessed from Menangle Bridge monitoring station, BoM reference 68216. (http://www.bom.gov.au/climate/data/)
Average daily river height data accessed from Menangle Weir gauging station, WaterNSW station reference 212238 (https://realtimedata.waternsw.com.au/)

Figure 2.3 Time series data – BH03 and BH04

2.3 Groundwater sampling

Groundwater sampling was undertaken by two suitably qualified and experienced EMM hydrogeologists, using a 'Micro-purge' low flow bladder pump. Sampling was undertaken in general accordance with:

- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC, 2004); and
- Australia/New Zealand Standard AS/NZS 5667.11:1998 Water Quality – Sampling, Part 11: Guidance on Sampling of Groundwaters (Standards Australia, 1998).

Laboratory results and certificates of analysis are attached as Appendix A and Appendix B, respectively. Field sampling records are attached as Appendix C.

A summary of groundwater pH and EC is provided in Table 2.2 with associated trigger values (EMM, 2021a), exceedances have been highlighted.

Table 2.2 Groundwater pH and EC summary (including trigger values)

Site ID	Screened lithology	EC trigger value[1] (µS/cm)		EC January 2022 (µS/cm)		pH trigger value		pH January 2022	
		Lower limit	Upper limit	Field	Laboratory	Lower limit	Upper limit	Field	Laboratory
BH01_S	Alluvium	125	2,500	390	505	6.5	8.0	**4.37**	**5.77**
BH01_D	Hawkesbury Sandstone	125	3,000	730	922	6.5	8.0	**5.52**	6.70
BH02	Hawkesbury Sandstone	125	10,000	7,404	9,200	6.5	8.5	**6.01**	6.76
BH03	Alluvium	125	2,500	1,690	2,080	6.5	8.0	**4.91**	**6.10**
BH04	Hawkesbury Sandstone	125	12,000	8,960	11,300	6.5	8.5	**6.31**	7.29

Notes: 1. (EMM, 2021a)

Bold font depicts a trigger value exceedance.

Results indicate groundwater is typically acidic (except for laboratory pH results at BH04 [pH 7.29]). All field pH results were below the lower limit trigger level. Laboratory pH results exceeded lower trigger values in BH01_S and BH03 however, did not exceed in BH01_D, BH02 and BH04. In accordance with Table 6.6 of the SWMP (EMM 2021a), groundwater quality data will continue to be monitored and assessed.

Fresh EC was noted closest to the Nepean River in BH01_S ranging from 390 µS/cm (field) – 505 µS/cm (laboratory) and BH01_D ranging from 730 µS/cm (field) – 922 µS/cm (laboratory). Brackish EC occurred in BH03 ranging from 1,690 µS/cm (field) – 2,080 µS/cm (laboratory). Higher EC is noted in the Hawkesbury Sandstone, marginal salinity in BH02 ranging from 7,404 µS/cm (field) – 9,200 µS/cm (laboratory), to slightly saline in BH04 (8,960 µS/cm (field) – 11,300 µS/cm (laboratory) No EC trigger value exceedances were recorded in the January 2023 monitoring event.

A summary of groundwater major ion results is provided in Table 2.3.

2.4 Surface water sampling

Surface water sampling at Nepean River Site 1 was collected directly from the river in accordance with Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC, 2004). SWMP Section 5 (EMM, 2021a) requires surface water monitoring monthly for the first 12 months of quarry extraction and quarterly thereafter. Surface water quality results are included in Appendix B and Appendix C.

Table 2.3 January 2023 groundwater quality summary

	Site ID	BH01_S	BH01_D	BH02	BH03	BH04
	Screened lithology	Alluvium	Hawkesbury Sandstone	Hawkesbury Sandstone	Alluvium	Hawkesbury Sandstone
Analyte	**Unit**					
Total hardness	mg/L	93	119	1350	328	1600
Total alkalinity	mg/L	27	207	256	23	479
Calcium	mg/L	14	18	98	24	102
Chloride	mg/L	120	142	3040	649	3670
Fluoride	mg/L	0.2	0.2	0.7	<0.1	0.6
Sodium	mg/L	55	148	1340	266	1720
Magnesium	mg/L	14	18	269	65	328
Potassium	mg/L	<1	2	13	3	34
Sulphate	mg/L	23	66	219	50	439
Cations	meq/L	4.24	8.870	85.60	18.20	108
Anions	meq/L	4.40	9.52	95.40	19.80	122
Ionic balance	%	1.85	3.52	5.40	4.25	6.29
Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	0.009	<0.001
Copper	mg/L	0.003	0.003	<0.001	0.011	<0.001
Mercury	mg/L	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Nickel	mg/L	0.024	0.015	0.071	0.116	0.037
Lead	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.085	0.120	0.005	0.138	0.010

Results summarised from Appendix B – Laboratory certificates of analysis.

Yours sincerely

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Hydrogeologist
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References

Australia/New Zealand Standard AS/NZS 5667.11:1998 Water Quality – Sampling – Part 11, Guidance on Sampling of Groundwaters (1998).

Bureau of Meteorology (BOM) 2009, *Climate data online.* Menangle Bridue (Nepean River), accessed 30 January 2023. http://www.bom.gov.au/climate/data/.

Department of Environment and Conservation (DEC) 2004, *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW.* Department of Environment and Conservation NSW.

EMM Consulting Pty Ltd (EMM) 2021a, *Menangle Sand and Soil Quarry - Soil and Water Management Plan.* prepared for Menangle Sand and Soil Pty Ltd.

EMM Consulting Pty Ltd (EMM) 2021b, *Menangle Quarry - Groundwater Model Report.* Technical report, Sydney: EMM Consulting Pty Ltd.

Geoscience Australia 2020, *Province and Sedimentary Basin Geology.* Accessed June 12, 2020. http://www.ga.gov.au/scientific-topics/energy/province-sedimentary-basin-geology/petroleum/offshore-eastern-australia/sydney

Standards Australia 1998, *Water quality - Sampling, Part 11: Guidance on sampling of groundwaters*. Sydney: Standards Australia.

Appendix A
Groundwater quality results

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		Analytical results – general				Analytical results – alkalinity				Inorganics										Metals								
		Hardness as $CaCO_3$ (filtered)	Electrical Conductivity (Lab)	pH (Lab)	Total Dissolved Solids (Calc.)	Alkalinity (Bicarbonate as $CaCO_3$)	Alkalinity (Carbonate as $CaCO_3$)	Alkalinity (Hydroxide) as $CaCO_3$	Alkalinity (total) as $CaCO_3$	Calcium (filtered)	Chloride	Fluoride	Sodium (filtered)	Magnesium (filtered)	Potassium (filtered)	Anions Total	Ionic Balance	Cations Total	Sulfate as SO_4 - Turbidimetric (filtered)	Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)
		mg/L	µS/cm	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	%	meq/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL		1	1	0.01	1	1	1	1	1	1	1	0.1	1	1	1	0.01	0.01	0.01	1	0.001	0.0001	0.001	0.001	0.05	0.001	0.0001	0.001	0.005
ADWG 2018 Health												1.5								0.01	0.002		2		0.01	0.001	0.02	
ANZECC 2000 slightly-moderately disturbed systems																					0.0002		0.0014		0.0034	0.00006	0.011	0.008
Location Code	**Date**																											
BH01_D	**02 Jun 2020**	260	2,730	6.85	1,770	228	<1	<1	228	43	732	<0.1	450	37	5	29.7	8.77	24.9	215	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	-	0.006	0.116
BH01_D	**18 Jun 2021**	130	1,310	7.35	852	322	<1	<1	322	34	172	0.4	210	11	6	13.8	7.38	11.9	120	-	-	-	-	-	-	-	-	-
BH01_D	**20 Jan 2023**	119	922	6.7	599	207	<1	<1	207	18	142	0.2	148	18	2	9.52	3.52	8.87	66	<0.001	<0.0001	<0.001	0.003	-	<0.001	<0.0001	0.015	0.12
BH01_S	**29 May 2020**	278	1,370	6.45	890	8	<1	<1	8	42	462	<0.1	138	42	2	13.4	7.33	11.6	12	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	-	0.003	0.074
BH01_S	**18 Jun 2021**	38	218	6.03	142	30	<1	<1	30	7	29	<0.1	28	5	<1	2.04	-	1.98	30	-	-	-	-	-	-	-	-	-
BH01_S	**20 Jan 2023**	93	505	5.77	328	27	<1	<1	27	14	120	0.2	55	14	<1	4.4	1.85	4.24	23	<0.001	<0.0001	<0.001	0.003	-	<0.001	<0.0001	0.024	0.085
BH02	**29 May 2020**	1,180	9,840	8.04	6,400	318	<1	<1	318	142	2,880	0.8	1,650	201	15	104	3.93	95.8	770	0.001	<0.0001	<0.001	0.004	<0.05	<0.001	-	0.02	0.041
BH02	**18 Jun 2021**	1,140	8,230	6.61	5,350	392	<1	<1	392	151	2,700	0.6	1,200	185	12	92.1	10	75.3	389	-	-	-	-	-	-	-	-	-
BH02	**20 Jan 2023**	1,350	9,200	6.76	5,980	256	<1	<1	256	98	3,040	0.7	1,340	269	13	95.4	5.4	85.6	219	<0.001	<0.0001	<0.001	<0.001	-	<0.001	<0.0001	0.071	0.005
BH03	**02 Jun 2020**	383	2,640	7.65	1,720	32	<1	<1	32	20	893	0.1	348	81	3	26.8	7.99	22.9	49	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	-	0.013	0.017
BH03	**18 Jun 2021**	40	141	5.9	92	8	<1	<1	8	11	24	<0.1	16	3	2	1.19	-	1.54	17	-	-	-	-	-	-	-	-	-
BH03	**20 Jan 2023**	328	2,080	6.1	1,350	23	<1	<1	23	24	649	<0.1	266	65	3	19.8	4.25	18.2	50	<0.001	0.0001	0.009	0.011	-	<0.001	<0.0001	0.116	0.138
BH04	**29 May 2020**	1,970	12,000	8.11	7,800	567	<1	<1	567	172	4,050	0.6	1,840	374	31	138	6.82	120	587	0.003	<0.0001	<0.001	0.006	<0.05	<0.001	-	0.023	0.109
BH04	**18 Jun 2021**	1,180	8,460	7.42	5,500	454	<1	<1	454	110	2,700	0.4	1,160	219	32	91.5	10	74.8	300	-	-	-	-	-	-	-	-	-
BH04	**20 Jan 2023**	1,600	11,300	7.29	7,340	479	<1	<1	479	102	3,670	0.6	1,720	328	34	122	6.29	108	439	<0.001	<0.0001	<0.001	<0.001	-	<0.001	<0.0001	0.037	0.01
River Site 1	**29 May 2020**	26	228	7.79	148	52	<1	<1	52	4	35	<0.1	34	4	3	2.15	-	2.08	6	<0.001	<0.0001	<0.001	0.017	0.38	<0.001	-	0.006	0.033
River Site 1	**20 Jan 2023**	37	209	7.15	136	42	<1	<1	42	5	39	<0.1	27	6	3	2.02	-	1.99	4	<0.001	<0.0001	<0.001	0.003	-	<0.001	<0.0001	<0.001	<0.005
River Site 3	**29 May 2020**	33	308	7.88	200	82	<1	<1	82	5	43	<0.1	47	5	4	3.08	-	2.81	11	<0.001	<0.0001	<0.001	<0.001	0.25	<0.001	-	0.003	<0.005

Environmental Standards

NHMRC, May 2019, ADWG 2018 Health

DoE, 2000, ANZECC 2000 slightly-moderately disturbed systems

Appendix B
Laboratory certificates of analysis

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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2302066**	Page	: 1 of 6
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Katharine Bond	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J190166 - Menangle Quarry	Date Samples Received	: 20-Jan-2023 16:00
Order number	: ----	Date Analysis Commenced	: 20-Jan-2023
C-O-C number	: ----	Issue Date	: 24-Jan-2023 12:23
Sampler	: , J DEBOER, KAITLYN BRODIE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 6		
No. of samples analysed	: 6		

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 Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

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*
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	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.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : 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
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BH01_Sandstone	BH01_Alluvium	BH02	BH03	BH04
			Sampling date / time	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00
Compound	CAS Number	LOR	Unit	ES2302066-001	ES2302066-002	ES2302066-003	ES2302066-004	ES2302066-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.70	5.77	6.76	6.10	7.29
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	922	505	9200	2080	11300
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	1	mg/L	599	328	5980	1350	7340
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	119	93	1350	328	1600
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	207	27	256	23	479
Total Alkalinity as CaCO3	----	1	mg/L	207	27	256	23	479
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	66	23	219	50	439
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	142	120	3040	649	3670
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	18	14	98	24	102
Magnesium	7439-95-4	1	mg/L	18	14	269	65	328
Sodium	7440-23-5	1	mg/L	148	55	1340	266	1720
Potassium	7440-09-7	1	mg/L	2	<1	13	3	34
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	0.009	<0.001
Copper	7440-50-8	0.001	mg/L	0.003	0.003	<0.001	0.011	<0.001
Nickel	7440-02-0	0.001	mg/L	0.015	0.024	0.071	0.116	0.037
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	0.120	0.085	0.005	0.138	0.010
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.7	<0.1	0.6

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH01_Sandstone	BH01_Alluvium	BH02	BH03	BH04
				Sampling date / time	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00	20-Jan-2023 00:00
Compound	CAS Number	LOR	Unit		ES2302066-001	ES2302066-002	ES2302066-003	ES2302066-004	ES2302066-005
					Result	Result	Result	Result	Result
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**9.52**	**4.40**	**95.4**	**19.8**	**122**
ø **Total Cations**	----	0.01	meq/L		**8.87**	**4.24**	**85.6**	**18.2**	**108**
ø **Ionic Balance**	----	0.01	%		**3.52**	**1.85**	**5.40**	**4.25**	**6.29**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Nepean River 1	----	----	----	----
				Sampling date / time	20-Jan-2023 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2302066-006	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.15**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**209**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)									
Total Dissolved Solids (Calc.)	----	1	mg/L		**136**	----	----	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		**37**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**42**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**42**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**4**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**39**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**5**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**6**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**27**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**3**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.003**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Sample ID	**Nepean River 1**	**----**	**----**	**----**	**----**
				Sampling date / time	20-Jan-2023 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES2302066-006**	**--------**	**--------**	**--------**	**--------**
					Result	----	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**2.02**	**----**	**----**	**----**	**----**
ø **Total Cations**	----	0.01	meq/L		**1.99**	**----**	**----**	**----**	**----**

QUALITY CONTROL REPORT

Work Order	: **ES2302066**	Page	: 1 of 7
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Katharine Bond	Contact	: Cez Bautista
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: J190166 - Menangle Quarry	Date Samples Received	: 20-Jan-2023
Order number	: ----	Date Analysis Commenced	: 20-Jan-2023
C-O-C number	: ----	Issue Date	: 24-Jan-2023
Sampler	: , J DEBOER, KAITLYN BRODIE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 6		
No. of samples analysed	: 6		

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*
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	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

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 (%)
EA005P: pH by PC Titrator (QC Lot: 4827877)									
ES2302085-004	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.39	7.46	0.9	0% - 20%
ES2302066-001	BH01_Sandstone	EA005-P: pH Value	----	0.01	pH Unit	6.70	6.64	0.9	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 4827878)									
ES2302085-020	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	195	194	0.6	0% - 20%
ES2302088-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	117	116	0.0	0% - 20%
ES2302085-004	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	190	190	0.0	0% - 20%
ES2302085-015	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	194	192	0.7	0% - 20%
ES2302066-001	BH01_Sandstone	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	922	913	1.1	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 4827879)									
ES2302088-001	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	34	31	8.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	34	31	8.9	0% - 20%
ES2302066-001	BH01_Sandstone	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	207	209	0.6	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	207	209	0.6	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4828953)									
ES2301882-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	57	58	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 4828954)									
ES2302025-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	27	28	0.0	0% - 20%
ES2301882-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	110	110	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4828079)									

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: 4828079) - continued									
ES2301382-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	159	160	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	79	79	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	123	122	0.9	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	1	1	0.0	No Limit
ES2301517-006	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	364	364	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	435	439	0.9	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	3770	3810	1.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	97	99	1.8	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 4828081)									
ES2302066-005	BH04	ED093F: Calcium	7440-70-2	1	mg/L	102	103	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	328	331	1.1	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1720	1750	1.3	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	34	35	0.0	0% - 20%
WN2300901-006	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	49	49	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	301	303	0.4	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	16	16	0.0	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4828077)									
ES2301382-002	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	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		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
ES2301517-006	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	0.004	0.004	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.105	0.104	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.020	0.020	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4828083)									
ES2302066-005	BH04	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: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.037	0.038	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.010	0.010	0.0	No Limit

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 (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4828083) - continued									
WN2300901-006	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: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.049	0.049	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4828076)									
ES2301382-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2301517-006	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4828082)									
ES2302066-006	Nepean River 1	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
WN2300901-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 4827880)									
ES2302085-004	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.0	1.0	0.0	No Limit
ES2302066-001	BH01_Sandstone	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	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
EA005P: pH by PC Titrator (QCLot: 4827877)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	101	98.8	101
				----	7 pH Unit	99.8	99.2	101
EA010P: Conductivity by PC Titrator (QCLot: 4827878)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	220 µS/cm	98.3	89.9	110
				<1	2100 µS/cm	102	90.2	111
ED037P: Alkalinity by PC Titrator (QCLot: 4827879)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.8	81.0	111
				----	50 mg/L	116	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4828953)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	107	82.0	122
				<1	500 mg/L	103	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 4828954)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	102	80.9	127
				<1	1000 mg/L	105	80.9	127
ED093F: Dissolved Major Cations (QCLot: 4828079)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	101	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	95.3	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	96.1	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	108	85.0	113
ED093F: Dissolved Major Cations (QCLot: 4828081)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	101	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	96.8	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	100	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	108	85.0	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828077)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	90.0	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.5	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	86.4	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	92.2	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.7	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	88.0	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.6	81.0	117
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828083)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828083) - continued								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	90.9	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.8	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	87.0	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.6	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.5	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	89.1	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	91.8	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4828076)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.9	83.0	105
EG035F: Dissolved Mercury by FIMS (QCLot: 4828082)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.6	83.0	105
EK040P: Fluoride by PC Titrator (QCLot: 4827880)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	109	82.0	116

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	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4828953)							
ES2301882-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 4828954)							
ES2301882-006	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	120	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828077)							
ES2301382-003	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	95.5	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	88.9	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	95.9	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	92.7	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	90.6	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	94.4	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828083)							
ES2302066-006	Nepean River 1	EG020A-F: Arsenic	7440-38-2	1 mg/L	110	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	112	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG020F: Dissolved Metals by ICP-MS (QCLot: 4828083) - continued							
ES2302066-006	Nepean River 1	EG020A-F: Chromium	7440-47-3	1 mg/L	106	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	114	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	109	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	109	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	112	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4828076)							
ES2301381-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	82.4	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4828082)							
WN2300651-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	85.2	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 4827880)							
ES2302066-002	BH01_Alluvium	EK040P: Fluoride	16984-48-8	5 mg/L	86.4	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2302066**	Page	: 1 of 5
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Katharine Bond	Telephone	: +61-2-8784 8555
Project	: J190166 - Menangle Quarry	Date Samples Received	: 20-Jan-2023
Site	: ----	Issue Date	: 24-Jan-2023
Sampler	: , J DEBOER, KAITLYN BRODIE	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 6

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES2301882--006	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	1	13	7.69	10.00	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)					
Conductivity by Auto Titrator	4	50	8.00	8.33	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*		*Sample Date*	*Extraction / Preparation* Date extracted	Due for extraction	Evaluation	*Analysis* Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**20-Jan-2023**	20-Jan-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**20-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
EA065: Total Hardness as CaCO3								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**21-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**20-Jan-2023**	03-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**23-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**23-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**21-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**21-Jan-2023**	19-Jul-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**24-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P)								
BH01_Sandstone,	BH01_Alluvium,	**20-Jan-2023**	**----**	----	----	**20-Jan-2023**	17-Feb-2023	✓
BH02,	BH03,							
BH04,	Nepean River 1							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	5	50	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	4	37	**10.81**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.69**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	4	50	**8.00**	**8.33**	×	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Conductivity by Auto Titrator	EA010-P	1	50	**2.00**	**1.67**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by Auto Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
Conductivity by Auto Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)
Calculated TDS (from Electrical Conductivity)	EA016	WATER	In house: Calculation from Electrical Conductivity (APHA 2510 B) using a conversion factor specified in the analytical report. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Fluoride by Auto Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)

Appendix C
Groundwater sampling forms

EMM
creating opportunities

Field sampling records 23-Jan-23

Sample time	Volume	Sample taken?	Temperature	Dissolved oxygen		Conductivity	TDS	pH	Redox	Colour/odour/comments	SWL
BH04	**L**		**°C**	**%**	**mg/L**	**µS/cm**	**mg/L**		**mV**		**m BTOC**
13:10	0.5	No	19.8	28.6	2.5	3662	2645	6.16	124	Brownish, odourless	42.45
13:13	0.8	No	19.2	20	1.84	5384	4056	6.22	56	Slightly cloudy, odourless	
13:15	1.2	No	18.8	22.5	1.98	7295	5388	6.26	-80.4	Slightly cloudy, odourless	
13:17	1.6	No	18.7	22	2.02	8452	6292	6.29	-103	Slightly cloudy, odourless	
13:20	2	No	18.7	18.8	1.64	8826	6532.5	6.3	-110	Slightly cloudy, odourless	
13:22	2.2	Yes	18.6	17.8	1.57	8960	6636	6.31	-112.9	Slightly cloudy, odourless	
BH03											
12:08		No	20	82	6.46	417	349	6.13	73.9	Clear, no odour	5.28
12:12		No	19	52.6	5	815	624	5.29	149.6	Clear, no odour	
12:13		No	18.7	34.2	3.06	1401	1070	4.98	194.6	Clear, no odour	
12:15		No	18.7	22.5	2.08	1656	1228.5	4.91	216.8	Clear, no odour	
12:17		Yes	18.7	19.3	1.79	1690	1248	4.91	226.8	Clear, no odour	
BH01_S (Alluvium)											
9:55		No	19.3	31	2.9	402	308.1	4.73	215.3	Turbid and Brown, no smell	6.33* - not an accurate dip
9:58		No	18.8	11.3	1.04	396.4	292.5	4.62	214.6		
10:00		No	18.8	7.7	0.72	394.8	291.85	4.48	226.2	Brown, getting clearer	
10:01		No	18.2	7	0.67	391.4	293.15	4.41	235.8	Slightly brown, no smell	
10:03		Yes	18	4.5	0.42	389.9	292.5	4.37	246.7	Slightly brown, no smell	
BH02											
11:05	0.5	No	19.2	13.2	1.22	7029	6161	5.99	-124.9	Clear, salty, odourless	25.58
11:08	1	No	19	9.3	0.86	7285	5375	5.99	-142.9	Clear, odourless	
11:11	1.5	No	19.9	6.2	0.55	7372	5434	5.99	-147.1	Clear, odourless	
11:14	2	No	19.9	4.2	0.38	7403	5453	6	-153.9	Clear, odourless	
11:17	2.5	No	19.8	3.9	0.34	7402	5453	6.01	-155.3	Clear, odourless	
11:20	3	Yes	18.8	3.6	0.32	7404	5460	6.01	-155.7	Clear, odourless	
BH01_D (Sandstone)											
10:20	0.2	No	18.5	13.5	1.17	730	546	5.52	149.9	Brown, odourless	6.7
10:25	0.5	No	18	7.9	0.72	726	546	5.39	153.9	Brown, odourless	
10:30	0.8	No	17.9	6.8	0.61	723	546	5.26	160.1	Brown, odourless	
10:35	1.2	No	17.9	5.7	0.52	722	546	5.29	160	Brownish, odourless	
10:40	1.6	No	17.8	6.8	0.69	721	539.5	5.43	153	Brownish, odourless	
10:45	2.1	Yes	17.8	7	0.66	721	539	5.51	152	Brownish, odourless	
Nepean River 1											
11:00		Yes	24.2	71.6	6.09	194.1	128.05	7.18	133.3	Clear, no odour	

Site Rehabilitation and Restoration

Annual Progress Report

Menangle Sand and Soil Pty Ltd

Benedict Sands Menangle

(LEC 2018/342158)

01 January 2023 - 31 December 2023

March 2024

Version	Date	Prepared by	Approved by	Comments
v1	28/3/24	E.Mckenzie	E.Dupere	For submission

CONTENTS

Attachments

1 Introduction

1.1 Background

Menangle Sand and Soil Pty Ltd (MSS) operates the Menangle Sand and Soil Quarry ('the quarry') at 15 Menangle Road, Menangle.

1.2 Consent

On 15 November 1989 the Minister for Planning, approved Development Consent 85/2865, allowing the quarry to extract sand and soil along the Nepean River and to process and blend material.

On 10 September 2020, the NSW Land and Environment Court (LEC) approved the Menangle Quarry Extension – Modification 1 (MOD1) to Development Consent 85/2865. Consent conditions are provided in the Notice of Orders for LEC 2018/342158).

On 5 November 2021, the Minister for Planning approved Menangle Quarry Extension – Modification 2 (MOD2) to Development Consent 85/2865.

The Consent allows the extraction of sand and soil in the Stage 8 area and processing and other operations in the Stage 6 and 7 areas (Figure 1.1).

Quarrying activities commenced in Stage 8 on 4 September 2023 and the Department was formally notified as such.

1.3 Biodiversity and rehabilitation management

The *Menangle Sand and Soil Quarry Biodiversity and Rehabilitation Plan* (BRMP) was prepared to meet Consent Condition B73. The BRMP (current version 3.1, 23 February 2022) describes the management of vegetation in the Stage 6 area, Stage 7 area, Substage 8A–8C extraction areas and Restoration Area 1 (Figure 1.2). Restoration Area 1 forms part of the biodiversity offsets to compensate for impacts to vegetation because of the Menangle Quarry Extension. Menangle Sand and Soil has rehabilitated substantial additional areas not required by the Consent to demonstrate its commitment to the final state of its lands, which are owned by a related entity.

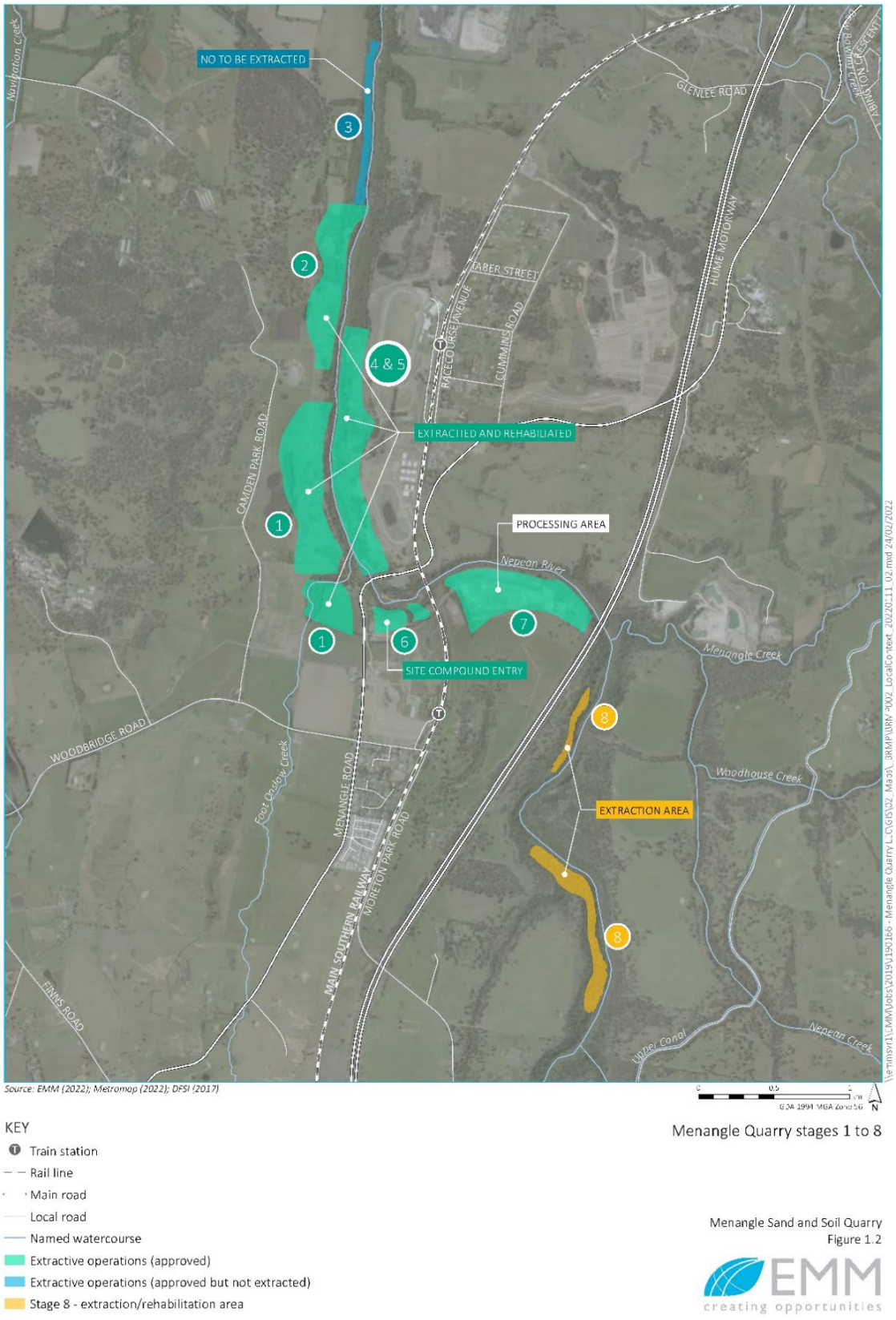


FIGURE 1. Menangle Quarry Stages 1 to 8

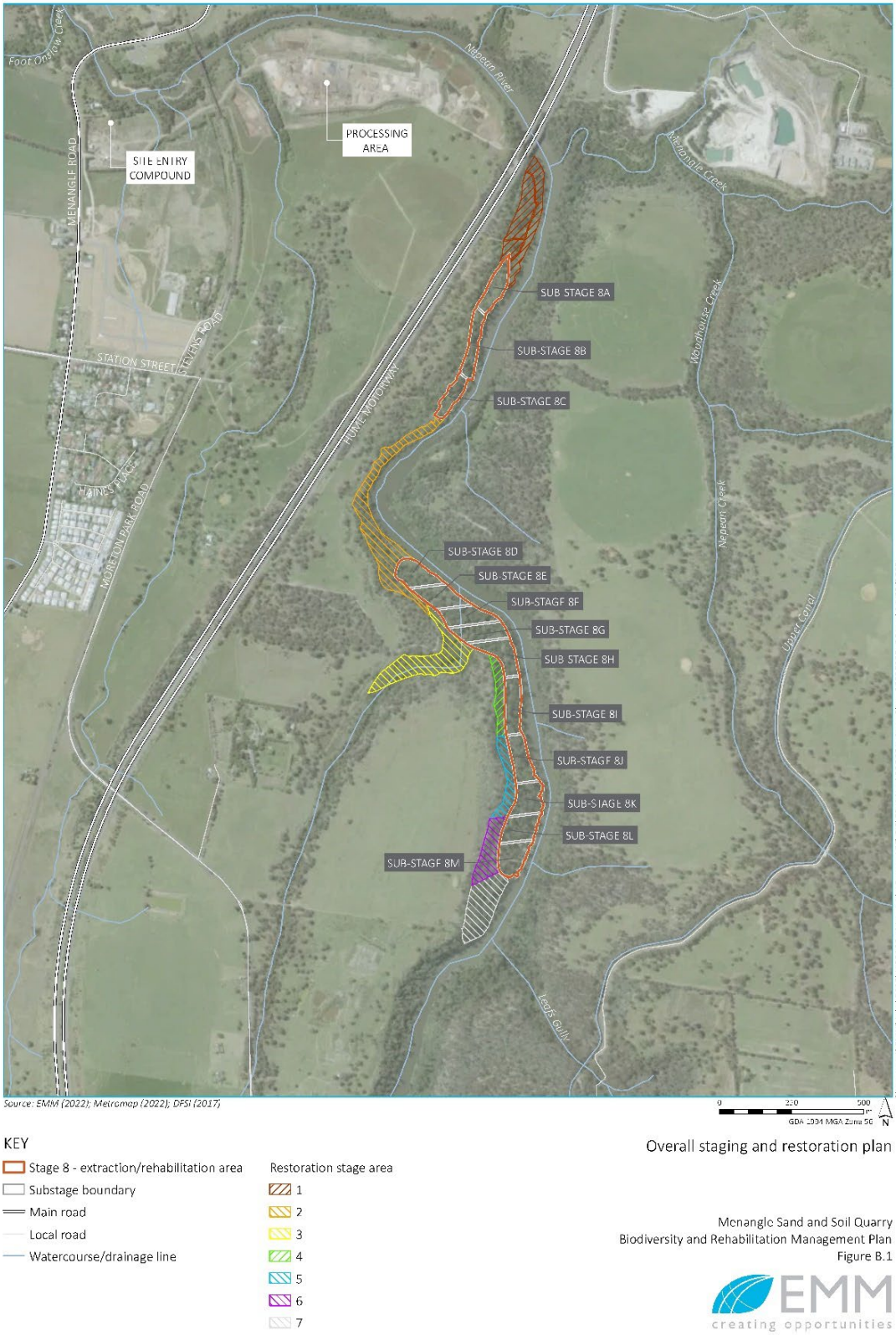


FIGURE 2. Overall Staging and Restoration Plan

1.4 Biodiversity and Rehabilitation Management Plan reporting

The annual reporting is described in BRMP Section 8.8.

This Rehabilitation and Restoration Site Annual Progress Report addresses the reporting requirements listed in BRMP Section 8.8. It provides:

1. landform establishment and stability assessment (see BRMP Section 8.3.1);
2. growth medium development assessment (see BRMP Section 8.3.2);
3. floristic monitoring report (see BRMP Section 8.4.1);
4. weed monitoring report (see BRMP Section 8.4.2); and
5. nest-box and woody debris report (see BRMP Sections 8.4.3 and 8.4.4).

The reporting period is January 2023 to December 2023. Some additional, more recent data is included from the period Jan24-Mar24

The BRMP states that MSS will complete and submit an Annual Review report to DPE for by the end of March each year (see Section 7.2 of the *Menangle Sand and Soil Quarry Environmental Management Strategy*). The rehabilitation and restoration activities, monitoring results, and progress towards achieving the completion criteria are to be reported in the Annual Review.

2 Landform establishment, stability and growth medium

2.1 Introduction

Landform establishment, stability and growth medium completion/performance indicators are provided in BRMP Table 8.1.

2.2 Management actions, performance/completion criteria, observations and effectiveness

Management actions in the reporting period, progress towards meeting the performance/completion criteria, the effectiveness of management actions, and progressive improvements are provided in the table below.

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
STAGE 6 & 7 - Establish stable final landform areas							
STAGE 6 Establish stable final landform area		Completed	Completed	See below	-	The area is formed, stable, and revegetated	completed
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.	-	-	Yes	None	As above	completed
	No reduction in flood storage capacity, compared with pre-development conditions.	-	-	Yes	None	The final landform is lower than the former landform, so we created flood storage volume	completed
	Final landform incorporates geomorphological features to allow for the free draining discharge of clean water.	-	-	Yes	None	It is suitably formed	completed

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
	Minimal sediment-laden run-off into the Nepean River.	-	-	Yes	None	There is no sediment laden water being produced	
STAGE 7 Establish stable final landform in **non-operational** area		2022	2022	See below	-	The landform is stable but being reshaped to forma more useful final landform	
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			No	It is being modified/reshaped	As above	It will be reshaped by mid-2024
	No reduction in flood storage capacity, compared with pre-development conditions.			No	As above	As above	The landform provides more flood storage than the pre-extraction landform
	Final landform incorporates geomorphological features to allow for the free draining discharge of clean water.			Yes	As above	As above	
	Minimal sediment-laden run-off into the Nepean River.			Yes	As above	The banks are grassed with Kikuyu and are stable	It will be supplemented with plantings of some riverine tree species
STAGE 7 Establish stable final landform in the **operational** area (post-closure)		2036	2036	No	-	The Processing Area continues to be used. Final landform will be established following the completion of quarry operations.	-

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			No	None	-	-
	No reduction in flood storage capacity, compared with pre-development conditions.			No	None	-	-
	Final landform incorporates geomorphological features to allow for the free draining discharge of clean water.			No	None	-	-
	Minimal sediment-laden run-off into the Nepean River.			Yes	None	-	-

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
SUBSTAGE 8A - Establish stable final landform areas							
SUBSTAGE 8A The final landform is consistent with the Consent		2024	2023	Yes	The extraction of Substage 8A is completed and the final landform has been created. Weedy topsoil and weedy vegetated materials from the advancing quarry were placed in the floor of the completed extraction area to build up the final landform. The completed extraction area has been backfilled to approximately 64 m AHD with scalps, coarse rejects and soil.	Slope angles are consistent with the Consent and the SWMP: • riverside batter: 1:5; • extraction area: minimum 1:50 slope towards swale at base of riverside batter; and • landward batter: maximum of 1:1, except where the batter is formed by the natural sandstone rock escarpment, which may be steep/vertical in places.	
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			Yes	As above.	As above.	The timber and brush stations have been placed and the area has been Hydroseeded with the recommended species mix.
	No reduction in flood storage capacity, compared with pre-development conditions.			No	As above.	As above.	The extraction has resulted in a net loss of materials in this area
	Final landform incorporates geomorphological features to			Yes	As above.	As above.	Most water percolates down through the backfilled material down to the water

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
	allow for the free draining discharge of clean water.						table which is only a few metres below
	Minimal sediment-laden run-off into the Nepean River.			Yes	The area has been hydroseeded and has a cover crop	The final landform profile prevents runoff from the extraction area as its lower than the 10m buffer	Effective
SUBSTAGE 8A The landform area is stable	Areas of active erosion are minimised.	2024	2023	Yes	The area was rehabilitated as intended as well as two large adjoining Additional Restoration Areas (outside of the Extraction Area and the Restoration Area 1) was weeded and mulched (and selected eucalypts were planted) to reduce the migration of weeds into the rehabilitated areas.	Spot spraying of weeds has been required in the Additional Restoration Areas as well as in the Restoration Area 1 and Substage 8A Extraction areas. This has not affected land stability but is monitored as the ground is exposed after weed removal	The Additional Restoration Areas (see Figure 11) allows a bigger buffer between other areas and
	No areas of active erosion as determined by: • no drills/gullies • no sheet erosion present • no tunnel erosion present.			No	See Attachment A: Drainage, erosion and sediment control inspections record.	See Attachment A: Drainage, erosion and sediment control inspections record.	There are no areas of active erosion.

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
SUBSTAGE 8B - Establish stable final landform areas							
SUBSTAGE 8B the final landform is consistent with the Consent	The final landform is suitable for the final land uses and generally compatible with surrounding topography. No reduction in flood storage capacity, compared with pre-development conditions. The final landform incorporates geomorphological features to allow for the free draining discharge of clean water. Minimal sediment-laden run-off into the Nepean River.	2025	2024	See below	Extraction of the Substage 8B area commenced in Feb 2024	-	-
SUBSTAGE 8B The landform area is stable	Areas of active erosion are minimised.	2025	Late 2024	See below	Extraction of Substage 8B area has commenced.	-	-
SUBSTAGE 8C - Establish stable final landforms in the area							
SUBSTAGE 8C The final landform is consistent with the Consent	The final landform is suitable for the final land uses and generally compatible with surrounding topography. No reduction in flood storage capacity, compared with pre-development conditions.	2026	2025	See below	Extraction of the Substage 8C is yet to commence.	-	-

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
	The final landform incorporates geomorphological features to allow for the free draining discharge of clean water. Minimal sediment-laden run-off into the Nepean River.						
SUBSTAGE 8C The Landform is stable	Areas of active erosion are minimised.	2026	2025	See below	Extraction of the Substage 8C is yet to commence.	-	-
RESTORATION AREA 1 - Establish stable final landform areas							
RESTORATION AREA 1 The landform is stable	Areas of active erosion are minimised.	2024	2024	Yes	Reshaping, grading, and placing of timbers, and hydroseeding to HN526 has occurred. Weed spraying is occurring as is irrigation.	The cover crop and some weeds have reestablished	Generally good but we are awaiting emergence of the Hydroseeded HN526 bushes and trees
	No areas of active erosion as determined by: • no drills/gullies • no sheet erosion present • no tunnel erosion present.	2024	2024	No	There are no areas of active erosion. See Attachment A: Drainage, erosion and sediment control inspections record.	See Attachment A: Drainage, erosion and sediment control inspections record.	The area is relatively flat as was originally mined in the 1920's for the Sydney Harbour Bridge construction sand

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
STAGE 6 & 7, SUBSTAGES 8A-8C & RESTORATION AREA 1 - Establish soil suitability for establishment and growth of River Flat Eucalypt Forest (HN526)							
Apply woody debris and habitat materials (eg branches and leaves from cleared native vegetation).	Substage 8A area	2023	2024	yes	See Section 5.2.	See Section 5.2.	See Section 5.2.
	Substage 8B area	2024	2024	No	Extraction of the Substage 8B commenced in Feb 2024	-	
	Substage 8C area	2025	2025	No	Extraction of the Substage 8C is yet to commence.	-	
	Restoration Area 1	2023	2023	Yes	See Section 5.2.	See Section 5.2.	See Section 5.2.
Establish vegetation rehabilitation plots	Stage 6 area - two 20 x 20 m vegetation rehabilitation plots established (see Figure 3, below)	2023	2023	Yes	Two vegetation plots established and are in Figure 3 - see Section 2.5 below	-	Significant Flooding Events in has hampered continuity of this stage. Flood events have occurred on 22-24 March 2021, 2 March 2022 and 6 April 2022.
	Stage 7 area - five 20 x 20 m vegetation restoration plots established (see Figure 4, below)	2023	2023	Yes	Five vegetation plots established and are located in Figure 4 - see Section 2.5 below	-	As above
	Substage 8A-8C area 20 x 20 m vegetation restoration plots established (see Figures 9 & 10 below)	2025	2024	Yes for 8A No for 8B and 8C	One vegetation plot established in Substage 8A and is located in Figure 9 and shown in Figure 10 - see Section 2.5 below. The Plots will be established progressively as the final	-	These have just been established and it's too early to assess

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
					landform in each area is completed.		
	Restoration Area 1 – three 20 x 20 m three vegetation restoration plots established (see Figure 5)	2023	2023	Yes	Three vegetation plots established and fenced and located in Figure 5 and shown in Figures 6,7 & 8 - see Section 2.5 below	-	Weed control has been carried out post Hydroseeding with HN526
Soil analysis	Soil analysis at each vegetation plot once following establishment of the final landform: • pH • electrical conductivity • cation exchange capacity • exchangeable sodium percentage • organic matter • phosphorus and nitrate • magnesium and aluminium.	2024	2024	yes	Soil samples were collected from each vegetation restoration plot and from 4 locations where HN526 is currently established.	Laboratory reports are provided in Attachment C.	The results will be considered, and recommendations followed

Landform establishment, stability and growth medium summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)**	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)**
		Required completion year	**Anticipated/ actual completion year**	**Action completed?** (Yes/No)			
Establish soil performance indicators	Upper and lower range performance indicators to be determined during first round of monitoring based on measurements in comparable soil types supporting HN526.	2024	2024	No	Soil analysis results have been carried out and are being assessed.	Upper and lower range performance indicators are provided in Attachment B.	The results will be considered, and recommendations implemented

2.3 Additional commentary

The quarry has decided that the best results will be obtained by adding the following actions:

1) Irrigating the rehabilitation areas when necessary, during post Hydroseeding activities until the cover crop is established.

2) Relocating the haul roads through already cleared adjoining grazing lands/areas so as to not allow quarry vehicles and machinery to transit through rehabilitated areas.

3) Clearing weeds on Additional Restoration Areas 1 & 2 (see Figure 11 below) inland to the Restoration Area 1 and covering them with a thick mulch to provide a clean buffer, reducing weed migration into the substage excavation restoration areas.

4) Planting Trees that are considered as suitable Koala food sources so that ultimately Koalas could be reintroduced into the corridor post-extraction (see Figure 3 below).

Stage 6 and Stage 7 Additional Restoration areas

MSS has planted additional areas for operational and strategic purposes which has added to the ecological diversity across the site. In Stage 6, the Company has voluntarily planted an area of some 1250m2 and is growing species which are harvested as Koala food, for the Symbio Wildlife Park, in Helensburg, NSW- see area shown on Figure. 3 "Koala Food Plantation" below. The trees are periodically harvested as a pure, reliable food supply for their Koalas.

Primary Trees (favoured) for Plantation:
Swamp Mahogany *Eucalyptus robusta*
Forest Red Gum *Eucalyptus tereticornis*
River red gum *Eucalyptus camaldulensis*
Cabbage Gum *Eucalyptus amplifolia*
Grey Gum *Eucalyptus punctata*

Secondary trees:
Tallowwood *Eucalyptus microcorys*
Pink Flowering Ironbark *Eucalyptus sideroxylon*
Nicoli *Eucalyptus nicholii*
River Red Gum *Eucalyptus camaldulensis*
Grey Box Gum Eucalyptus *microcarpa*
Scoparia *E Scoparia*

In Stage 7, MSS has planted a number of bund wall areas with a range of casuarinas and eucalypts to provide screening and increased post-extraction habitat areas**.**

This additional 26,700m^2 of additional Restoration Area (see Figure 4 below) represents some ~46% of increased tree-planted area that is not required by the Consent.

2.4 Measures to be taken in the next 12 months.

MSS will monitor the efficacy of our initiatives and procedures and adapt depending on success or failure.

2.5 Restoration Stage Plans and Areas

VEGETATION MONITORING PLOTS

STAGE 6

FIGURE 3. Stage 6 Restoration Area with two Vegetation Monitoring Plot locations

STAGE 7

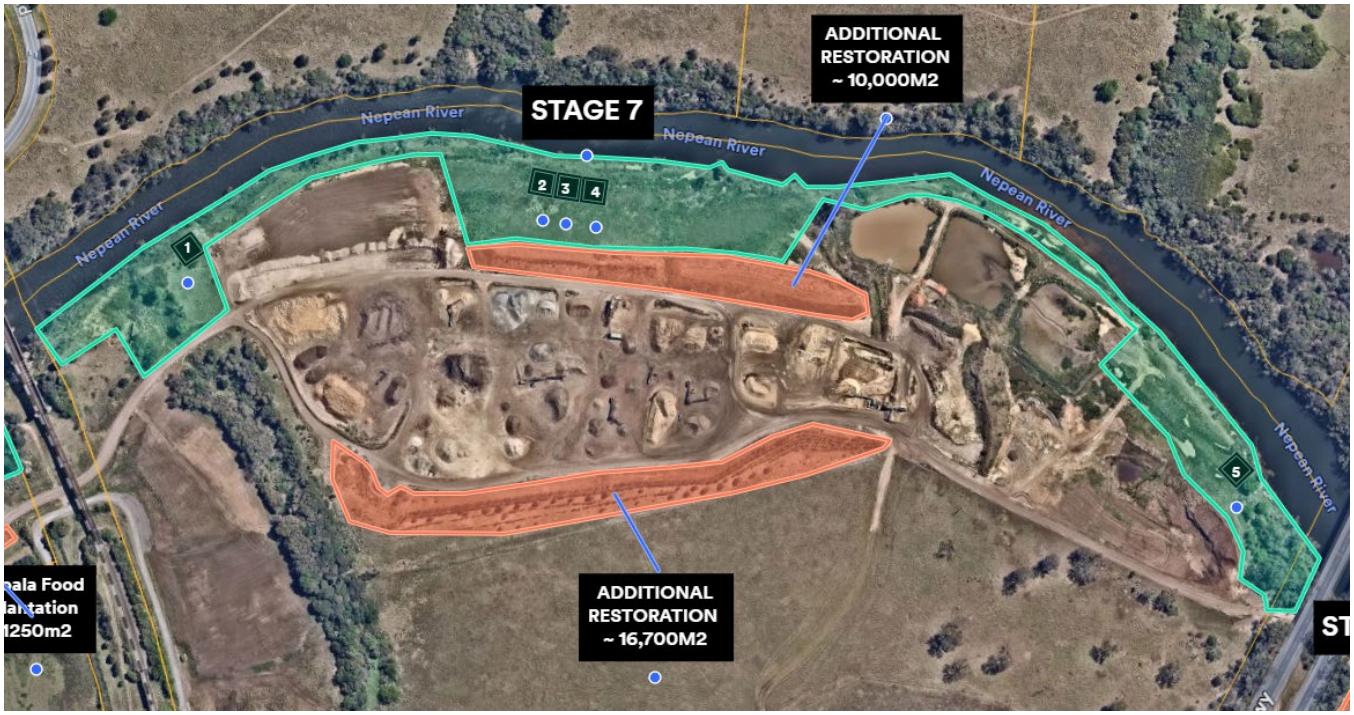


FIGURE 4. Stage 7 Restoration Area with five Vegetation Monitoring Plot locations and two Additional Restoration Areas

STAGE 8

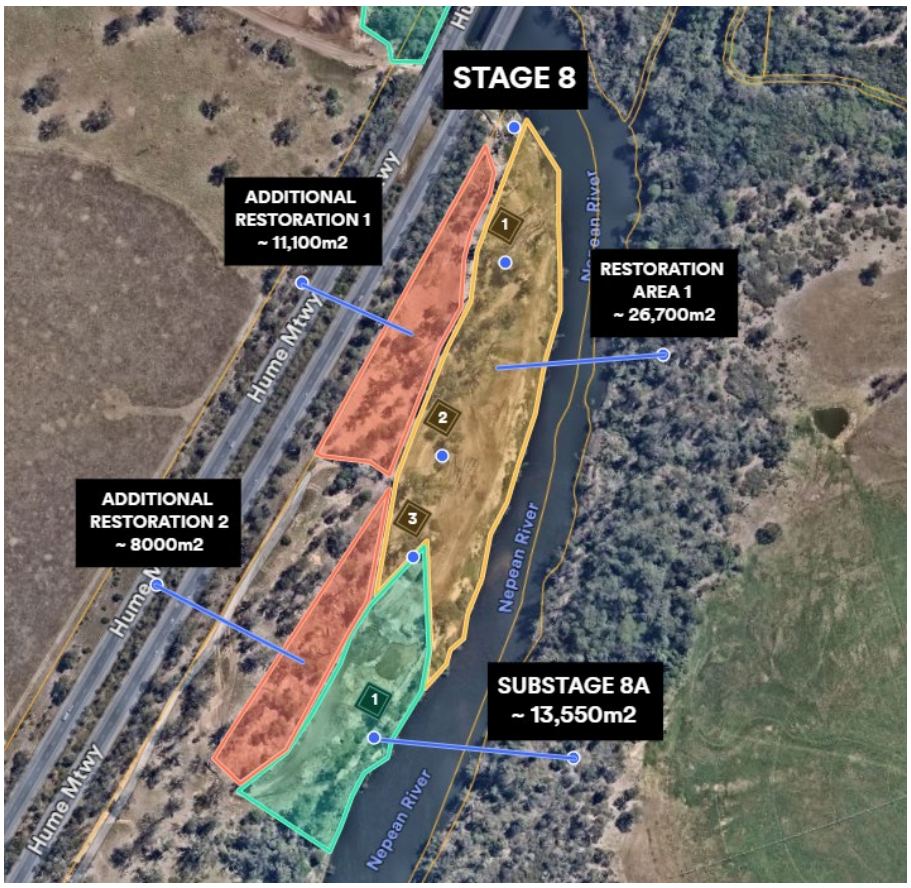


FIGURE 5. Stage 8 Restoration Area 1 with three Vegetation Monitoring Plot locations and two Additional Restoration areas.

FIGURE 6. Restoration Area 1 - Vegetation Restoration Monitoring Plot 1

FIGURE 7. Restoration Area 1 - Vegetation Restoration Monitoring Plot 2

FIGURE 8. Restoration Area 1 - Vegetation Restoration Monitoring Plot 3

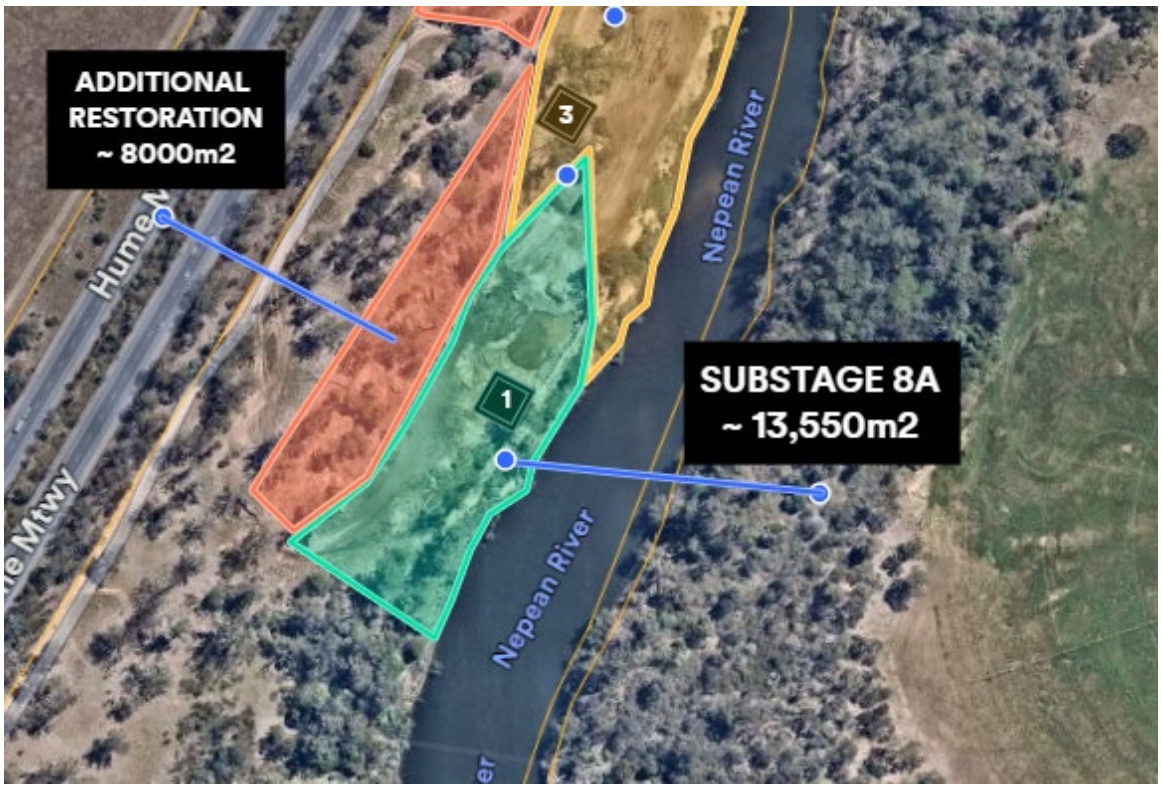


FIGURE 9. Substage 8A Restoration Area with one Vegetation Restoration Monitoring Plot location

FIGURE 10. Substage 8A Vegetation Restoration Monitoring Plot 1

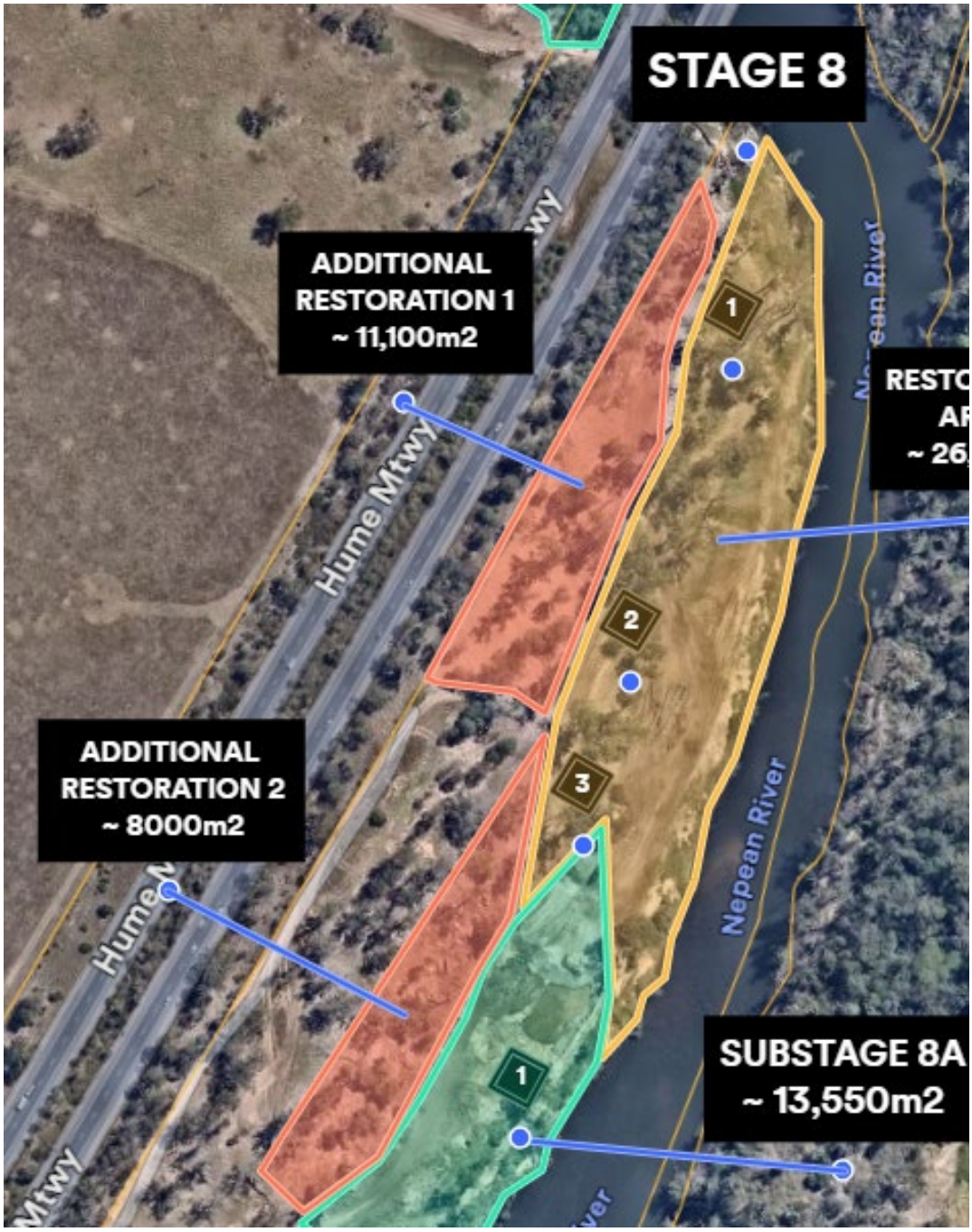


FIGURE 11. Stage 8 Additional Restoration Areas

MSS has restored additional areas in the Stage 8 area (see Figures 3,4 & 5) as part of its genuine commitment to successful rehabilitation of the extraction.

It has identified that the adjoining, mainly Lantana-infested areas would re-invade restored areas and the use of excessive amounts of weed-poisons would need to be employed. Therefore, MSS has undertaken additional areas of weed removal by stripping the weed mass (but leaving the eucalypts) and surface soils and burying them, and then mulching the area. The areas are then improved by sparsely planting additional Koala food tree species from the species listed in Section 2.3.

These additional areas represent a 71% increase in the restored area that is not required by the Consent.

3 Biodiversity management measures

3.1 Introduction

Biodiversity rehabilitation and restoration completion/performance indicators are provided in BRMP Table 8.2. Management actions in the reporting period, progress towards meeting the criteria, the effectiveness of management actions, progressive improvements and actions in the next reporting period are summarised below.

The biodiversity offsets management actions are provided in Section 3.2 and Attachment D of the BRMP.

3.2 Management actions, performance/completion criteria, observations and effectiveness

A summary of actions, performance/completion criteria, observations and effectiveness is provided in the table below.

The results of detailed floristic monitoring are described in the Floristic Monitoring Report provided in Attachment E and are summarised in the table below.

Biodiversity rehabilitation and restoration summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period** (including where undertaken, any variations and the reasons for variation)	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments** (including reasons for non-completion)
		Required completion year	**Anticipated/ actual completion year**	**Action completed** (Yes/No)			
SUBSTAGE 8 - Vegetation establishment for soil stabilisation							
Initial planting/seeding for soil stabilisation	**SUBSTAGE 8A area** Vegetation established to stabilise soils in Substage 8A area substages that have been completed: • Native species from HN526 at one per square metre or greater. Or • Initial cover crop with 70% cover.	2022	2024	Yes both	The start of extraction had been delayed until Sept 2023, delaying Substage 8A planting/seeding. The area, post extraction, was Hydroseeded with the HN526 seed mix plus a cover crop in Dec 2023 Floristic monitoring was completed in the Substage 8A plots in accordance with BRMP Section 8.4.1. Please see Ecologist Report in Attachment E	See Attachment E for details.	See Attachment E for details.
	SUBSTAGE 8B area	2024	Mid-late 2024	No	Extraction of the Substage 8B area commenced in Feb 2024	-	-

Biodiversity rehabilitation and restoration summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period** (including where undertaken, any variations and the reasons for variation)	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments** (including reasons for non-completion)
		Required completion year	**Anticipated/ actual completion year**	**Action completed** (Yes/No)			
	SUBSTAGE 8C area	2025	2025	No	Extraction of the Substage 8C is yet to commence.	-	-
	RESTORATION AREA 1: Vegetation established to stabilise soils in area: • Native species from HN526 at one per square metre or greater. Or • Initial cover crop with 70% cover.	2023	2023	Yes	The area has been restored and Hydroseeded with HN526 species list. Floristic monitoring (see BRMP Section 8.4.1) in the Restoration Area 1 plots (see BRMP Figure 7.1).	See Attachment E for details.	See Attachment E for details.
SUBSTAGE 8A - Area vegetation management							
SUBSTAGE 8A Vegetation management, including planting/seeding of native species.	Native plant species are characteristic of HN526. The vegetation structure is recognisable as, or is trending towards, HN526. Total foliage cover of species allocated to Tree (TG) growth form; Shrub (SG) growth form; Grass and Grasslike (GG) growth form; and Forb (FG) growth form	2028	2028	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris Floristic sampling (see BRMP Section 8.4.1) in the Substage 8A plots (see BRMP Figure 7.1).	See Attachment E for details.	See Attachment E for details.

Biodiversity rehabilitation and restoration summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period** (including where undertaken, any variations and the reasons for variation)	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments** (including reasons for non-completion)
		Required completion year	**Anticipated/ actual completion year**	**Action completed** (Yes/No)			
	are trending towards the benchmark ranges. See Attachment G for details.						
Vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: • The cover and species richness of the groundcover is stable or increasing. • Evidence of plant reproduction and regeneration is present. See Attachment G for details.	2033	2033	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris Floristic sampling (see BRMP Section 8.4.1) in the Substage 8A plots (see BRMP Figure 7.1).	See Attachment E for details.	See Attachment E for details.
SUBSTAGE 8B- Vegetation management							
SUBSTAGE 8B Vegetation management, including	As for Substage 8A area.	**Initial planting: 2029**	**Initial planting: 2029**	**No**	Extraction of the Substage 8B is yet to finish.	-	-

Biodiversity rehabilitation and restoration summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period** (including where undertaken, any variations and the reasons for variation)	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments** (including reasons for non-completion)
		Required completion year	**Anticipated/ actual completion year**	**Action completed** (Yes/No)			
planting/seeding of native species.		**Completion: 2034**	**Completion: 2034**				
SUBSTAGE 8C - Vegetation management							
SUBSTAGE 8C Vegetation management, including planting/seeding of native species.	As for Substage 8A area.	Initial planting: 2030 Completion: 2035	Initial planting: 2030 Completion: 2035	No	Extraction of the Substage 8C is yet to commence.	-	-
RESTORATION AREA 1 - Vegetation management							
RESTORATION AREA 1 Vegetation management, including planting/seeding of native species.	Native plant species are characteristic of HN526. The vegetation structure is recognisable as, or is trending towards, HN526. Total foliage cover of species allocated to Tree (TG) growth form; Shrub (SG) growth form; Grass and Grasslike (GG) growth form; and Forb (FG) growth form are trending towards the benchmark ranges.	2028	2028	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris. Floristic sampling (see BRMP Section 8.4.1) in Restoration Area 1 plots (see BRMP Figure 7.1).	See Attachment E for details.	See Attachment E for details.

Biodiversity rehabilitation and restoration summary							
Management actions	**Performance/completion criteria**	**Progress against performance/completion criteria**			**Description of management actions/monitoring in the reporting period** (including where undertaken, any variations and the reasons for variation)	**Visual observations, monitoring results and trends**	**Effectiveness of management actions, progressive improvements, and other comments** (including reasons for non-completion)
		Required completion year	**Anticipated/ actual completion year**	**Action completed** (Yes/No)			
	See Attachment E for details.						
Vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: • The cover and species richness of the groundcover is stable or increasing. • Evidence of plant reproduction and regeneration is present. See Attachment E for details.	2033	2033	No	Floristic sampling (see BRMP Section 8.4.1) in the Restoration Area 1 (see BRMP Figure 7.1).	See Attachment E for details.	See Attachment E for details.

3.3 Additional commentary

N/A

3.4 Measures to be taken in the next 12 months

The rehabilitation practices will continue to be refined as results/successes/failures become more evident.

- Ongoing weed management in Restoration Area 1, Completed Substage 8A and soon to be completed Substage 8B
- Monitoring soil stability and drainage
- Ongoing Hydroseeding and monitoring of any infill requirements
- Adding woody debris
- Establishment of required Monitoring Plots
- Monitoring and adding nest boxes

4 Weed monitoring report

4.1 Introduction

The quarry's weed management strategy aims to improve the vegetation community in the restoration area and to preventing the spread of weeds to the rehabilitation and restoration areas (see BRMP Section 5.5).

Weed species present within the quarry area in 2021 (ie prior to operations in the Stage 8 area) are listed in BRMP Table 4.1. There are extensive areas of Lantana (*Lantana camara*), Small-leaved Privet (*Ligustrum sinense*), and Broad-leaf Privet (*Ligustrum lucidum*) in the Stage 8 area.

Areas with a total weed cover of at least 10% are considered to be 'weed infested'. As of April 2021, the quarry areas could be mapped as a single weed invested. The closure criteria is to reduce 'high threat weeds' (HTW)[1] and 'priority weeds' is no more than 2%.

Lantana is considered to be a HTW under the *Biodiversity Assessment Method* and a priority weed in the *Greater Sydney Regional Strategic Weed Management Plan 2017–2022 - Revised July 2021* prepared by Local Land Services in partnership with the Greater Sydney Regional Weed Committee.

Privet is considered to be a weed of regional concern in the *Greater Sydney Regional Strategic Weed Management Plan 2017–2022 - Revised July 2021*.

A 'novel weed' species is defined in the BRMP as any exotic species not recorded in previous surveys of the area (BRMP Table 4.1).

4.2 Management actions

The following weed management activities were completed in the reporting period:

- Campaign weed spraying and hand removal.
- Mulching methods were employed to minimise weed re-emergence.

4.3 Records

Data, such as other weed species present, is recorded opportunistically. However, as noted in BRMP Section 8.4.2, this additional data is not reported against annual progress goals except where a novel weed species are monitored. Novel weed species are only mapped if they are deemed to be serious weed invasions by the Rehabilitation Officer, in which case the species is included in the annual weed mapping program.

In addition, weeds were recorded as part of floristic monitoring of permanent plots (see Attachment E).

[1] Called 'high threat exotics (HTE)' in the BRMP.

4.4 Progress against performance and completion criteria

Progress against weed performance and completion criteria is summarised below and details are provided in Attachment E.

Weed management summary				
Weed	**Coverage at March 2024** (ha)	**Coverage this year** (ha)	**% change**	**Requirement met?** (Yes/No)
Lantana				
Stage 6	0	N/A	N/A	Yes
Stage 7	80	N/A	N/A	No
Stage 8	40	N/A	N/A	No
Privet				
Stage 6	0	N/A	N/A	Yes
Stage 7	80	N/A	N/A	No
Stage 8	100	N/A	N/A	No
Novel Weed Species Identified	N/A	N/A	N/A	N/A

4.5 Annual trends

This the first Site Rehabilitation and Restoration Annual Progress Report. Annual trends will be considered in the next Progress Report.

4.6 Effectiveness of weed management measures

Weedy areas have been drastically reduced given the strip-and-bury initial protocol. It is too early to tell how the hydroseeding interrelates to the re-emergence of weed species.

4.7 Measures to be taken in the next 12 months

As extraction and rehabilitation has just recently commenced it is too early to tell whether the methods employed are the ideal program. During 2024, Ongoing weed management in Restoration Area 1, Completed Substage 8A and soon to be completed Substage 8B will be a priority.

5 Nest box and woody debris report

5.1 Nest boxes

5.1.1 Introduction

Since April 2023, 35 nest boxes were installed in the restoration areas adjacent to Stages 8A to 8C as described in BRMP Section 7.5.1. The nest box locations are shown in Figure 5.1.

5.1.2 Management actions

Nest boxes were checked following the following significant weather events to ensure that they are present and remain suitable for use by the target species:

- September 2023
- January 2024

On January 10th, 2024, a representative sample of nest boxes (8 nest boxes) were visually monitored using a manlift for recent signs of habitation (e.g. animal sightings). Thus far only 3 boxes were used by birds and no mammal habitation was suspected.

5.1.3 Records

Nest box locations, inspection records are provided in Attachment G.

5.1.4 Progress against performance and completion criteria

Nest box performance is summarised below.

Nest box performance summary			
Nest box type	**Number required**	**Number functional/used**	**Percentage functional** (%)
Double chamber microbat	40	1	2.5
Brushtail/ringtail possum, front entry	30	2	6.6
Sugar/squirrel, rear entry	30	0	0
Large owl	6	0	0
Total	**106**	**3**	**2.8**

5.1.5 Annual trends

This the first Rehabilitation and Restoration Site Annual Progress Report. Annual trends will be considered in the next Progress Report.

5.1.6 Measures to be taken in the next 12 months.

We will continue to install and monitor the required nest boxes 12 months before we enter a phase for extraction. To safely install all nest boxes on all phases now requires substantial clearing, in many cases, years before the arrival of extraction.

5.2 Woody debris

5.2.1 Introduction

As described in BRMP Section 7.5.2, woody debris and habitat materials (eg smaller branches and leave material) are placed on the Stage 8 substage rehabilitation and restoration areas.

5.2.2 Management actions

Woody debris was placed in Restoration Area 1 and Extraction Substage 8A during the reporting period.

The completion criteria for the placement of woody debris in the Restoration Substages (8A–8C) is summarised below. There are no woody debris completion criteria conditioned for the Stage 6, Stage 7 or Restoration Area 1.

5.2.3 Measures to be taken in the next 12 months

Continue the rehabilitation program placement of woody debris of all sizes (but particularly large trunks) into rehabilitated extraction areas.

Attachment A
Drainage, erosion and sediment control inspections record

A.1 Drainage, erosion and sediment control inspections

Drainage, erosion and sediment control measures will be inspected in accordance with BRMP Table 8.1:

- weekly during normal operations hours;
- daily during periods of rainfall; and
- within 12 hours of the cessation of a rainfall event (greater than 10 mm) causing runoff to occur on, or from, the quarry.

Drainage, erosion and sediment control inspections								
Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
06/11/2023	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 25mm rain recorded between the 29/10/23 - 5/11/23, Trees and guards not affected	As required
13/11/2023	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 30mm rain recorded between the 29/10/23 - 5/11/23. Trees and guards not affected	
13/11/2023	Stages 6, 7	No	0	0	No	No	Approx 30mm rain recorded between the 29/10/23 - 5/11/23. Trees and guards not affected	
4/12/2023	Stage 8, Restoration Area 1	No	1	Up to 5 m^2	No	No	Approx 59mm rain recorded between the 06/11/23 - 12/11/23. Slight gully formed in one area at the crest of batted Trees and guards not affected	Repaired, installed sediment control fence on top of batter
4/12/2023	Stages 6, 7	No	0	0	No	No	Approx 59mm rain recorded between the 06/11/23 - 12/11/23. No visual issues	
2/01/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 - 31/12/23. Sediment control fence on crest has eliminated rill/gullies Trees and guards not affected	

Drainage, erosion and sediment control inspections								
Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
2/01/2024	Substage 8A,	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 - 31/12/23. Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	
2/01/2024	Stages 6, 7	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 - 31/12/23. No visual issues	
22/01/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 60mm rain recorded between the 14/01/24 - 21/1/2024 Trees and guards not affected	
22/01/2024	Substage 8A,	No	0	0	No	No	Approx 60mm rain recorded between the 14/01/24 - 21/1/2024 Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	
22/01/2024	Stages 6, 7	No	0	0	No	No	Approx 54mm rain recorded between the 14/01/24 - 21/1/2024 Trees and guards not affected No visual issues	
12/02/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024 Trees and guards not affected	

Drainage, erosion and sediment control inspections								
Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
12/02/2024	Substage 8A,	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	
12/02/2024	Stages 6, 7	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024Trees and guards where not affected No visual issues	

Attachment B
Initial soil condition indicators

B.1 Initial soil condition indicators

Soil samples were collected from the plots. Laboratory analytical reports for the reporting period are provided in Attachment C and summarised below.

Baseline soil performance indicators					
Parameter	**Units**	**No. of samples**	**Results**		
			Minimum	**Maximum**	**Mean**
pH in water (1:5 extraction)	-	11	6.05	7	6.64
Electrical conductivity (1:5 extraction)	dS/m	11	0.1	0.14	0.05
Cation exchange capacity	eCEC	11	3.1	16.4	9.04
Sodium	mg/kg	11	0.7	2	1.14
Organic matter	%	11	0.8	8	3.13
Phosphorus	mg/kg	11	5.2	64	14.24
Nitrate	mg/kg	11	<0.05	14	4.76
Aluminium	mg/kg	11	N/A	N/A	N/A
Magnesium	mg/kg	11	51	540	238

Sampling and analysis underway and to be reported in 2024 progress report.

Attachment C
Laboratory reports on initial Soil conditions

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 1** **Date Report Generated: 11/03/2024** **Report Status: Final**

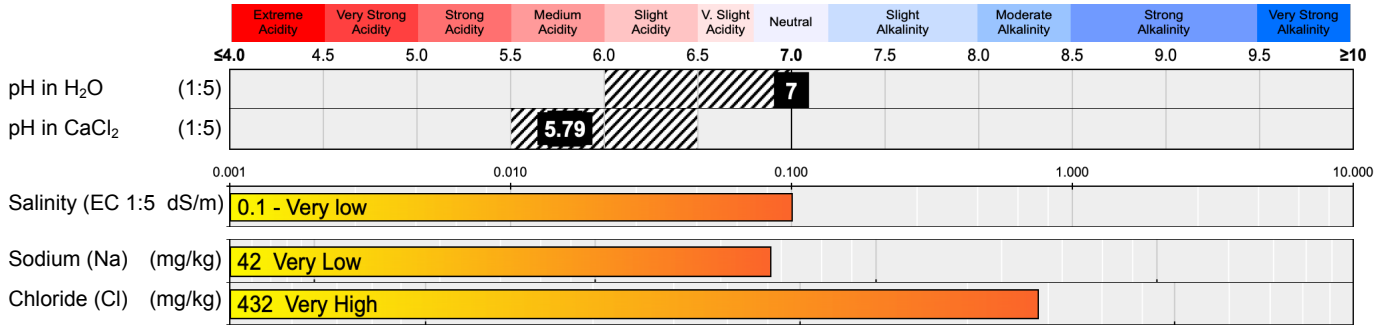
Client Name:	**Benedict Industries Pty Ltd**	Project Name:	**Menangle - FSC _Plus**
		SESL Quote N°:	
Client Contact:	**Results**	Sample Name:	**Stage 6 Restoration Area PLOT 1**
Client Order N°:		Description:	**Soil**
Address:	**PO Box 431** **FRENCHS FOREST NSW 1640**	Test Type:	**FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

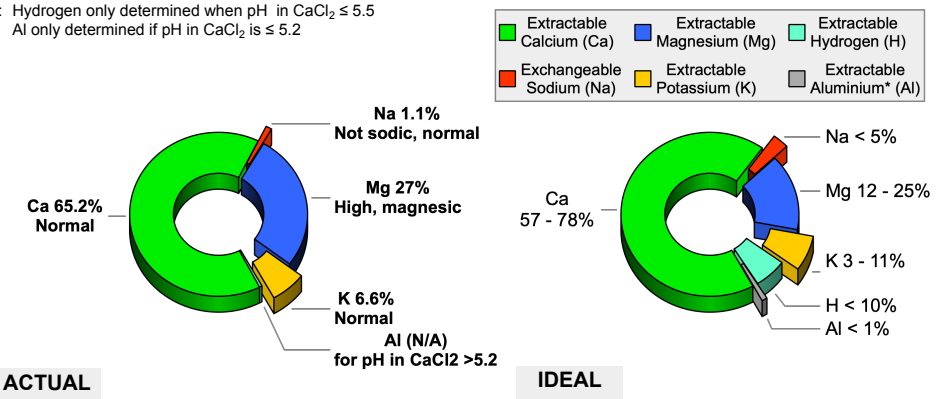
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2.4**	3 – 6
Comment: Calcium low		
Mg:K	**4**	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	**0.07**	< 0.07
Comment: High		
K:Na	**6.1**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.18	1.09	10.7	4.42	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 1** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 6 Restoration Area PLOT 1**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	<0.05		<0.4	4	3.6
Phosphorus (P)	mg P/kg	64		8.5	8.4	Drawdown
Potassium (K)	mg/kg	420		55.9	40.4	Drawdown
Sulfur (S)	mg S/kg	20		2.7	9	6.3
Calcium (Ca)	mg/kg	2100		279.3	287.8	8.5
Magnesium (Mg)	mg/kg	540		71.8	29.9	Drawdown
Iron (Fe)	mg/kg	430		57.2	73.4	16.2
Manganese (Mn)	mg/kg	81		10.8	5.9	Drawdown
Zinc (Zn)	mg/kg	14		1.9	0.7	Drawdown
Copper (Cu)	mg/kg	3.1		0.4	0.8	0.4
Boron (B)	mg/kg	0.68		0.1	0.4	0.3

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

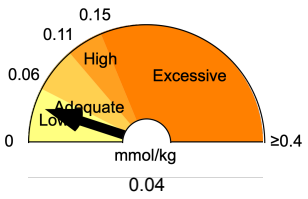
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m^3 and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**16.4**
Eff. Cation Exch. Capacity (eCEC):	**16.4**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **42**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Fine Sandy Clay Loam**
Estimated clay content:	**20 - 30%**
Tactually gravelly:	**Gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.9**

– Non-saline. Salinity effects on plants are mostly negligible.

Munsell Colour:	-
Structure Size:	**Medium (11 - 25mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Moderate**
Est. Permeability Class (mm/hr):	**5 - 20**
Additional comments:	

Organic Carbon (OC %):	**Very High - 4.7**
Organic Matter (OM %):	**8**
Est. Field Capacity (% water):	**28**
Est. Permanent Wilting Point (% water):	**15**
Est. Plant Available Water (% water):	**13**
Est. Plant Available Water (mm/m):	**130**

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 2** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

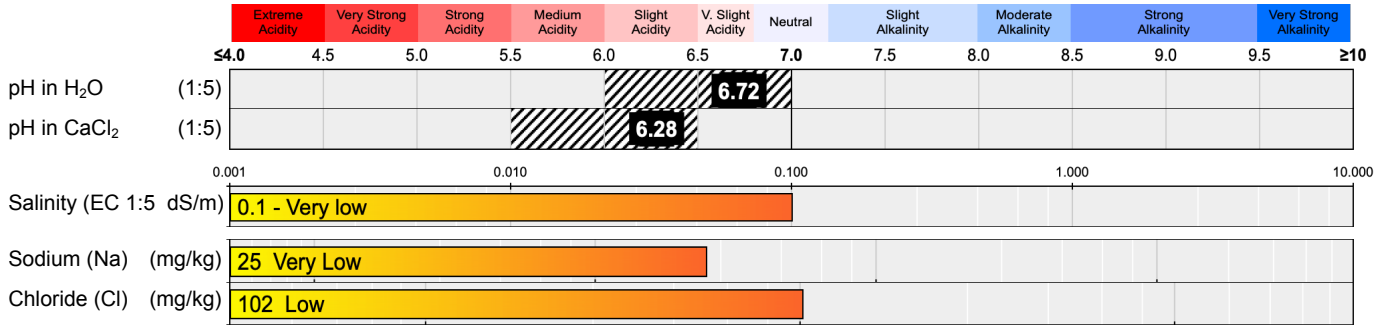
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 6 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

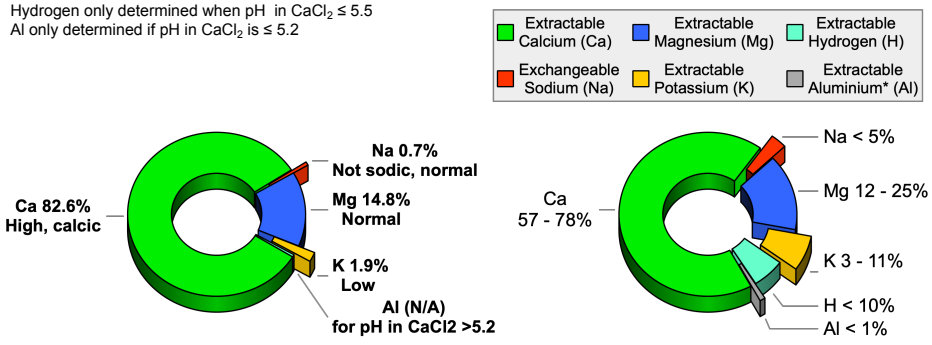
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**5.6**	3 – 6
Comment: Balanced		
Mg:K	**8**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**2.7**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.11	0.3	12.97	2.32	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 2** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 6 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	0.36		0	4	4
Phosphorus (P)	mg P/kg	14		1.9	8.4	6.5
Potassium (K)	mg/kg	120		16	40.4	24.4
Sulfur (S)	mg S/kg	20		2.7	9	6.3
Calcium (Ca)	mg/kg	2600		345.8	287.8	Drawdown
Magnesium (Mg)	mg/kg	280		37.2	29.9	Drawdown
Iron (Fe)	mg/kg	360		47.9	73.4	25.5
Manganese (Mn)	mg/kg	98		13	5.9	Drawdown
Zinc (Zn)	mg/kg	5.5		0.7	0.7	0
Copper (Cu)	mg/kg	2.5		0.3	0.8	0.5
Boron (B)	mg/kg	0.5		0.1	0.4	0.3

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

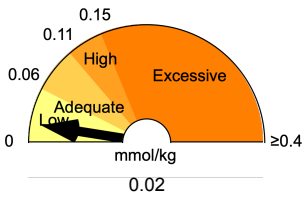
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**15.7**
Eff. Cation Exch. Capacity (eCEC):	**15.7**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sandy Loam**
Estimated clay content:	**10 - 20%**
Tactually gravelly:	**Gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**1.4**
– Non-saline. Salinity effects on plants are mostly negligible.	

Munsell Colour:	-
Structure Size:	**Medium (11 - 25mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**High - 2.6**
Organic Matter (OM %):	**4.4**
Est. Field Capacity (% water):	**26**
Est. Permanent Wilting Point (% water):	**9**
Est. Plant Available Water (% water):	**17**
Est. Plant Available Water (mm/m):	**170**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 3** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

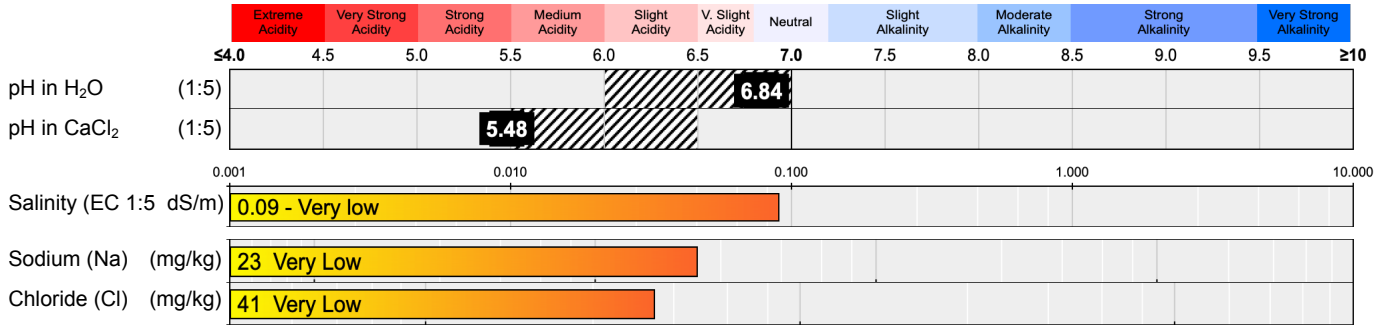
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 1**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

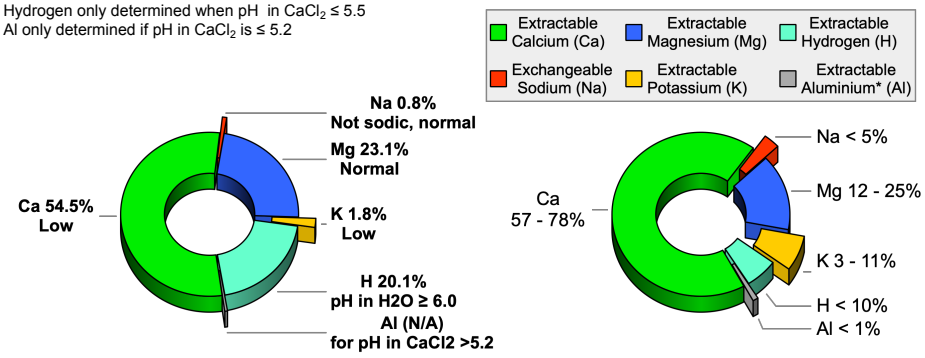
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



ACTUAL IDEAL

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2.4**	3 – 6
Comment: Calcium low		
Mg:K	**10**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**2.2**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.1	0.22	6.6	2.79	2.43	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 3** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 1**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	11		1.5	4	2.5
Phosphorus (P)	mg P/kg	8.3		1.1	8.4	7.3
Potassium (K)	mg/kg	85		11.3	34.8	23.5
Sulfur (S)	mg S/kg	30		4	9	5
Calcium (Ca)	mg/kg	1300		172.9	248	75.1
Magnesium (Mg)	mg/kg	340		45.2	25.8	Drawdown
Iron (Fe)	mg/kg	380		50.5	73.4	22.9
Manganese (Mn)	mg/kg	50		6.7	5.9	Drawdown
Zinc (Zn)	mg/kg	6.6		0.9	0.7	Drawdown
Copper (Cu)	mg/kg	1.5		0.2	0.8	0.6
Boron (B)	mg/kg	0.19		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

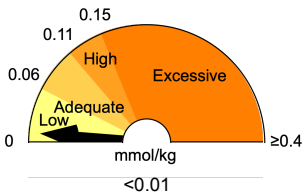
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.6**
Sum of Base Cations (cmol(+)/kg):	**9.7**
Eff. Cation Exch. Capacity (eCEC):	**12.1**
Base Saturation (%):	**80.17**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **179**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Loamy Sand**
Estimated clay content:	**5 - 10%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**2.1**

– Slightly saline. Growth on sensitive plant species is affected.

Munsell Colour:	**-**
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**High - 2.7**
Organic Matter (OM %):	**4.6**
Est. Field Capacity (% water):	**18**
Est. Permanent Wilting Point (% water):	**7**
Est. Plant Available Water (% water):	**11**
Est. Plant Available Water (mm/m):	**110**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 4** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

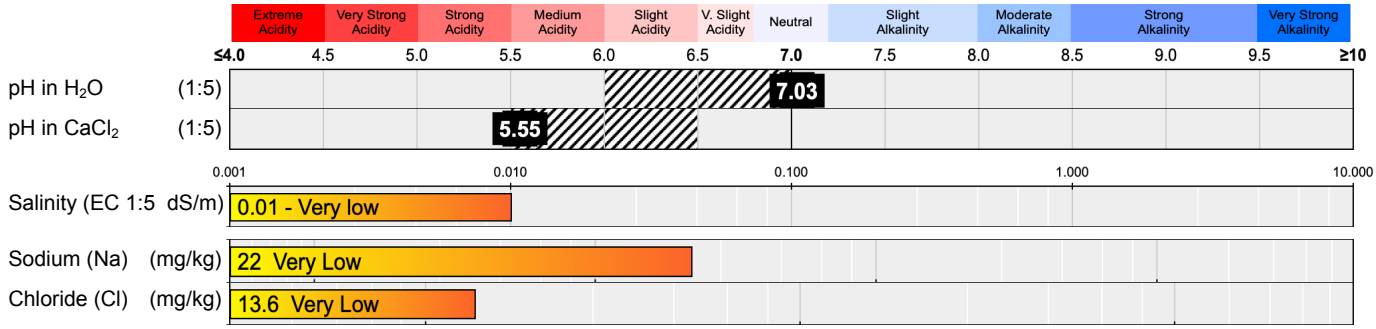
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

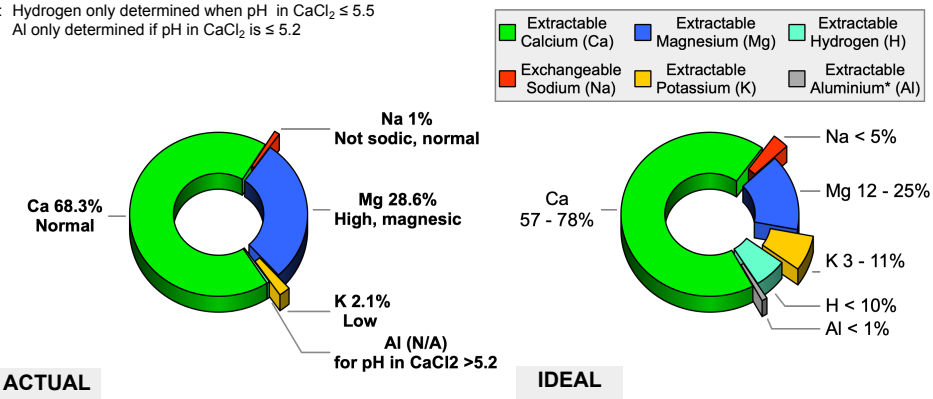
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2 \leq 5.5$
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2.4**	3 – 6
Comment: Calcium low		
Mg:K	**10**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**2**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.1	0.2	6.56	2.75	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 4** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	1.8		0.2	4	3.8
Phosphorus (P)	mg P/kg	7.8		1	8.4	7.4
Potassium (K)	mg/kg	77		10.2	29.3	19.1
Sulfur (S)	mg S/kg	33		4.4	9	4.6
Calcium (Ca)	mg/kg	1300		172.9	208.3	35.4
Magnesium (Mg)	mg/kg	330		43.9	21.7	Drawdown
Iron (Fe)	mg/kg	370		49.2	73.4	24.2
Manganese (Mn)	mg/kg	50		6.7	5.9	Drawdown
Zinc (Zn)	mg/kg	6.6		0.9	0.7	Drawdown
Copper (Cu)	mg/kg	1.5		0.2	0.8	0.6
Boron (B)	mg/kg	0.12		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

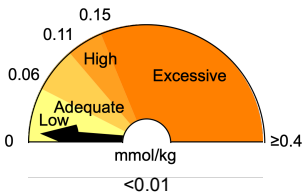
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m^3 and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**9.6**
Eff. Cation Exch. Capacity (eCEC):	**9.6**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sand**
Estimated clay content:	**< 5%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.2**
– Non-saline. Salinity effects on plants are mostly negligible.	

Munsell Colour:	-
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Apedal - Single**
Structural Unit:	**No Structure**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Low - 0.7**
Organic Matter (OM %):	**1.2**
Est. Field Capacity (% water):	**8 - 14**
Est. Permanent Wilting Point (% water):	**4**
Est. Plant Available Water (% water):	**4 - 10**
Est. Plant Available Water (mm/m):	**40 - 100**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 5** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

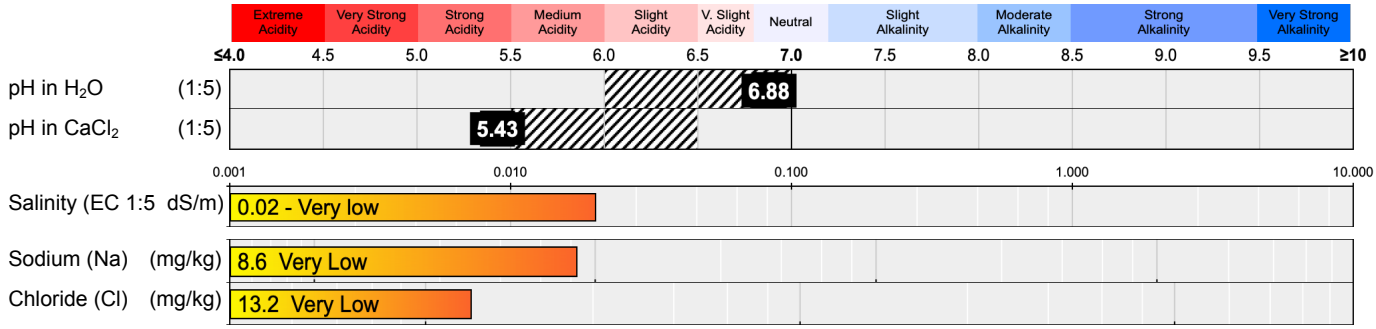
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 3**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

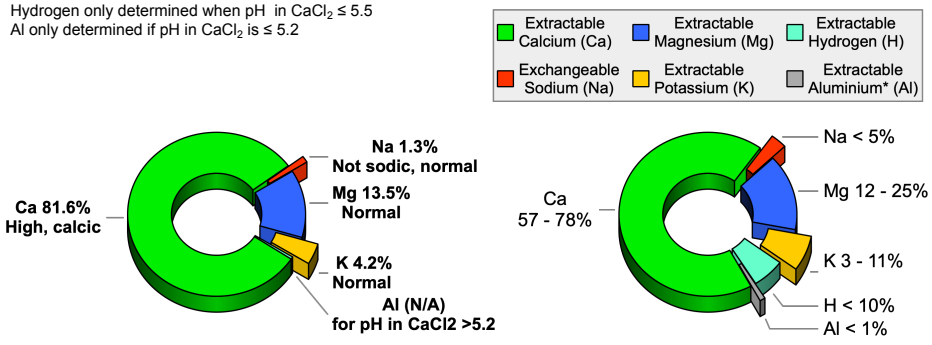
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**6**	3 – 6
Comment: Balanced		
Mg:K	**3**	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	**0.04**	< 0.07
Comment: Acceptable		
K:Na	**3.3**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.04	0.13	2.53	0.42	0	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 5** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 3**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	1.3		0.2	4	3.8
Phosphorus (P)	mg P/kg	6.5		0.9	8.4	7.5
Potassium (K)	mg/kg	52		6.9	23.7	16.8
Sulfur (S)	mg S/kg	15		2	9	7
Calcium (Ca)	mg/kg	510		67.8	168.5	100.7
Magnesium (Mg)	mg/kg	51		6.8	17.8	11
Iron (Fe)	mg/kg	130		17.3	73.4	56.1
Manganese (Mn)	mg/kg	16		2.1	5.9	3.8
Zinc (Zn)	mg/kg	2.5		0.3	0.7	0.4
Copper (Cu)	mg/kg	1.3		0.2	0.8	0.6
Boron (B)	mg/kg	0.19		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

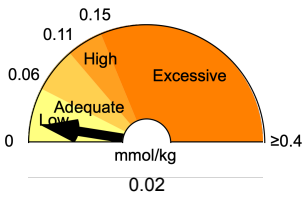
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**8.1**
Sum of Base Cations (cmol(+)/kg):	**3.1**
Eff. Cation Exch. Capacity (eCEC):	**3.1**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sand**
Estimated clay content:	**< 5%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.5**

– Non-saline. Salinity effects on plants are mostly negligible.

Munsell Colour:	**-**
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Apedal - Single**
Structural Unit:	**No Structure**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Very low - 0.5**
Organic Matter (OM %):	**0.8**
Est. Field Capacity (% water):	**8 - 14**
Est. Permanent Wilting Point (% water):	**4**
Est. Plant Available Water (% water):	**4 - 10**
Est. Plant Available Water (mm/m):	**40 - 100**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 6** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

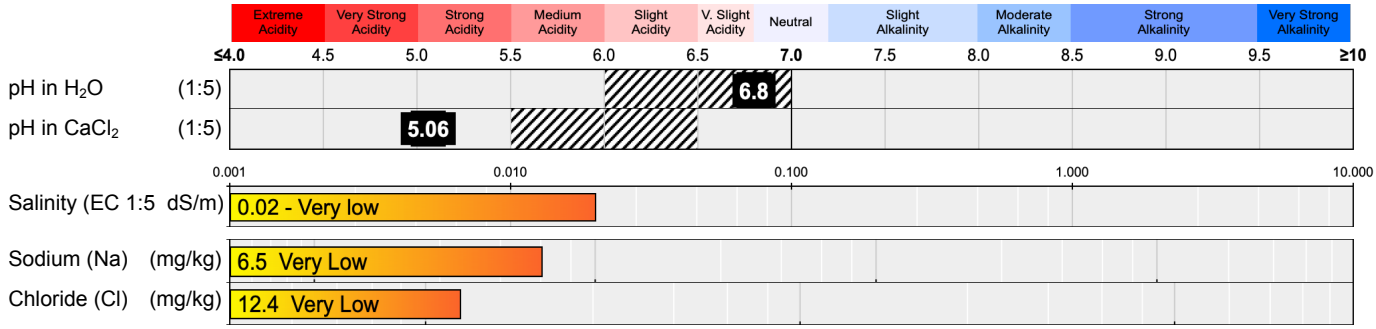
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 4**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

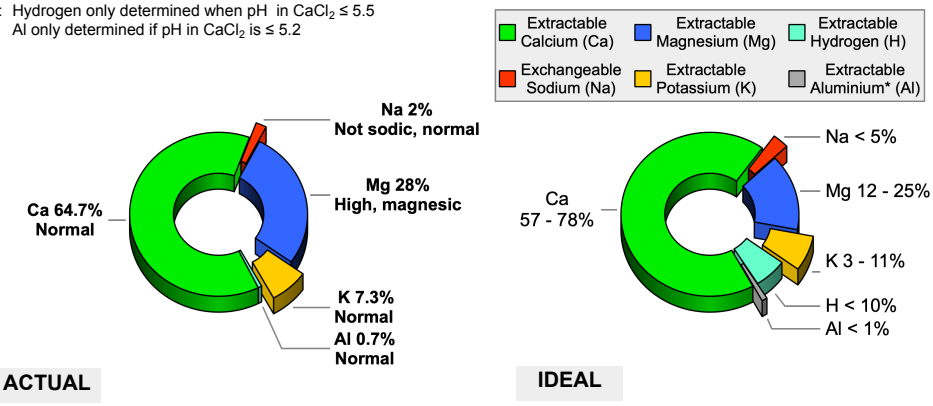
pH and ELECTRICAL CONDUCTIVITY



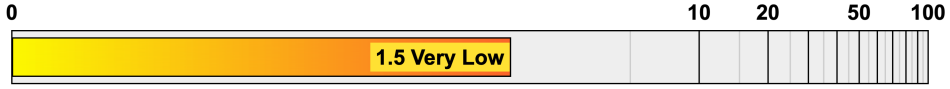
CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2.3**	3 – 6
Comment: Calcium low		
Mg:K	**4**	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	**0.08**	< 0.07
Comment: High		
K:Na	**3.7**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.03	0.11	0.97	0.42	0	0.01

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 6** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 4**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	2.2		0.3	4	3.7
Phosphorus (P)	mg P/kg	5.7		0.8	8.4	7.6
Potassium (K)	mg/kg	43		5.7	23.7	18
Sulfur (S)	mg S/kg	9.4		1.3	9	7.7
Calcium (Ca)	mg/kg	190		25.3	168.5	143.2
Magnesium (Mg)	mg/kg	51		6.8	17.8	11
Iron (Fe)	mg/kg	110		14.6	73.4	58.8
Manganese (Mn)	mg/kg	12		1.6	5.9	4.3
Zinc (Zn)	mg/kg	1.5		0.2	0.7	0.5
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7
Boron (B)	mg/kg	<0.1		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

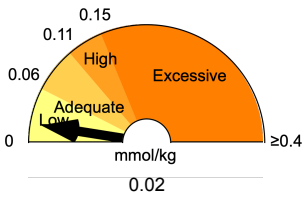
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**8.1**
Sum of Base Cations (cmol(+)/kg):	**1.5**
Eff. Cation Exch. Capacity (eCEC):	**1.5**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0:	**0**
– to neutralise Al:	**1**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **5**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sand**
Estimated clay content:	**< 5%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.5**
– Non-saline. Salinity effects on plants are mostly negligible.	

Munsell Colour:	**-**
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Apedal - Single**
Structural Unit:	**No Structure**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Very low - 0.5**
Organic Matter (OM %):	**0.8**
Est. Field Capacity (% water):	**8 - 14**
Est. Permanent Wilting Point (% water):	**4**
Est. Plant Available Water (% water):	**4 - 10**
Est. Plant Available Water (mm/m):	**40 - 100**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 7** **Date Report Generated: 11/03/2024** **Report Status: Final**

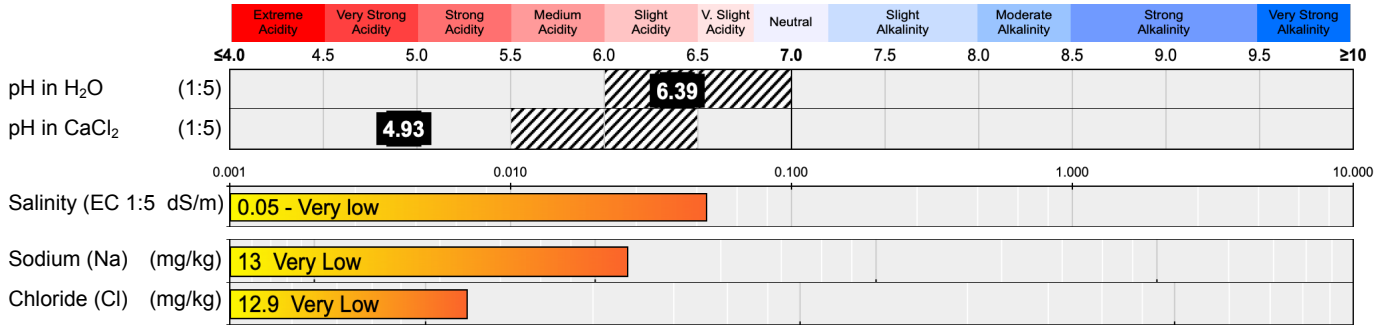
Client Name:	**Benedict Industries Pty Ltd**	Project Name:	**Menangle - FSC _Plus**
		SESL Quote N°:	
Client Contact:	**Results**	Sample Name:	**Stage 7 Restoration Area PLOT 5**
Client Order N°:		Description:	**Soil**
Address:	**PO Box 431** **FRENCHS FOREST NSW 1640**	Test Type:	**FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

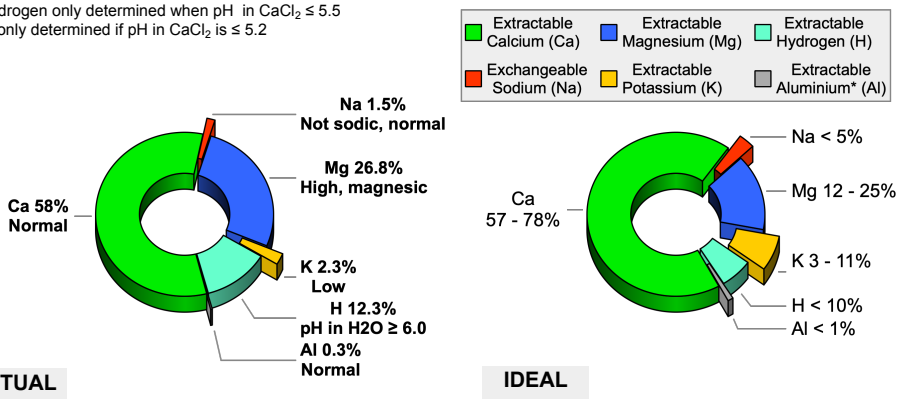
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2.2**	3 – 6
Comment: Calcium low		
Mg:K	**10**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.03**	< 0.07
Comment: Acceptable		
K:Na	**1.5**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.06	0.09	2.32	1.07	0.49	0.01

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 7** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 7 Restoration Area PLOT 5**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	9.1		1.2	4	2.8
Phosphorus (P)	mg P/kg	6.7		0.9	8.4	7.5
Potassium (K)	mg/kg	36		4.8	23.7	18.9
Sulfur (S)	mg S/kg	16		2.1	9	6.9
Calcium (Ca)	mg/kg	460		61.2	168.5	107.3
Magnesium (Mg)	mg/kg	130		17.3	17.8	0.5
Iron (Fe)	mg/kg	220		29.3	73.4	44.1
Manganese (Mn)	mg/kg	22		2.9	5.9	3
Zinc (Zn)	mg/kg	2.6		0.3	0.7	0.4
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7
Boron (B)	mg/kg	<0.1		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

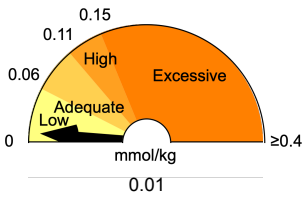
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.9**
Sum of Base Cations (cmol(+)/kg):	**3.5**
Eff. Cation Exch. Capacity (eCEC):	**4**
Base Saturation (%):	**87.5**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **1**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **43**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sand**
Estimated clay content:	**< 5%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**1.2**

– Non-saline. Salinity effects on plants are mostly negligible.

Munsell Colour:	**-**
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Moderate - 1.5**
Organic Matter (OM %):	**2.5**
Est. Field Capacity (% water):	**8 - 14**
Est. Permanent Wilting Point (% water):	**4**
Est. Plant Available Water (% water):	**4 - 10**
Est. Plant Available Water (mm/m):	**40 - 100**

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 8** **Date Report Generated: 11/03/2024** **Report Status: Final**

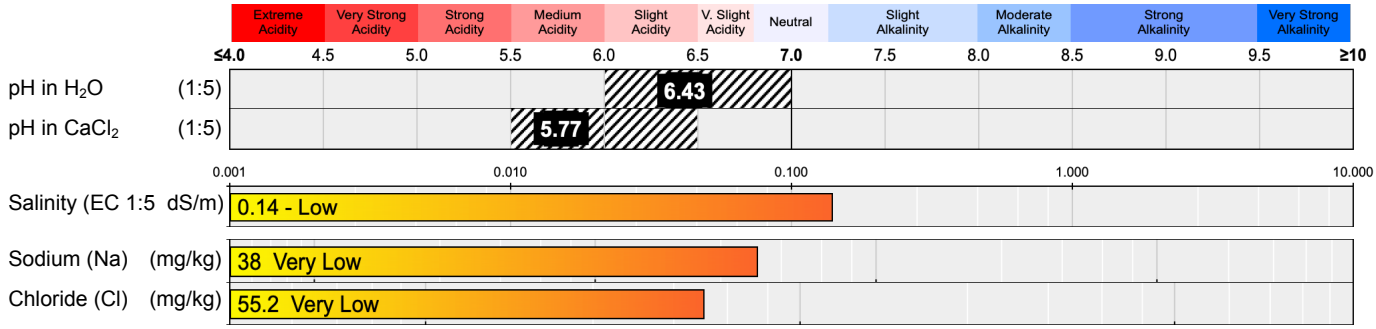
Client Name:	**Benedict Industries Pty Ltd**	Project Name:	**Menangle - FSC _Plus**
		SESL Quote N°:	
Client Contact:	**Results**	Sample Name:	**Stage 8 Restoration Area PLOT 1**
Client Order N°:		Description:	**Soil**
Address:	**PO Box 431** **FRENCHS FOREST NSW 1640**	Test Type:	**FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

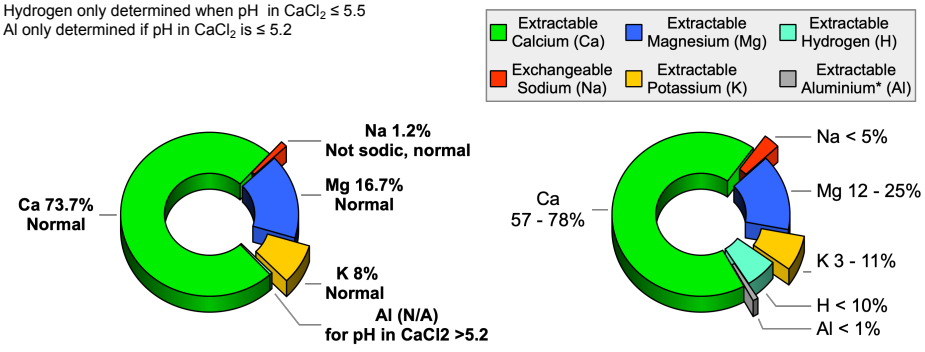
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**4.4**	3 – 6
Comment: Balanced		
Mg:K	**2**	2.6 – 5.0
Comment: Magnesium low		
K/(Ca+Mg)	**0.09**	< 0.07
Comment: High		
K:Na	**6.5**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.17	1.11	10.17	2.3	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
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Tel: 1300 30 40 80
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Batch N°: 67163 **Sample N°: 8** **Date Report Generated: 11/03/2024** **Report Status: Final**

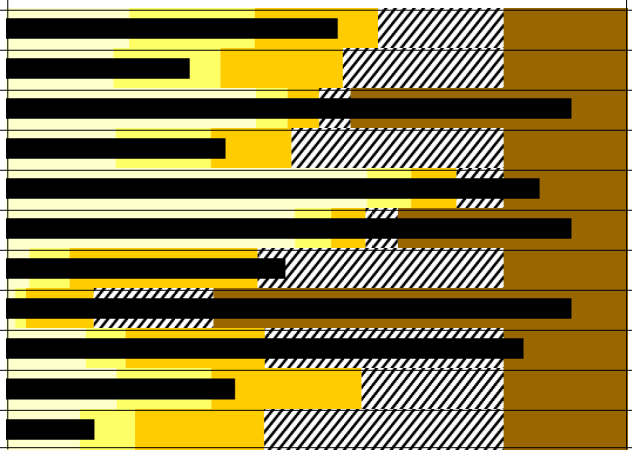
Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 8 Restoration Area PLOT 1**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	14		1.9	4	2.1
Phosphorus (P)	mg P/kg	24		3.2	8.4	5.2
Potassium (K)	mg/kg	430		57.2	34.8	Drawdown
Sulfur (S)	mg S/kg	30		4	9	5
Calcium (Ca)	mg/kg	2000		266	248	Drawdown
Magnesium (Mg)	mg/kg	280		37.2	25.8	Drawdown
Iron (Fe)	mg/kg	310		41.2	73.4	32.2
Manganese (Mn)	mg/kg	120		16	5.9	Drawdown
Zinc (Zn)	mg/kg	5.2		0.7	0.7	0
Copper (Cu)	mg/kg	2.9		0.4	0.8	0.4
Boron (B)	mg/kg	0.48		0.1	0.4	0.3



Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

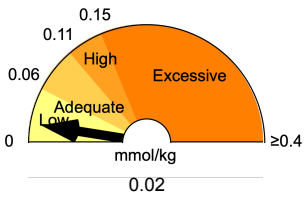
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	-
Sum of Base Cations (cmol(+)/kg):	**13.8**
Eff. Cation Exch. Capacity (eCEC):	**13.8**
Base Saturation (%):	**100**
Exchangeable Acidity (cmol(+)/kg):	-
Exchangeable Acidity (%):	-

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sandy Loam**
Estimated clay content:	**10 - 20%**
Tactually gravelly:	**Gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**2**
– Slightly saline. Growth on sensitive plant species is affected.	

Munsell Colour:	-
Structure Size:	**Medium (11 - 25mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**High - 2.3**
Organic Matter (OM %):	**3.9**
Est. Field Capacity (% water):	**26**
Est. Permanent Wilting Point (% water):	**9**
Est. Plant Available Water (% water):	**17**
Est. Plant Available Water (mm/m):	**170**

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 9** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

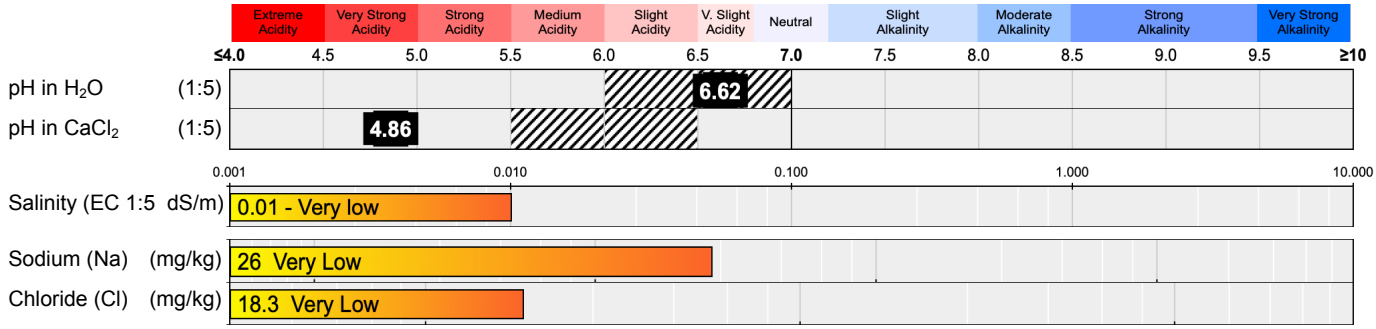
Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 8 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

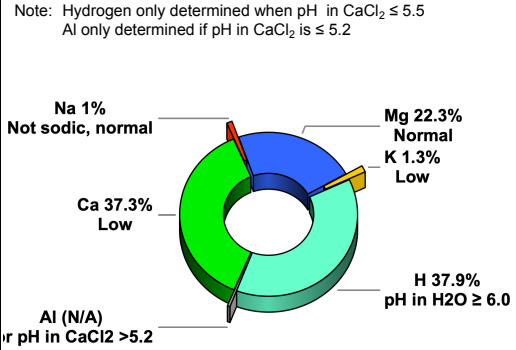
pH and ELECTRICAL CONDUCTIVITY



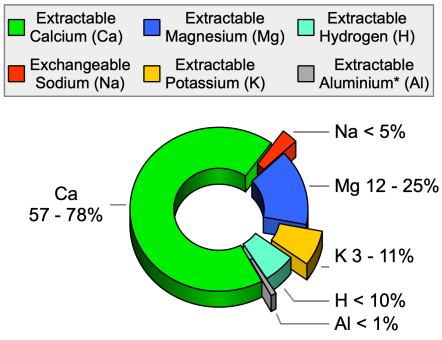
CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



ACTUAL



IDEAL

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**1.7**	3 – 6
Comment: Calcium low		
Mg:K	**20**	2.6 – 5.0
Comment: Potential Potassium		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**1.3**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.11	0.14	3.99	2.39	4.06	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 9** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 8 Restoration Area PLOT 2**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	1.2		0.2	4	3.8
Phosphorus (P)	mg P/kg	5.2		0.7	8.4	7.7
Potassium (K)	mg/kg	53		7	34.8	27.8
Sulfur (S)	mg S/kg	12		1.6	9	7.4
Calcium (Ca)	mg/kg	800		106.4	248	141.6
Magnesium (Mg)	mg/kg	290		38.6	25.8	Drawdown
Iron (Fe)	mg/kg	220		29.3	73.4	44.1
Manganese (Mn)	mg/kg	18		2.4	5.9	3.5
Zinc (Zn)	mg/kg	<0.65		0.1	0.7	0.6
Copper (Cu)	mg/kg	0.67		0.1	0.8	0.7
Boron (B)	mg/kg	<0.1		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

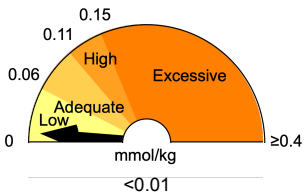
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.4**
Sum of Base Cations (cmol(+)/kg):	**6.6**
Eff. Cation Exch. Capacity (eCEC):	**10.7**
Base Saturation (%):	**61.68**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0:	**0**
– to neutralise Al:	**0**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **370**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sandy Loam**
Estimated clay content:	**10 - 20%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.1**

– Non-saline. Salinity effects on plants are mostly negligible.

Munsell Colour:	**-**
Structure Size:	**Medium (11 - 25mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**High - 2.4**
Organic Matter (OM %):	**4.1**
Est. Field Capacity (% water):	**26**
Est. Permanent Wilting Point (% water):	**9**
Est. Plant Available Water (% water):	**17**
Est. Plant Available Water (mm/m):	**170**

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 10** **Date Report Generated: 11/03/2024** **Report Status: Final**

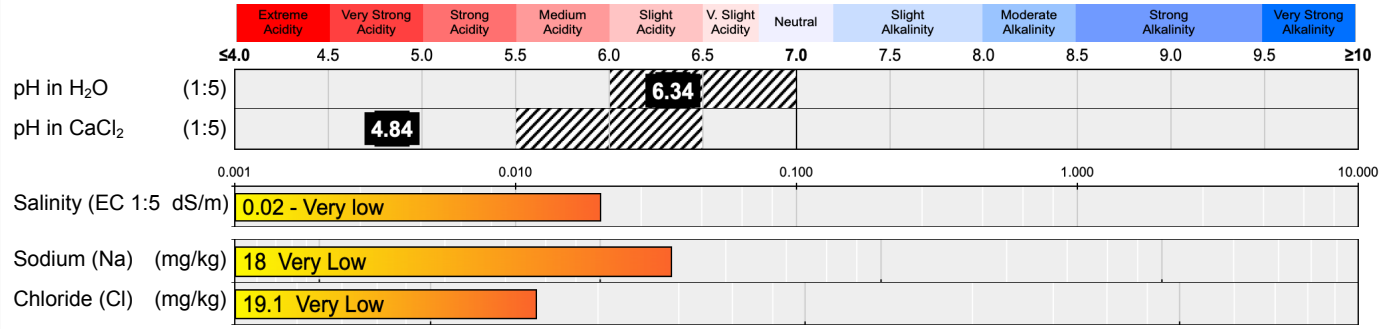
Client Name:	**Benedict Industries Pty Ltd**	Project Name:	**Menangle - FSC _Plus**
		SESL Quote N°:	
Client Contact:	**Results**	Sample Name:	**Stage 8 Restoration Area PLOT 3**
Client Order N°:		Description:	**Soil**
Address:	**PO Box 431** **FRENCHS FOREST NSW 1640**	Test Type:	**FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

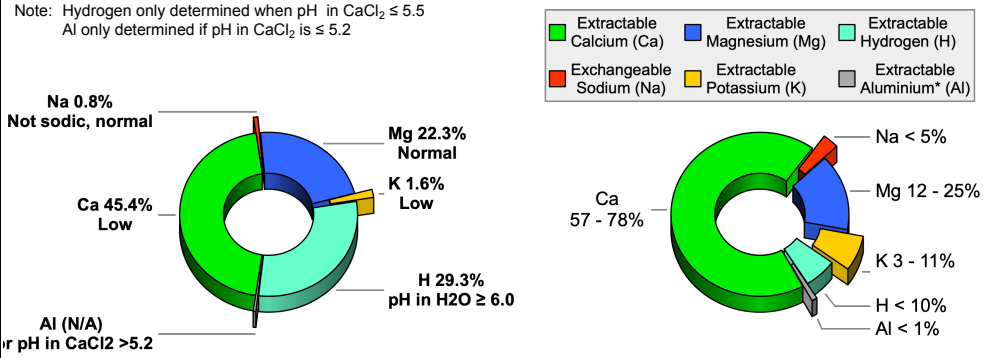
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)

CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**2**	3 – 6
Comment: Calcium low		
Mg:K	**10**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.02**	< 0.07
Comment: Acceptable		
K:Na	**2**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.08	0.16	4.45	2.19	2.87	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 10** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Stage 8 Restoration Area PLOT 3**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	2.5		0.3	4	3.7
Phosphorus (P)	mg P/kg	6.3		0.8	8.4	7.6
Potassium (K)	mg/kg	64		8.5	29.3	20.8
Sulfur (S)	mg S/kg	12		1.6	9	7.4
Calcium (Ca)	mg/kg	890		118.4	208.3	89.9
Magnesium (Mg)	mg/kg	270		35.9	21.7	Drawdown
Iron (Fe)	mg/kg	180		23.9	73.4	49.5
Manganese (Mn)	mg/kg	15		2	5.9	3.9
Zinc (Zn)	mg/kg	2.2		0.3	0.7	0.4
Copper (Cu)	mg/kg	0.74		0.1	0.8	0.7
Boron (B)	mg/kg	0.26		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

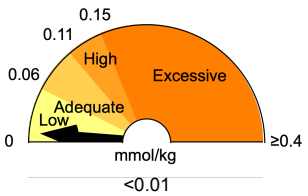
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.5**
Sum of Base Cations (cmol(+)/kg):	**6.9**
Eff. Cation Exch. Capacity (eCEC):	**9.8**
Base Saturation (%):	**70.41**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **0**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **248**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sandy Loam**
Estimated clay content:	**10 - 20%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.3**

– Non-saline. Salinity effects on plants are mostly negligible.

Munsell Colour:	**-**
Structure Size:	**Medium (11 - 25mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Moderate - 1.9**
Organic Matter (OM %):	**3.2**
Est. Field Capacity (% water):	**26**
Est. Permanent Wilting Point (% water):	**9**
Est. Plant Available Water (% water):	**17**
Est. Plant Available Water (mm/m):	**170**

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 11** **Date Report Generated: 11/03/2024** **Report Status: Final**

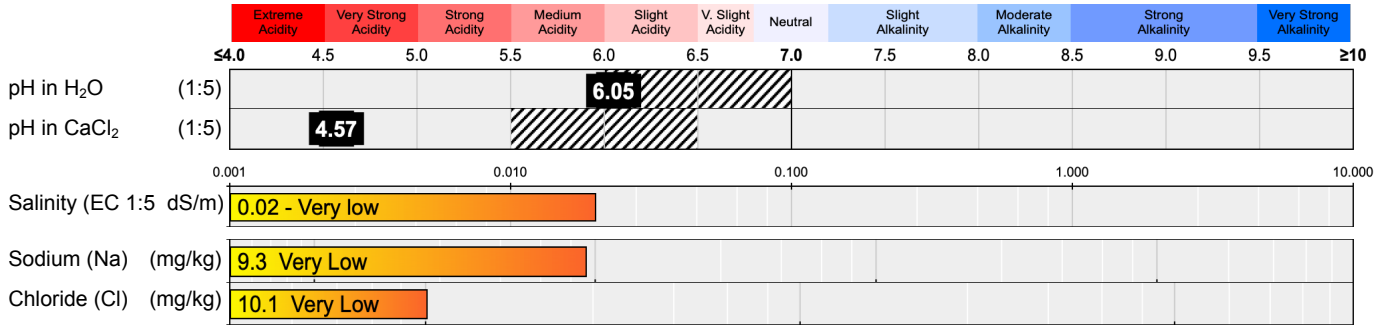
Client Name:	**Benedict Industries Pty Ltd**	Project Name:	**Menangle - FSC _Plus**
		SESL Quote N°:	
Client Contact:	**Results**	Sample Name:	**Substage 8A Restoration Area PLOT 1**
Client Order N°:		Description:	**Soil**
Address:	**PO Box 431** **FRENCHS FOREST NSW 1640**	Test Type:	**FSC_Plus**

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

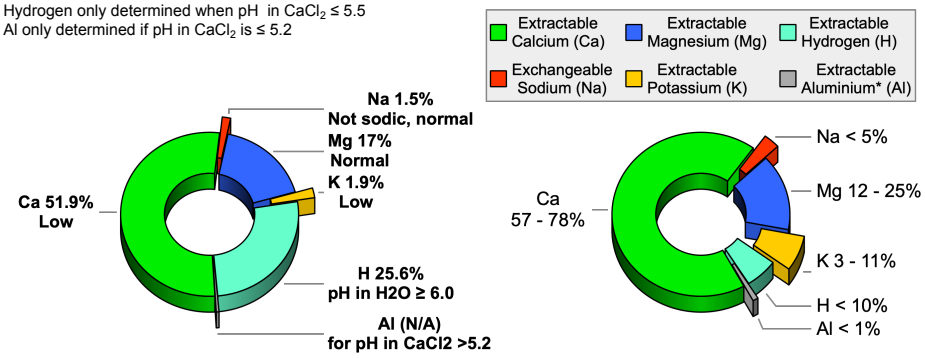
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

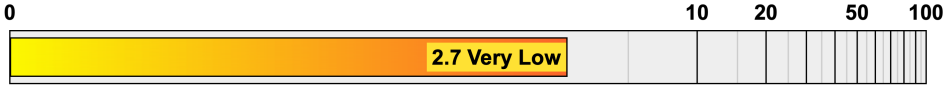
EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in $CaCl_2$ ≤ 5.5
Al only determined if pH in $CaCl_2$ is ≤ 5.2



ACTUAL IDEAL

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	**3**	3 – 6
Comment: Balanced		
Mg:K	**9**	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	**0.03**	< 0.07
Comment: Acceptable		
K:Na	**1.3**	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.04	0.05	1.4	0.46	0.69	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC *cmol(+)/kg* are the SI unit and are equivalent to *meq/100g*.

Consultant: Annalise Grieve

Authorised Signatory: Owen Guy

Soil Chemistry Profile
Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163 **Sample N°: 11** **Date Report Generated: 11/03/2024** **Report Status: Final**

Client Name: **Benedict Industries Pty Ltd**
Client Contact: **Results**
Client Order N°:
Address: **PO Box 431**
FRENCHS FOREST NSW 1640

Project Name: **Menangle - FSC _Plus**
SESL Quote N°:
Sample Name: **Substage 8A Restoration Area PLOT 1**
Description: **Soil**
Test Type: **FSC_Plus**

PLANT AVAILABLE NUTRIENTS

EFFECTIVE AMELIORATION DEPTH (mm): ◉ 100 ○ 150 ○ 200 **DESIRED FERTILITY CLASS:** ○ Low ◉ Moderate ○ High

Major Nutrients	Unit	Result	Very Low / Low / Marginal / Adequate / High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)
Nitrate-N (NO_3)	mg N/kg	3.7		0.5	4	3.5
Phosphorus (P)	mg P/kg	8.1		1.1	8.4	7.3
Potassium (K)	mg/kg	18		2.4	23.7	21.3
Sulfur (S)	mg S/kg	14		1.9	9	7.1
Calcium (Ca)	mg/kg	280		37.2	168.5	131.3
Magnesium (Mg)	mg/kg	56		7.4	17.8	10.4
Iron (Fe)	mg/kg	190		25.3	73.4	48.1
Manganese (Mn)	mg/kg	15		2	5.9	3.9
Zinc (Zn)	mg/kg	1.3		0.2	0.7	0.5
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7
Boron (B)	mg/kg	<0.1		0	0.4	0.4

Explanation of graph ranges:

Very Low Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

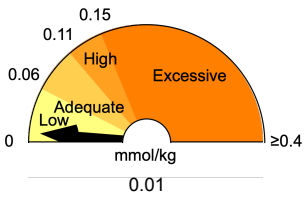
Marginal Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate Supply of this nutrient is adequate for the plant, and and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.
Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.
• g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH):	**7.9**
Sum of Base Cations (cmol(+)/kg):	**2**
Eff. Cation Exch. Capacity (eCEC):	**2.7**
Base Saturation (%):	**74.07**
Exchangeable Acidity (cmol(+)/kg):	**-**
Exchangeable Acidity (%):	**-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0:	**0**
– to neutralise Al:	**0**

Calculated Gypsum Application Rate (CGAR)
(g/sqm) to achieve 67.5 % exch. Ca: **48**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture:	**Sand**
Estimated clay content:	**< 5%**
Tactually gravelly:	**Not gravelly**
Tactually organic:	**Not Organic**
Calculated EC_{SE} (dS/m):	**0.5**
– Non-saline. Salinity effects on plants are mostly negligible.	

Munsell Colour:	**-**
Structure Size:	**Fine (1 - 10mm)**
Structural Organisation:	**Pedal - Weak**
Structural Unit:	**Crumb**
Potential infiltration rate:	**Very Rapid**
Est. Permeability Class (mm/hr):	**>120**
Additional comments:	

Organic Carbon (OC %):	**Low - 0.7**
Organic Matter (OM %):	**1.1**
Est. Field Capacity (% water):	**8 - 14**
Est. Permanent Wilting Point (% water):	**4**
Est. Plant Available Water (% water):	**4 - 10**
Est. Plant Available Water (mm/m):	**40 - 100**

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

Attachment D

Restoration Area 1 management summary

D.1 Biodiversity management actions in Restoration Area 1

The following biodiversity management actions were completed were completed in Restoration Area 1 in the reporting period 2023:

- Soil amelioration on the lower slopes
- Stabilisation and amelioration of the steeper slopes
- Seeding of native vegetation
- Erosion control measures
- Ongoing weed and pest control measures
- Established monitoring plots x 3 – marked out and sign posted.

D.2 Status of all biodiversity management actions in Restoration Area 1

The status of all biodiversity management actions in Restoration Area 1 funded by the Trust are summarised below.

Restoration Area 1 management actions summary																				
Management action	**Year**																			
	1*	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Soil amelioration (low slopes)	X	X																		
Stabilisation and soil amelioration (steep slopes)	X	X																		
Seeding native vegetation	X	X																		
Infill tubestock planting			X																	
Infill seeding			X																	
Erosion and sediment control maintenance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weed and pest control	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Planting maintenance 4 times/year			X	X	X	X	X													
Planting maintenance 2 times/year								X	X	X	X	X								
Planting maintenance 1 times/year													X	X	X	X	X	X	X	X
Fencing (installation)		X																		
Fencing (maintenance)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Establish monitoring locations and formal annual monitoring audit	X	X																		
Inspections & monitoring - establishment phase		X	X	X	X	X														
Inspections & monitoring - RA1 ongoing							X	X	X	X	X	X	X	X	X	X	X	X	X	X
Annual report preparation		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External review and audit		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Reporting period.

Legend

Management action required (X)
Required management action completed (C)
Required management action incomplete (IC)

Attachment E

Ecologist Report – Vegetation Restoration Assessment 2023:

Floristic plot data

Photo-point monitoring

Floristic monitoring assessment – Annual Performance

Weed mapping and monitoring

Ecological Monitoring

Menangle Sand and Soil Quarry

Prepared for Menangle Sand and Soil Pty Ltd

March 2024

Ecological Monitoring

Menangle Sand and Soil Quarry

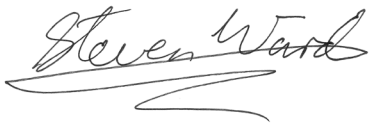
Menangle Sand and Soil Pty Ltd

E190166 RP57

March 2024

Version	Date	Prepared by	Approved by	Comments
V1	26 March 2024	C.Douchkov	-	Draft
v2	28 March 2024	C.Douchkov	S. Ward	Final

Approved by [to be completed on finalisation]



Steven Ward
Associate Director
28 March 2024

Level 3 175 Scott Street
Newcastle NSW 2300

TABLE OF CONTENTS

Attachments

Tables

1 Introduction

Menangle Sand and Soil Pty Ltd (Menangle Sand and Soil) operates the Menangle Sand and Soil Quarry ('the quarry') at 15 Menangle Road, Menangle. The quarry, located in the Wollondilly and Campbelltown local government areas, extracts sand and soil along the Nepean River as approved by Development Consent 85/2865 MOD2.

The Consolidated Consent ('the consent') allows the extraction of up to 150,000 tonnes per annum (tpa) of sand and soil from the approved Stage 8 area, which is about 13 hectares (ha) extending about 2 kilometres (km) along the Nepean River and divided into 13 separate sub-stages, designated sub-stage 8A to sub-stage 8M. As per condition B73 of the consent, a *Biodiversity and Rehabilitation Management Plan* (BRMP) (EMM, 2022) has been prepared for the quarry and governs the management of vegetation and clearing activities undertaken at the quarry site.

Extraction in the Stage 8 area of the quarry commenced on 4 September 2023. At the time of this report, Substage 8A has been extracted and rehabilitation commenced. Extraction of Substage 8B commenced in February 2024, with minimal rehabilitation to date.

The BRMP (Section 8.4) describes rehabilitation and restoration area monitoring that includes:

- floristic monitoring (BRMP Section 8.4.1)
- weed monitoring (BRMP Section 8.4.2).

EMM was engaged by Menangle Sand and Soil to undertake this floristic and weed monitoring in March 2024.

2 Method

2.1 Floristic monitoring

Biodiversity restoration and rehabilitation outcomes are monitored annually using permanent 20 m by 20 m floristic plots quadrats in the restoration and rehabilitation areas. The following parameters are monitored in the plots:

- native species diversity
- tree, shrub, grass, and forb diversity and abundance for both native and exotic species
- litter cover within five 1 m^2 subplots within each 20 m by 20 m floristic plot
- photographic monitoring points
- regeneration of overstorey species.

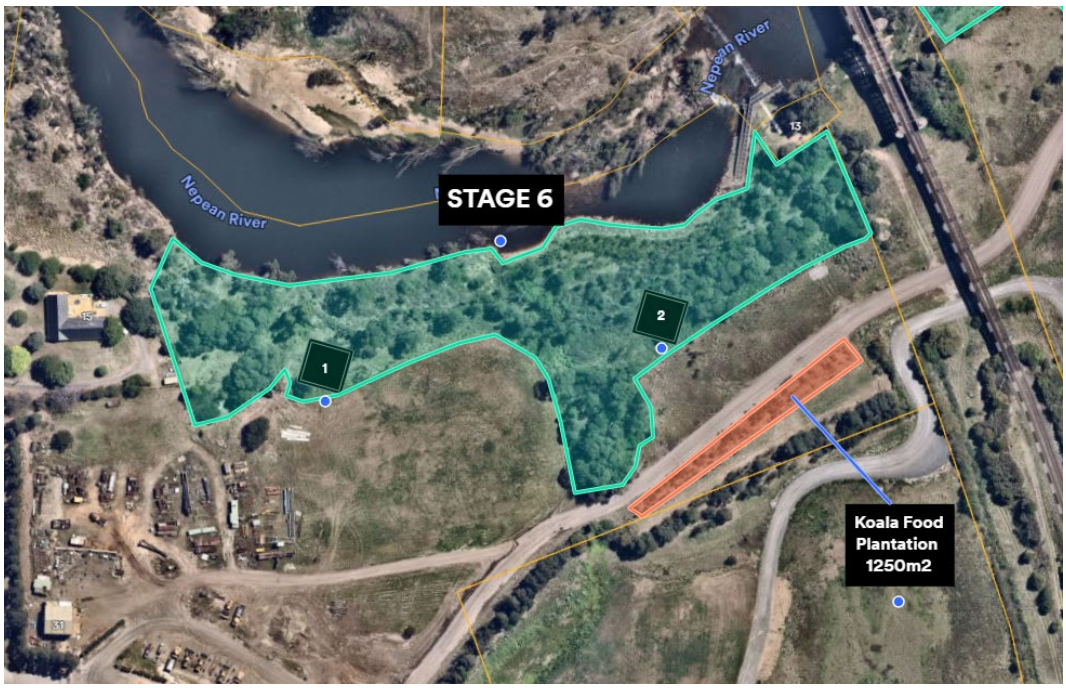
The monitoring methods for each of these aspects are described in BRMP Section 8.4.

The locations of monitoring plots are shown in BRMP Figure 6.1 (Stage 6), BRMP Figure 6.2 (Stage 7), and BRMP Figure 7.1 (Substages 8A–8C). Menangle Sand and Soil have established initial rehabilitation plots in each of these areas, where rehabilitation is more advanced than in the surrounding areas (see Figure 2.1, Figure 2.2 and Figure 2.3 below). These are not in the same locations as the BRMP monitoring plots.

The following plots were monitored:

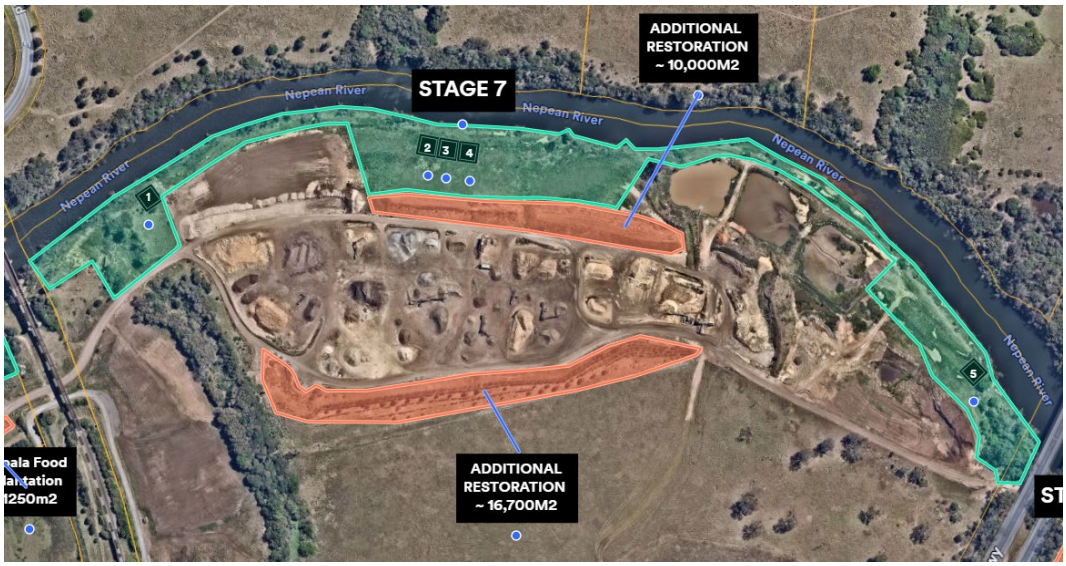
- Stage 6: Plot 6.1 and Plot 6.2
- Stage 7: Plot 7.1, Plot 7.3 (as representative of Plot 7.2–7.4), and Plot 7.5
- Stage 8A extraction/rehabilitation area: Plot 8A.1
- Stage 8 Restoration Area 1: Plot 8R1.1 to Plot 8R1.3.

Floristic monitoring was undertaken by EMM Consulting ecologists Paul Rossington and Callan Douchkov on 5 March 2024. Floristic monitoring was carried out within the plots established and maintained by Menangle Sand and Soil to provide information on early rehabilitation progress in these areas.



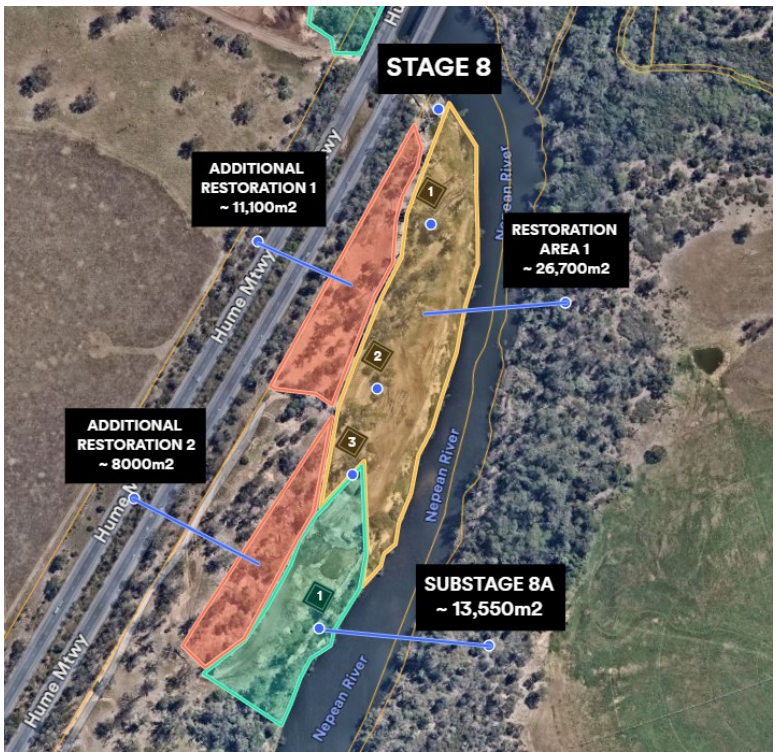
Source: Menangle and Soil.

Figure 2.1 Stage 6 area



Source: Menangle and Soil.

Figure 2.2 Stage 7 area



Source: Menangle and Soil.

Figure 2.3 Stage 7 area

2.2 Weed monitoring

EMM ecologist Callan Douchkov conducted the weed survey on 6 March 2024.

The survey was undertaken via walked transects at 20 m spacings across restoration and rehabilitation areas. Transect separation varied slightly where vegetation density and steep slope gradients impeded access.

Weed species were mapped via GPS recordings in field via point records (for infestations 1 m^2 to 25 m^2), and polygon records for infestations greater than 25 m^2. Polygon records were recorded by walking the boundary of each infestation, or estimated boundaries in the case of prohibited access by dense vegetation.

The weed monitoring survey primarily targeted the mapping of Lantana (*Lantana camara*), and Privet (*Ligustrum sinense* and *Ligustrum lucidum*). Observations of other weed species listed by the NSW Biodiversity Assessment Method (BAM) High Threat Weed (HTW) list were recorded to assess for weed species which are either new to the project or are forming/are likely to form a significant infestation within the project site.

Weed species which are new to the project site and likely to/are forming a significant infestation are classified as a 'novel weed species' and are included in the annual weed mapping program.

3 Results

3.1 Floristic monitoring

3.1.1 Floristic plot data

The floristic monitoring results are provided in Table 3.1.

Particularly in the Stage 8 area, the rehabilitation and restoration program has only recently commenced. The floristic monitoring indicates that up to 8 of the 24 target species characteristic of River-Flat Eucalypt Forest are present in the plots. The early establishment of a greater number of River-Flat Eucalypt Forest species will greatly assist in the long-term development of a high-quality vegetation community.

While the thick layer of mulch is supressing weed growth, it also appears to be inhibiting the growth of species characteristic of River-Flat Eucalypt Forest.

It is recommended that the mulching strategy is modified to improve the establishment of River-Flat Eucalypt Forest species. This will be assisted by additional seeding or planting. The weed management regime will need to be modified as part of changing the mulching strategy.

Floristic data sheets are provided in Attachment A.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Vegetation establishment for soil stabilisation in Stage 8 areas				
Initial planting/seeding for soil stabilisation	Substage 8A: Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	Extraction of Substage 8A commenced in September 2023. Plot 8A.1 Plot 8A.1 has evidence of hydroseeding having been undertaken. Ground cover: Native: 3.5% Invasive: 5% Total: 8.5%	No	One plot has been established within the Substage 8A area. Evidence of hydromulch application to the area within the plot was observed, with the total coverage of native ground cover calculated at 3.5%. As this survey constitutes as the first monitoring period, the current value of ground cover observed will serve as a benchmark for comparison and improvement upon in the following year.
	Substage 8B area	Extraction commenced in February 2024. Monitoring not commenced.	N/A	-
	Substage 8C area	Extraction/rehabilitation not commenced. Monitoring not commenced.	N/A	-

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Restoration Area 1: Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	Plot 8R1.1 Evidence of slashing, weed spraying and soil scraping observed within plot. Ground cover: Native:69.5% Invasive: 1.4% Total: 70.9% Plot 8R1.2 Evidence of slashing, weed spraying and soil scraping observed within plot. Ground cover: Native: 5.6% Invasive: 9.2% Total: 14.8% Plot 8R1.3 Evidence of slashing, weed spraying and soil scraping observed within plot. Ground cover: Native: 12.2% Invasive: 16.2% Total: 28.4%	No	Three plots have been established within the Stage 8 restoration area. Evidence of tube stock planting was observed at all three plots, and hydromulch application observed at plot 8R1.1. As this survey constitutes as the first monitoring period, the current value of ground cover observed will serve as a benchmark for comparison and improvement upon in the following year.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Substage 8A area rehabilitation vegetation management				
Vegetation management, including planting/seeding of native species in Substage 8A area.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	Plot 8A.1 Based on the floristic monitoring records (Attachment A), there are currently 7 species characteristic of HN526 within this plot area.	No	Hydromulch application was also observed to have occurred within this plot area. Tube stock planting has not been undertaken in this plot area. It is recommended that planting of native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	Plot 8A.1 Plot 8A.1 was observed to have recently been established, with a soil-stabilising hydromulch applied and rehabilitation plantings not having taken place. One HN526 canopy species were observed at the canopy layer (*Eucalyptus botryoides*) to comprise 10% coverage of the plot. One other HN526 canopy species was also observed within the plot (*Angophora floribunda*), however this species was observed as a sprouting within the groundcover layer. One HN526 midstory species (*Acacia parramattensis*) was observed within the plot as a sprouting within the groundcover layer. Four HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 0.5%.	No	Hydromulch application was also observed to have occurred within this plot area. Tube stock planting has not been undertaken in this plot area. It is recommended that planting of native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	Plot 8A.1 Total foliage cover allocated to Tree Growth (TG) within plot 8A.1 is 10%. One TG species was observed within the rehabilitation plot (*Angophora floribunda*), however was identified to be a newly sprouted individual and not applicable to the Tree layer at time of survey.	No	Species counted towards TG are comprised of HN526 species only. It is recommended that planting of native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	Plot 8A.1 Total foliage cover allocated to Shrub Growth (SG) within plot 8A.1 is 0%. One SG species was observed within the rehabilitation plot (*Acacia parramattensis*), however was identified to be a newly sprouted individual and not applicable to the Shrub layer at time of survey.	No	Species counted towards SG are comprised of HN526 species only. It is recommended that additional planting of native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	Plot 8A.1 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8A.1 is 0.1%	No	Species counted towards GG are comprised of HN526 species only. It is recommended that additional planting of native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	Plot 8A.1 Total foliage cover allocated to Forb Growth (FG) within plot 8A.1 is 0.4%	No	Species counted towards FG are comprised of HN526 species only. It is recommended that additional planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Ongoing vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: The cover and species richness of the groundcover is stable or increasing. Evidence of plant reproduction and regeneration is present.	Plot 8A.1 Cover and species richness of native groundcover species within the plot is low. No evidence of plant reproduction and regeneration was observed within the plot.	No	Planting of native species has not been undertaken within the plot. This monitoring period constitutes the first monitoring event for this plot, therefore no prior years monitoring results are available to assess against.
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	Plot 8A.1 Cover and species richness of native groundcover, including grasses and forbs was assessed to be below the benchmark ranges.	No	It is recommended that planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	Plot 8A.1 No second generation individuals observed within plot 8A.1.	No	First-generation plants have not yet been planted in the plot.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	Plot 8A.1 Cover of HTW and priority weeds within the plot was assessed to be 1.8% coverage. Also see weed mapping (Section 3.2).	Yes	It is recommended that weed management measures are continued to keep HTW and priority weed species suppressed within the vegetation management areas.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	Plot 8A.1 Average litter cover was calculated from each 5-set sub-plot assessed within Plot 8A.1. Average litter cover: 9.4%	No	This monitoring period constitutes the first monitoring event for this plot, therefore no prior years monitoring results are available to assess whether litter cover within plot 8A.1 is trending towards the BAM benchmark of 40.
Substage 8B vegetation management				
Vegetation management	As for Substage 8A	Extraction commenced in February 2024. Monitoring not commenced.		
Substage 8C vegetation management				
Vegetation management	As for Substage 8A	Extraction/rehabilitation not commenced. Monitoring not commenced.		
Restoration Area 1 vegetation management				

Vegetation management, including planting/seeding of native species in Restoration Area 1.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	Plot 6.1 Based on the floristic monitoring records (Attachment A), there are currently 4 species characteristic of HN526 within this plot area. Plot 6.2 Based on the floristic monitoring records (Attachment A), there are currently 5 species characteristic of HN526 within this plot area. Plot 7.1 Based on the floristic monitoring records (Attachment A), there are currently 4 species characteristic of HN526 within this plot area. Plot 7.3 Based on the floristic monitoring records (Attachment A), there are currently 8 species characteristic of HN526 within this plot area. Plot 7.5 Based on the floristic monitoring records (Attachment A), there are currently 2 species characteristic of HN526 within this plot area. Plot 8R1.1 Based on the floristic monitoring records (Attachment A), there are currently 4 species characteristic of HN526 within this plot area. Plot 8R1.2 Based on the floristic monitoring records (Attachment A), there are currently 5 species characteristic of HN526 within this plot area. Plot 8R1.3 Based on the floristic monitoring records (Attachment A), there are currently 3 species characteristic of HN526 within this plot area. Results from this monitoring period comprise the first monitoring results for the rehabilitation plots. These results will therefore form baseline values to be compared to for the following monitoring year.	No	This monitoring period constitutes the first monitoring event for the Restoration Area 1 plots, therefore no prior years monitoring results are available to assess whether HN526 native plant species diversity within monitored plots is trending towards HN526. It is recommended that mulch within plots 6.1, 6.2, 7.1, and 7.5 is removed and replaced with topsoil, as the mulch covering will exclude growth of native understory species required to establish HN526. It is recommended that planting of additional native flora species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	Plot 6.1 Plot 6.1 recorded three HN526 canopy species (two as fully formed trees at a total of 11% plot coverage, and one as tube stock), and one HN526 groundcover species at 0.1% plot coverage. Plot 6.2 Plot 6.2 recorded three HN526 canopy species at 15% plot coverage, and two HN526 groundcover species at 0.2% plot coverage. Plot 7.1 Plot 7.1 recorded three HN526 canopy species (two as emerging trees at a total of 3% plot coverage, and one as tube stock), and one HN526 groundcover species at 0.1% plot coverage. Plot 7.3 Plot 7.3 recorded two HN526 canopy species as tube stock plantings at a total of 0.5% plot coverage, one emerging HN526 midstory shrub species at 0.2% plot coverage, and five HN526 groundcover species at 0.5% plot coverage. Plot 7.5 Plot 7.5 recorded one HN526 canopy species as newly planted tube stock at 0.1% plot coverage, and one HN526 groundcover species as newly planted tube stock at 0.1% plot coverage. Plot 8R1.1 Plot 8R1.1 recorded three HN526 canopy species as newly planted tube stock at 0.3% total plot coverage, and one HN526 groundcover species at 0.1% plot coverage. Plot 8R1.2 Plot 8R1.2 recorded four HN526 canopy species as newly planted tube stock at 0.7% total plot coverage, and one HN526 groundcover species at 1% plot coverage. Plot 8R1.3 Plot 8R1.3 recorded two HN526 canopy species as newly planted tube stock at 0.2% total plot coverage, and one HN526 groundcover species at 7% plot coverage.	No	This monitoring period constitutes the first monitoring event for the Restoration Area 1 plots, therefore no prior years monitoring results are available to assess whether HN526 native plant species structure within monitored plots is effectively progressing towards the creation of HN526. Results from this monitoring period will form baseline values to be compared to the following monitoring year. It is recommended that planting of native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	Plot 6.1 Total foliage cover allocated to Tree Growth (TG) within plot 6.1 is 11.1%. Plot 6.2 Total foliage cover allocated to Tree Growth (TG) within plot 6.2 is 15%. Plot 7.1 Total foliage cover allocated to Tree Growth (TG) within plot 7.1 is 1.1%. Plot 7.3 Total foliage cover allocated to Tree Growth (TG) within plot 7.3 is 0.5%. Plot 7.5 Total foliage cover allocated to Tree Growth (TG) within plot 7.5 is 0.1%. Plot 8R1.1 Total foliage cover allocated to Tree Growth (TG) within plot 8R1.1 is 0.3%. Plot 8R1.2 Total foliage cover allocated to Tree Growth (TG) within plot 8R1.2 is 0.7%. Plot 8R1.3 Total foliage cover allocated to Tree Growth (TG) within plot 8R1.3 is 0.3%.	No	Species counted towards TG are comprised of HN526 species only. Results from this monitoring period comprise the first monitoring results for the plots. These results will therefore form baseline values to be compared to for the following monitoring year.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	Plot 6.1 Total foliage cover allocated to Shrub Growth (SG) within plot 6.1 is 0%. Plot 6.2 Total foliage cover allocated to Shrub Growth (SG) within plot 6.2 is 0%. Plot 7.1 Total foliage cover allocated to Shrub Growth (SG) within plot 7.1 is 2%. Plot 7.3 Total foliage cover allocated to Shrub Growth (SG) within plot 7.3 is 0.2%. Plot 7.5 Total foliage cover allocated to Shrub Growth (SG) within plot 7.5 is 0%. Plot 8R1.1 Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.1 is 0%. Plot 8R1.2 Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.2 is 0%. Plot 8R1.3 Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.3 is 0%.	No	Species counted towards SG are comprised of HN526 species only. Results from this monitoring period comprise the first monitoring results for the plots. These results will therefore form baseline values to be compared to for the following monitoring year.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	Plot 6.1 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 6.1 is 0.1%. Plot 6.2 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 6.2 is 0.2%. Plot 7.1 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.1 is 0.1%. Plot 7.3 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.3 is 0.3%. Plot 7.5 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.5 is 0.1%. Plot 8R1.1 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.1 is 0%. Plot 8R1.2 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.2 is 0%. Plot 8R1.3 Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.3 is 0%.	No	Species counted towards GG are comprised of HN526 species only. Results from this monitoring period comprise the first monitoring results for the plots. These results will therefore form baseline values to be compared to for the following monitoring year.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	Plot 6.1 Total foliage cover allocated to Forb Growth (FG) within plot 6.1 is 0%. Plot 6.2 Total foliage cover allocated to Forb Growth (FG) within plot 6.2 is 0%. Plot 7.1 Total foliage cover allocated to Forb Growth (FG) within plot 7.1 is 0%. Plot 7.3 Total foliage cover allocated to Forb Growth (FG) within plot 7.3 is 0.2%. Plot 7.5 Total foliage cover allocated to Forb Growth (FG) within plot 7.5 is 0%. Plot 8R1.1 Total foliage cover allocated to Forb Growth (FG) within plot 8R1.1 is 0.1%. Plot 8R1.2 Total foliage cover allocated to Forb Growth (FG) within plot 8R1.2 is 1%. Plot 8R1.3 Total foliage cover allocated to Forb Growth (FG) within plot 8R1.3 is 7%.	No	Species counted towards FG are comprised of HN526 species only. Results from this monitoring period comprise the first monitoring results for the plots. These results will therefore form baseline values to be compared to for the following monitoring year.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Second generation individuals of shrubs and trees are present.	Plot 6.1 No second generation individuals observed within plot 6.1 Plot 6.2 No second generation individuals observed within plot 6.2 Plot 7.1 No second generation individuals observed within plot 7.2 Plot 7.3 No second generation individuals observed within plot 7.3 Plot 7.5 No second generation individuals observed within plot 7.5 Plot 8R1.1 No second generation individuals observed within plot 8R1.1 Plot 8R1.2 No second generation individuals observed within plot 8R1.2 Plot 8R1.3 No second generation individuals observed within plot 8R1.3	No	No second generation individuals of shrubs or trees were observed in any of the assessed plots.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	Plot 6.1 Total HTW and priority weed coverage: 0.5% Plot 6.2 Total HTW and priority weed coverage: 1.9% Plot 7.1 Total HTW and priority weed coverage: 1.8% Plot 7.3 Total HTW and priority weed coverage: 3.5% Plot 7.5 Total HTW and priority weed coverage: 0.2% Plot 8R1.1 Total HTW and priority weed coverage: 0.4% Plot 8R1.2 Total HTW and priority weed coverage: 0.6% Plot 8R1.3 Total HTW and priority weed coverage: 2.7% Also see weed mapping (Section 3.2).	No	All plots except Plot 7.3 and Plot 8R1.3 recorded high threat and priority weed coverage of less than 2%. *Paspalum quadrifarium* (Tussock Paspalum) was recorded as the highest coverage HTW species in Plot 7.3 at 2% *Bidens pilosa* (Cobblers pegs) was recorded as the highest coverage HTW species in Plot 8R1.3 at 2%.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	Average litter cover was calculated from each 5-set sub-plot per plot. Plot 6.1 Average litter cover: 90% Plot 6.2 Average litter cover: 74% Plot 7.1 Average litter cover: 74% Plot 7.3 Average litter cover: 40% Plot 7.5 Average litter cover: 85% Plot 8R1.1 Average litter cover: 47% Plot 8R1.2 Average litter cover: 9.8% Plot 8R1.3 Average litter cover: 17%	No	For rehabilitation plots 6.1, 6.2, 7.1, and 7.5, evidence of soil scraping was observed, and a thick layer of mulch applied to the entire plot area.

3.1.2 Photo-point monitoring

Photo-point monitoring results are presented below. These will be used in future monitoring programs to provide a visual reference of restoration/rehabilitation success.

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	6.1	N/A: 2023 is the first year of monitoring.	
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	6.2		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	7.1		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	7.3		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken perpendicular to star picket across site.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	7.5		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	8R1.1		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	8R1.2		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	8R1.3		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

Photo-point monitoring			
		Last year(N/A)	This year (05/03/24)
Site	8A.1		
Photo-point no.	1		
Comments about how to take the photo consistently each time, improvements, problems, etc.:			
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45 degree angle across site from star picket.			

3.2 Weed monitoring

3.2.1 Weed monitoring records

Weeds monitoring results within the plots are provided in Attachment A.

Weed monitoring and mapping was also undertaken in restoration management areas within the quarry site, targeting the presence and coverage of Lantana, Privet, and novel weed species as described in Chapter 2.2.

The weed monitoring results are presented in Table 3.2 and mapped in Figure 3.1 and Figure 3.2. Two species previously recorded in project vegetation surveys, Balloon Vine (*Cardiospermum grandiflorum*) and Trad (*Tradescantia fluminensis*) were observed to have established dense infestations in select areas of the site. As these species have been previously recorded in project vegetation surveys they do not qualify as novel weed species under the BRMP. Nonetheless, management of these species is recommended (Section 3.2.4).

Table 3.2 Weed monitoring records

Date	Area (eg Substage 8A)	Surveyed area (ha)	Lantana			Privet			Novel weed species			
			Cover (ha)	Cover (%)	Locations Patches >25 m²: see map below Patches 1–25 m²: see map below or provide coordinates	Cover (ha)	Cover (%)	Locations Patches >25 m²: see map below Patches 1–25 m²: see map below or provide coordinates	Species	Cover (ha)	Cover (%)	Locations Patches >25 m²: see map below Patches 1–25 m²: see map below or provide coordinates
6/3/2024	Stage 6	2.3	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
6/3/2024	Stage 7	7.41	0.36	80	See maps below	0.41	80	See maps below	N/A	N/A	N/A	N/A
6/3/2024	Stage 8	6.51	0.21	40	See maps below	0.1	100	See maps below	N/A	N/A	N/A	N/A

KEY

- Lantana *(Lantana camara)* (1 m^2 to 25m^2)
- Lantana *(Lantana camara)* (>25 m^2)

Restoration area

- Additional Stage 7 restoration area 1
- Additional Stage 7 restoration area 2
- Additional Stage 8 restoration area 1
- Additional Stage 8 restoration area 2

Vegetation management area

- Stage 6
- Stage 7

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

Lantana infestation location

Source: EMM (2024); DCSSS (2024); GA (2009); MetroMap (2024)

0 250 500 m

GDA 1994 MGA Zone 56

N

Weed Mapping
Figure 3.1

EMM
creating opportunities

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KEY

- Privet *(Ligustrum sinense and Ligustrum lucidum)* (1 m^2 to 25 m^2)
- Privet *(Ligustrum sinense and Ligustrum lucidum)* (>25 m^2)

Restoration area

- Additional Stage 7 restoration area 1
- Additional Stage 7 restoration area 2
- Additional Stage 8 restoration area 1
- Additional Stage 8 restoration area 2

Vegetation management area

- Stage 6
- Stage 7

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2024); DCSSS (2024); GA (2009); MetroMap (2024)

0 250 500 m

GDA 1994 MGA Zone 56

N

Privet infestation location

Weed Mapping
Figure 3.2

EMM
creating opportunities

\\emm.local\xdrive\Pre2020\2019\J190166- Menangle Quarry LEC\GIS\02_Maps\Weed Mapping\WM002_PrivetInfestationLocations_20240327_01\WM002_PrivetInfestationLocations_20240327_02.aprx 28/03/2024

3.2.2 Progress against performance and completion criteria

Weed management completion criteria, performance indicators, performance guidance and corrective actions are provided in BRMP Table 8.2. Progress against weed performance and completion criteria is summarised in Table 3.2.

Table 3.3 Weed management summary

Weed	Coverage last year (ha)	Coverage this year (ha)	% change	Requirement met? (Yes/No)
Lantana (*Lantana camara)*	N/A	0.58	N/A	N/A
Small-leaved Privet (*Ligustrum sinense*) Broad-leaf Privet (*Ligustrum lucidum*)	N/A	0.41	N/A	N/A

N/A: trend not available as first year of mapping.

3.2.3 Annual trends

Weed monitoring undertaken for this report constitute the first year of weed monitoring results. A comparison to previous year's survey results is therefore not possible. The weed monitoring results of this report will be used as a baseline for comparison of the following years survey results.

3.2.4 Effectiveness of weed management measures

In general, the rehabilitation and restoration areas of the site are heavily impacted by weed invasion. Two species previously recorded in project vegetation surveys (Balloon Vine and Trad) were observed to have established dense infestations in select areas of the site, but do not qualify as novel weed species as were also observed during the BRMP. However, due to the invasiveness of both species and observed prevalence on site they have therefore been identified as additional priority weed species to be managed as part of weed control efforts.

References

EMM. (2022). *Biodiversity and Rehabilitation Management Plan.*

EMM. (2023). *Ecological Pre-clearance Assessment - Menangle Quarry Sub-stages 8a and 8b.*

Attachment A

Floristic monitoring datasheets

EMM
creating opportunities

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:43:57 pm

Basic site information

Date and time:

5 Mar 2024, 10:15:00 am

RealTime

05/03/2024 10:15:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 6.1

Site name:

Stage 6

Recorders:

CD, PR

Plot location:

Lat: -34.119506 Lon: 150.740826

Datum

GDA94

Latitude

-34.11951

Longitude

150.74083

MGAzone

56

Easting

291,642

Northing

6,222,288

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scraped, slashed and mulched. Dead weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

1

Tree count: 20 - 29 cm

1

Tree count: 10 - 19 cm

1

Tree count: 5 - 9 cm

1

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

1

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

90

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

85

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

90

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

90

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

95

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

10

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Angophora floribunda (Rough-barked Apple)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Eucalyptus elata (River Peppermint)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Themeda triandra

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cardiospermum grandiflorum (Balloon Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens subalternans (Greater Beggar's Ticks)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum nigrum (Black-berry Nightshade)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Rumex crispus (Curled Dock)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Alternanthera philoxeroides (Alligator Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Hirschfeldia incana (Buchan Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:06 pm

Basic site information

Date and time:

5 Mar 2024, 10:52:00 am

RealTime

05/03/2024 10:52:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 6.2

Site name:

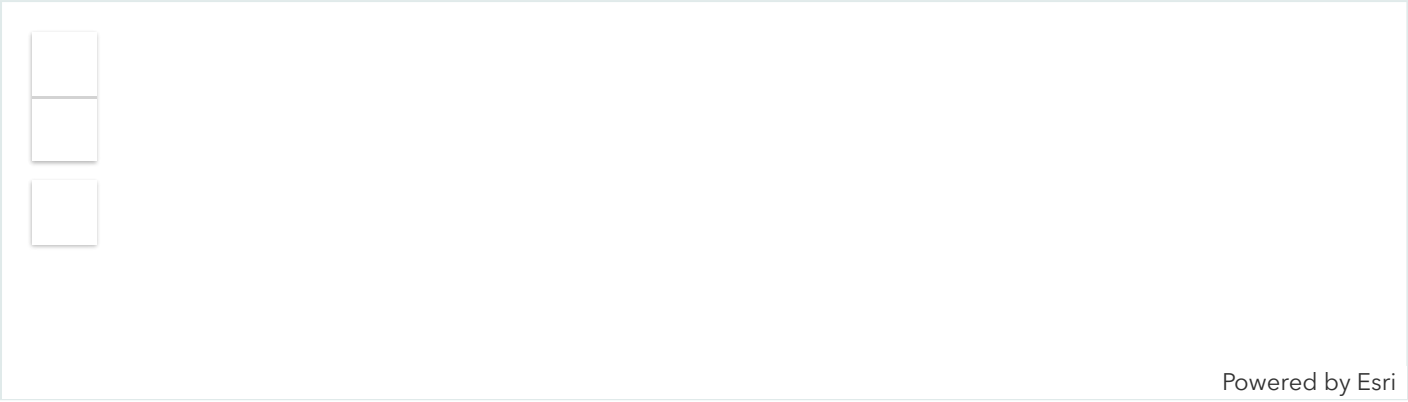
Stage 6

Recorders:

CD, PR

Plot location:

Lat: -34.119335 Lon: 150.742883



Datum

GDA94

Latitude

-34.11934

Longitude

150.74288

MGAzone

56

Easting

291,832

Northing

6,222,311

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scraped, slashed and mulched. Some weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

1

Tree count: 20 - 29 cm

1

Tree count: 10 - 19 cm

1

Tree count: 5 - 9 cm

1

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

1

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

5

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

85

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

95

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

90

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

95

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Casuarina cunninghamiana subsp. cunninghamiana (River Oak)

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Notes:

Physical damage to tree trunks

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Eucalyptus botryoides (Bangalay)

Notes:

Physical damage to trunks

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Acacia parramattensis (Parramatta Wattle)

Cover (%):

10

Abundance:

1

Voucher:

No

Species:

Ehrharta erecta (Panic Veldtgrass)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Tradescantia fluminensis (Wandering Jew)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Lomandra longifolia (Spiny-headed Mat-rush)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Araujia sericifera (Moth Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Phalaris aquatica (Phalaris)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acetosa sagittata (Rambling Dock)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Euphorbia peplus (Petty Spurge)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.5

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Cardiospermum grandiflorum (Balloon Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Verbena bonariensis (Purpletop)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Alternanthera philoxeroides (Alligator Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Juncus usitatus

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Stenotaphrum secundatum (Buffalo Grass)

Cover (%):

0.6

Abundance:

1

Voucher:

No

Species:

Conyza bonariensis (Flaxleaf Fleabane)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Plantago lanceolata (Lamb's Tongues)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bromus catharticus (Praire Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Themeda triandra

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:12 pm

Basic site information

Date and time:

5 Mar 2024, 11:27:00 am

RealTime

05/03/2024 11:27:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 7.1

Site name:

Stage 7

Recorders:

CD, PR

Plot location:

Lat: -34.117582 Lon: 150.745328

Datum

GDA94

Latitude

-34.11758

Longitude

150.74533

MGAzone

56

Easting

292,053

Northing

6,222,511

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scraped, slashed and mulched. Some weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

1

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

0

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

5

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

95

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

85

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

90

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

95

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Acacia parramattensis (Parramatta Wattle)

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Casuarina cunninghamiana subsp. cunninghamiana (River Oak)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eucalyptus elata (River Peppermint)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Themeda triandra

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.7

Abundance:

1

Voucher:

No

Species:

Ligustrum sinense (Small-leaved Privet)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Ligustrum lucidum (Large-leaved Privet)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Conyza bonariensis (Flaxleaf Fleabane)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.4

Abundance:

1

Voucher:

No

Species:

Tradescantia fluminensis (Wandering Jew)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Ageratina adenophora (Crofton Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens subalternans (Greater Beggar's Ticks)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens pilosa (Cobbler's Pegs)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Araujia sericifera (Moth Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Verbena bonariensis (Purpletop)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Stellaria media (Common Chickweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cardiospermum grandiflorum (Balloon Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bromus catharticus (Praire Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Senecio madagascariensis (Fireweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Ehrharta erecta (Panic Veldtgrass)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Ricinus communis (Castor Oil Plant)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:20 pm

Basic site information

Date and time:

5 Mar 2024, 12:07:00 pm

RealTime

05/03/2024 12:07:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 7.3

Site name:

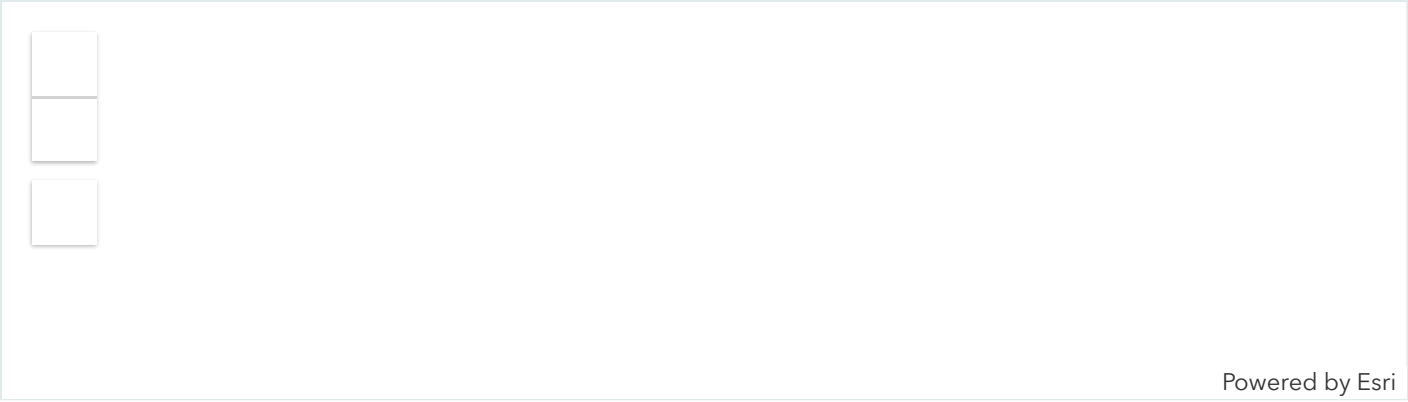
Stage 7

Recorders:

CD, PR

Plot location:

Lat: -34.117242 Lon: 150.748799



Datum

GDA94

Latitude

-34.11724

Longitude

150.7488

MGAzone

56

Easting

292,372

Northing

6,222,555

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

Attach plot photo (max. 5)

Plot photo:

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Weed invasion, previous clearing

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

0

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

50

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

30

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

30

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

60

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

30

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Callistemon salignus (Willow Bottlebrush)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Angophora floribunda (Rough-barked Apple)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Acacia floribunda (White Sally)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Acacia elata (Mountain Cedar Wattle)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Dodonaea multijuga

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acacia binervata (Two-veined Hickory)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Lysimachia arvensis (Scarlet Pimpernel)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Polymeria calycina

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Conyza bonariensis (Flaxleaf Fleabane)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Hydrocotyle acutiloba

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Neptunia gracilis f. gracilis (Sensitive Plant)

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Microlaena stipoides (Weeping Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

70

Abundance:

1

Voucher:

No

Species:

Verbena litoralis

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Tagetes minuta (Stinking Roger)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Hakea salicifolia (Willow-leaved Hakea)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum linnaeanum (Apple of Sodom)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Paspalum quadrifarium (Tussock Paspalum)

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Verbena bonariensis (Purpletop)

Cover (%):

0.4

Abundance:

1

Voucher:

No

Species:

Senecio madagascariensis (Fireweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cirsium vulgare (Spear Thistle)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Celtis sinensis (Japanese Hackberry)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Aster subulatus (Wild Aster)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sigesbeckia orientalis subsp. orientalis (Indian Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Modiola caroliniana (Red-flowered Mallow)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Austrostipa spp. (A Speargrass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens pilosa (Cobbler's Pegs)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Juncus usitatus

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Alternanthera philoxeroides (Alligator Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Trema tomentosa var. aspera (Native Peach)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Commelina cyanea (Native Wandering Jew)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eragrostis curvula (African Lovegrass)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Lomandra longifolia (Spiny-headed Mat-rush)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Paspalum urvillei (Vasey Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Echinochloa crus-galli (Barnyard Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:29 pm

Basic site information

Date and time:

5 Mar 2024, 1:24:00 pm

RealTime

05/03/2024 13:24:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 7.5

Site name:

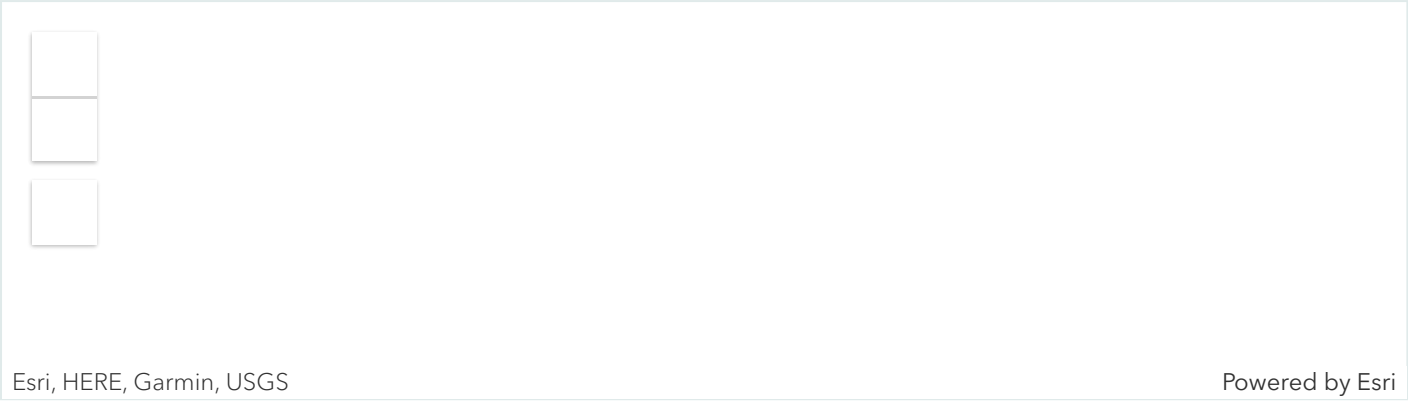
Stage 7

Recorders:

CD, PR

Plot location:

Lat: -34.119747 Lon: 150.754872



Datum

GDA94

Latitude

-34.11975

Longitude

150.75487

MGAzone

56

Easting

292,938

Northing

6,222,290

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scraped, slashed and mulched. Some weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

0

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

85

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

85

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

85

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

90

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

80

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eucalyptus elata (River Peppermint)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Themeda triandra

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Ricinus communis (Castor Oil Plant)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:45:01 pm

Basic site information

Date and time:

5 Mar 2024, 3:39:00 pm

RealTime

05/03/2024 15:39:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 8A.1

Site name:

Stage 8A

Recorders:

CD, PR

Plot location:

Lat: -34.125316 Lon: 150.754599

Datum

GDA94

Latitude

-34.12532

Longitude

150.7546

MGAzone

56

Easting

292,927

Northing

6,221,672

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scraped, slashed and hydromulched. Some weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

1

Tree count: 50 - 79 cm

1

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

0

Number of hollow trees:

0

Length of logs (m):

1

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

2

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

10

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

5

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

20

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

10

Attach photo for subplot 5:

Flora species, cover and abundance repeat

Flora species, cover and abundance repeat

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

10

Abundance:

1

Voucher:

No

Species:

Solanum chenopodioides (Whitetip Nightshade)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Hirschfeldia incana (Buchan Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Alternanthera denticulata (Lesser Joyweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Einadia trigonos (Fishweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acacia binervia (Coast Myall)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Neptunia gracilis f. gracilis (Sensitive Plant)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

0.8

Abundance:

1

Voucher:

No

Species:

Cyperus polystachyos

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum linnaeanum (Apple of Sodom)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Echinochloa crus-galli (Barnyard Grass)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Amaranthus viridis (Green Amaranth)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Carex inversa (Knob Sedge)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eleusine indica (Crowsfoot Grass)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.8

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Phytolacca octandra (Inkweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Trifolium spp. (A Clover)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acetosa sagittata (Rambling Dock)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Fumaria spp. (Fumitory)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Ligustrum lucidum (Large-leaved Privet)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Polycarpon tetraphyllum (Four-leaved Allseed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens subalternans (Greater Beggar's Ticks)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sigesbeckia orientalis subsp. orientalis (Indian Weed)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Commelina cyanea (Native Wandering Jew)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Silene gallica (French Catchfly)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Dysphania pumilio (Small Crumbweed)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Calystegia marginata

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Dichondra repens (Kidney Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens pilosa (Cobbler's Pegs)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Trema tomentosa var. aspera (Native Peach)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Ehrharta erecta (Panic Veldtgrass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Tradescantia fluminensis (Wandering Jew)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Phyllanthus gunnii

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Juncus usitatus

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Senecio madagascariensis (Fireweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Conyza spp. (A Fleabane)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Verbena bonariensis (Purpletop)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Lolium spp. (A Ryegrass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Polymeria calycina

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Glycine microphylla (Small-leaf Glycine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Angophora floribunda (Rough-barked Apple)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acacia parramattensis (Parramatta Wattle)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Lycopersicon esculentum (Tomato)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum mauritianum (Wild Tobacco Bush)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cardiospermum grandiflorum (Balloon Vine)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Modiola caroliniana (Red-flowered Mallow)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Portulaca oleracea (Pigweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sporobolus elongatus (Slender Rat's Tail Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Chloris truncata (Windmill Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Callitris gracilis

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Entolasia marginata (Bordered Panic)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Mollugo verticillata

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Stachys arvensis (Stagger Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:38 pm

Basic site information

Date and time:

5 Mar 2024, 1:41:00 pm

RealTime

05/03/2024 13:41:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 8R1.1

Site name:

Stage 8R

Recorders:

CD, PR

Plot location:

Lat: -34.122026 Lon: 150.755854

Datum

GDA94

Latitude

-34.12203

Longitude

150.75585

MGAzone

56

Easting

293,035

Northing

6,222,039

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently slashed. Some weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

0

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

50

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

50

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

30

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

45

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

60

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Angophora floribunda (Rough-barked Apple)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Modiola caroliniana (Red-flowered Mallow)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sonchus oleraceus (Common Sowthistle)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum nigrum (Black-berry Nightshade)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Verbena litoralis

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Setaria spp.

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Echinochloa crus-galli (Barnyard Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Paspalum dilatatum (Paspalum)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

65

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Einadia trigonos (Fishweed)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Echium plantagineum (Patterson's Curse)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Conyza spp. (A Fleabane)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Dichondra repens (Kidney Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eucalyptus elata (River Peppermint)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:45 pm

Basic site information

Date and time:

5 Mar 2024, 2:15:00 pm

RealTime

05/03/2024 14:15:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 8R1.2

Site name:

Stage 8R

Recorders:

CD, PR

Plot location:

Lat: -34.123529 Lon: 150.755118

Datum

GDA94

Latitude

-34.12353

Longitude

150.75512

MGAzone

56

Easting

292,970

Northing

6,221,871

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Some erosion, weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

0

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

3

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

3

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

8

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

20

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

15

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Eucalyptus elata (River Peppermint)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acacia floribunda (White Sally)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Tagetes minuta (Stinking Roger)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Phytolacca octandra (Inkweed)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Sigesbeckia orientalis subsp. orientalis (Indian Weed)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Neptunia gracilis f. gracilis (Sensitive Plant)

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Senecio madagascariensis (Fireweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.6

Abundance:

1

Voucher:

No

Species:

Conyza spp. (A Fleabane)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Trema tomentosa var. aspera (Native Peach)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens pilosa (Cobbler's Pegs)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Phalaris aquatica (Phalaris)

Cover (%):

3

Abundance:

1

Voucher:

No

Species:

Lysimachia arvensis (Scarlet Pimpernel)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Einadia trigonos (Fishweed)

Cover (%):

1

Abundance:

1

Voucher:

No

Species:

Dactylis glomerata (Cocksfoot)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Verbena bonariensis (Purpletop)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Persicaria lapathifolia (Pale Knotweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Oenothera spp.

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Hirschfeldia incana (Buchan Weed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Echinochloa crus-galli (Barnyard Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum nigrum (Black-berry Nightshade)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acetosa sagittata (Rambling Dock)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Celtis sinensis (Japanese Hackberry)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum chenopodioides (Whitetip Nightshade)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Datura spp.

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Phyllanthus gunnii

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eleusine indica (Crowsfoot Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Solanum linnaeanum (Apple of Sodom)

Cover (%):

0.1

Abundance:

1

Voucher:

No

PROD_EMM_EcologyNSW_BAMSurvey_v3

Submitted by: EMMGISApps

Submitted time: 20 Mar 2024, 3:44:54 pm

Basic site information

Date and time:

5 Mar 2024, 2:59:00 pm

RealTime

05/03/2024 14:59:00

Project number:

E190166a

Project name:

Menangle Quarry

Plot identifier:

Plot 8R1.3

Site name:

Stage 8R

Recorders:

CD, PR

Plot location:

Lat: -34.123868 Lon: 150.754878

Datum

GDA94

Latitude

-34.12387

Longitude

150.75488

MGAzone

56

Easting

292,949

Northing

6,221,833

Plot dimensions:

20x20

Bearing:

0

PlotImages_count

5

Attach plot photo (max. 5)

Plot photo:

PCT condition class:

Low

PCT confidence:

Low

EEC?:

Yes

EEC confidence:

High

Physiography and site features (optional):

River floodplain bench

Plot disturbance:

Recently scalped. Weeds.

BAM attribute (20 x 50 m plot)

Tree count: 80 cm plus

0

Tree count: 50 - 79 cm

0

Tree count: 30 - 49 cm

0

Tree count: 20 - 29 cm

0

Tree count: 10 - 19 cm

0

Tree count: 5 - 9 cm

0

Tree count: < 5 cm

1

Number of hollow trees:

0

Length of logs (m):

1

BAM attribute (1 x 1 m plot)

Subplot 1 - Litter cover (%):

15

Attach photo for subplot 1:

Subplot 2 - Litter cover (%):

20

Attach photo for subplot 2:

Subplot 3 - Litter cover (%):

20

Attach photo for subplot 3:

Subplot 4 - Litter cover (%):

10

Attach photo for subplot 4:

Subplot 5 - Litter cover (%):

20

Attach photo for subplot 5:

Flora species, co

Flora species, cover and abundance repeat

Species:

Eucalyptus botryoides (Bangalay)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Eucalyptus amplifolia (Cabbage Gum)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Phyllanthus gunnii

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Neptunia gracilis f. gracilis (Sensitive Plant)

Cover (%):

4

Abundance:

1

Voucher:

No

Species:

Digitaria sanguinalis (Crab Grass)

Cover (%):

5

Abundance:

1

Voucher:

No

Species:

Tagetes minuta (Stinking Roger)

Cover (%):

7

Abundance:

1

Voucher:

No

Species:

Conyza spp. (A Fleabane)

Cover (%):

0.8

Abundance:

1

Voucher:

No

Species:

Sigesbeckia orientalis subsp. orientalis (Indian Weed)

Cover (%):

7

Abundance:

1

Voucher:

No

Species:

Cynodon dactylon (Common Couch)

Cover (%):

0.3

Abundance:

1

Voucher:

No

Species:

Cenchrus clandestinus (Kikuyu Grass)

Cover (%):

0.4

Abundance:

1

Voucher:

No

Species:

Verbena litoralis

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens pilosa (Cobbler's Pegs)

Cover (%):

2

Abundance:

1

Voucher:

No

Species:

Echinochloa crus-galli (Barnyard Grass)

Cover (%):

0.2

Abundance:

1

Voucher:

No

Species:

Oxalis spp.

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Eleusine indica (Crowsfoot Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Melia azedarach (White Cedar)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Persicaria lapathifolia (Pale Knotweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Trema tomentosa var. aspera (Native Peach)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Sida rhombifolia (Paddy's Lucerne)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bromus catharticus (Praire Grass)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Senecio madagascariensis (Fireweed)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Acetosa sagittata (Rambling Dock)

Cover (%):

0.1

Abundance:

1

Voucher:

No

Species:

Bidens subalternans (Greater Beggar's Ticks)

Cover (%):

0.1

> Abundance:
>
> **1**
>
> Voucher:
>
> **No**

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Attachment F

Planting Guidelines and Plant Species

Planting Guidelines

"The following vegetation establishment measures will be applied...:

- Weed control measures will be implemented. It is anticipated that several rounds of weed treatment will be needed prior to the native species in-fill planting.

- In areas of existing native vegetation, in-fill planting of native plant species will be undertaken to increase species diversity and to shade out weed species. Planting density will vary depending on the species' growth types. Trees will be planted at a rate of 1 individual per 9 m2, and mid-story/ground cover species at a rate of 1 individual per m2. Plants that die will be replaced.

- In areas of exotic grass, seeding or in-fill planting of native plant species will be undertaken. Planting density will vary depending on the species' growth types. Trees will be planted at a rate of 1 individual per 9 m2, and mid-story/ground cover species at a rate of 1 individual per m2. Plants that die will be replaced.

Species selection

Species targeted for native seed collection will focus on establishing the **40** key River-flat Eucalypt Forest EEC species listed in Table 5.1[below], noting that River-flat Eucalypt Forest includes a wider range of species.

A rehabilitation and restoration criterion is the establishment of ≥24 species, across all Vegetation Restoration Monitoring Plots, that are aligned with the River Flat Eucalypt Forest EEC species list in the Final Determination.

Table 5.1 Plant species list

Tree (canopy layer)	
Angophora floribunda	Rough-barked Apple
Angophora subvelutina	Broad-leaved Apple
Casuarina cunninghamiana subsp. cunninghamiana	River Oak
Casuarina glauca	Swamp Oak
Eucalyptus baueriana	Blue Box
Eucalyptus benthamii	Camden White Gum
Eucalyptus botryoides	Bangalay
Eucalyptus elata	River Peppermint
Eucalyptus saligna x botryoides	Southern Blue Gum
Eucalyptus tereticornis	Forest Red Gum
Melia azedarach	White Cedar
Small tree/shrub (mid-story layer)	
Acacia floribunda	White Sally

Acacia parramattensis	Parramatta Wattle
Backhousia myrtifolia	Grey Myrtle
Breynia oblongifolia	Coffee Bush
Grass/vine/rush/fern (ground layer)	
Adiantum aethiopicum	Maidenhair Fern
Austrostipa ramosissima	Stout Bamboo Grass
Cheilanthes sieberi subsp. sieberi	Rock Fern
Clematis aristata	Old Man's Beard
Commelina cyanea	Native Wandering Jew
Dichondra repens	Kidney Weed
Echinopogon ovatus	Forest Hedgehog Grass
Einadia hastada	Saltbush
Entolasia marginata	Bordered Panic
Entolasia stricta	Wiry Panic
Eustrephus latifolius	Wombat Berry
Glycine clandestina	Twining glycine
Lomandra filiformis	Wattle Mat-rush
Lomandra longifolia	Spiny-headed Mat-rush
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush
Microlaena stipoides var. stipoides	Weeping Grass
Oplismenus aemulus	Australian Basket Grass
Plectranthus parviflorus	Little Spurflower
Poranthera microphylla	Small Poranthera
Pratia purpurascens	Whiteroot
Pteridium esculentum	Bracken
Sigesbeckia orientalis subsp. orientalis	Indian Weed
Solanum prinophyllum	Forest Nightshade
Themeda australis / Themeda triandra	Kangaroo Grass
Veronica plebeia	Trailing Speedwell

Attachment G

Nest box Installation and monitoring records

E.1 Nest box installation

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B1	28/04/2023	Double chamber microbat	S 34.123541	E 150.754905		4m from ground level on trunk of a tree
B2	28/04/2023	Double chamber microbat	S34.123011	E 150.755194		Lower canopy 4-6m from ground level
B3	28/04/2023	Double chamber microbat	S 34.123127	E 150.755313		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B4	28/04/2023	Double chamber microbat	S 34.122137	E150.755434		In the tree canopy, on trunk or branch with relatively clear space to allow owls space for flight
B5	14/03/2024	Double chamber microbat	S 34.124704	E150.753927		Lower canopy 4-6m from ground level
B6	14/03/2024	Double chamber microbat	S 34.125381	E150.753367		Lower canopy 4-6m from ground level
B7	14/03/2024	Double chamber microbat	S 34.125811	E150.753249		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B8	14/03/2024	Double chamber microbat	S 34.126195	E150.752764		Lower canopy 4-6m from ground level
B9	14/03/2024	Double chamber microbat	S 34.127128	E150.753052		Lower canopy 4-6m from ground level
B10	14/03/2024	Double chamber microbat	S 34.127572	E150.753122		Lower canopy 4-6m from ground level
B11		Double chamber microbat				
B12		Double chamber microbat				
B13		Double chamber microbat				
B14		Double chamber microbat				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B15		Double chamber microbat				
B16		Double chamber microbat				
B17		Double chamber microbat				
B18		Double chamber microbat				
B19		Double chamber microbat				
B20		Double chamber microbat				
B21		Double chamber microbat				
B22		Double chamber microbat				
B23		Double chamber microbat				
B24		Double chamber microbat				
B25		Double chamber microbat				
B26		Double chamber microbat				
B27		Double chamber microbat				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B28		Double chamber microbat				
B29		Double chamber microbat				
B30		Double chamber microbat				
B31		Double chamber microbat				
B32		Double chamber microbat				
B33		Double chamber microbat				
B34		Double chamber microbat				
B35		Double chamber microbat				
B36		Double chamber microbat				
B37		Double chamber microbat				
B38		Double chamber microbat				
B39		Double chamber microbat				
B40		Double chamber microbat				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP101	28/04/2023	Brushtail/ringtail possum/front entry	S 34.122627	E 150.755569		Lower canopy 4-6m from ground level
LP102	28/04/2023	Brushtail/ringtail possum/front entry	S34.124020	E 150.754773		Lower canopy 4-6m from ground level
LP103	28/04/2023	Brushtail/ringtail possum/front entry	S 34.122122	E 150.755462		Lower canopy 4-6m from ground level
LP104	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.6808	E 150.45.0971		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP105	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7360	E 150.45.0035		Lower canopy 4-6m from ground level
LP106	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7238	E 150.45.0528		Lower canopy 4-6m from ground level
LP107	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7555	E 150.45.0005		
LP108	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.6529	E 150.45.1362		Lower canopy 4-6m from ground level
LP109	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.5307	E 150.45.2038		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP110		Brushtail/ringtail possum/front entry				
LP111		Brushtail/ringtail possum/front entry				
LP112		Brushtail/ringtail possum/front entry				
LP113		Brushtail/ringtail possum/front entry				
LP114		Brushtail/ringtail possum/front entry				
LP115		Brushtail/ringtail possum/front entry				
LP116		Brushtail/ringtail possum/front entry				
LP117		Brushtail/ringtail possum/front entry				
LP118		Brushtail/ringtail possum/front entry				
LP119		Brushtail/ringtail possum/front entry				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP120		Brushtail/ringtail possum/front entry				
LP121		Brushtail/ringtail possum/front entry				
LP122		Brushtail/ringtail possum/front entry				
LP123		Brushtail/ringtail possum/front entry				
LP124		Brushtail/ringtail possum/front entry				
LP125		Brushtail/ringtail possum/front entry				
LP126		Brushtail/ringtail possum/front entry				
LP127		Brushtail/ringtail possum/front entry				
LP128		Brushtail/ringtail possum/front entry				
LP129		Brushtail/ringtail possum/front entry				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP130		Brushtail/ringtail possum/front entry				
SP201	28/04/2023	Sugar/squirrel/rear entry	S 34.123676	E 150.754609		Lower canopy 4-6m from ground level
SP202	28/04/2023	Sugar/squirrel/rear entry	S 34.122627	E 150.755365		Lower canopy 4-6m from ground level
SP203	28/04/2023	Sugar/squirrel/rear entry	S 34.12.3112	E 150.75.5300		Lower canopy 4-6m from ground level
SP204	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6924	E 150.45.0697		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP205	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7881	E 150.44.9767		Lower canopy 4-6m from ground level
SP206	1/02/2024	Sugar/squirrel/rear entry	S 34.07.5181	E 150.45.2131		Lower canopy 4-6m from ground level
SP207	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6300	E 150.45.1552		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP208	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6688	E 150.45.1037		Lower canopy 4-6m from ground level
SP209	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6150	E 150.45.1685		Lower canopy 4-6m from ground level
SP210	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7029	E 150.45.0707		Lower canopy 4-6m from ground level
SP211	1/02/2024	Sugar/squirrel/rear entry	S 34.07.8068	E 150.44.9656		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP212	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7761	E 150.44.9953		Lower canopy 4-6m from ground level
SP213	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7918	E 150.45.0017		Lower canopy 4-6m from ground level
SP214	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7372	E 150.45.0185		Lower canopy 4-6m from ground level
SP215	1/02/2024	Sugar/squirrel/rear entry	S 34.07.8093	E 150.45.0185		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP216		Sugar/squirrel/rear entry				
SP217		Sugar/squirrel/rear entry				
SP218		Sugar/squirrel/rear entry				
SP219		Sugar/squirrel/rear entry				
SP220		Sugar/squirrel/rear entry				
SP221		Sugar/squirrel/rear entry				
SP222		Sugar/squirrel/rear entry				
SP223		Sugar/squirrel/rear entry				
SP224		Sugar/squirrel/rear entry				
SP225		Sugar/squirrel/rear entry				
SP226		Sugar/squirrel/rear entry				
SP227		Sugar/squirrel/rear entry				
SP228		Sugar/squirrel/rear entry				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP229		Sugar/squirrel/rear entry				
SP230		Sugar/squirrel/rear entry				
O300	28/04/2023		S 34.12.2945	E 150.75.5201		Lower canopy 4-6m from ground level
O301	1/02/2024	Large owl	S 34.07.5132	E 150.45.2256		Lower canopy 4-6m from ground level
O302		Large owl				
O303		Large owl				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
O304		Large owl				
O305		Large owl				
O306		Large owl				

Nest box locations – Substages 8A, 8B and 8C

E.2 Nest box monitoring records

Representative nest box monitoring				
Date	**Nest box ID**	**Functional?** (Yes/No)	**Condition description**	**Remediation actions required**
10/1/24	LP103	N	Good – Signs of activity	Nil
10/1/24	B4	Y	Good – Signs of activity	Nil
10/1/24	0300	N	Good - Unused	Nil
10/1/24	SP202	N	Good - Unused	Nil
10/1/24	LP101	Y	Good – Signs of activity	Nil
10/1/24	B3	N	Good – Unused	Nil
10/1/24	B2	N	Good - Unused	Nil
10/1/24	SP203	N	Good – Unused	Nil

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28 March 2024

Michael Holz
Quarry Manager
Menangle Sand and Soil Pty Ltd
31 Menangle Rd,
Menangle NSW 2568

Re: Menangle Sand and Soil Quarry - Review of BRMP monitoring reporting

Dear Michael,

1 Introduction

Menangle Sand and Soil Pty Ltd operates the Menangle Sand and Soil Quarry at 15 Menangle Road, Menangle. The quarry, located in the Wollondilly and Campbelltown local government areas, extracts sand and soil along the Nepean River as approved by Development Consent 85/2865.

Extraction in the Stage 8 area of the quarry commenced on 4 September 2023. Vegetation management and rehabilitation are conducted in accordance with the *Menangle Sand and Soil Biodiversity and Rehabilitation Management Plan* (version 3, EMM 2022) (BRMP) as approved by the Planning Secretary.

Section 8.8.2 of the BRMP requires that a Rehabilitation and Restoration Site Annual Progress Report is prepared.

Section 8.9 of the BRMP states that:

> Annually, an ecologist will audit the monitoring described in this BRMP, either as part of the annual floristic monitoring program or as a separate activity. This will consist of auditing the results of monitoring of:
>
> - landform establishment and stability assessment;
> - growth medium development;
> - weeds; and
> - nest-box and woody debris.

This letter specifically reviews monitoring of these matters as presented in the *Rehabilitation and Restoration Site Annual Progress Report 01 January 2023 - 31 December 2023* (Menangle Sand and Soil Pty Ltd, March 2024).

To inform the report, a site inspection was undertaken by Steven Ward on 21 March 2024. This involved a rapid inspection of Stage 6 restoration area, Stage 7 restoration area, Stage 8A and 8B extraction and restoration areas. Conditions on the day were fine, with approximately 1 mm of rainfall occurring over the night prior to the site inspection. Photographs are also presented to help document observations.

Rehabilitation/restoration and growth medium development (applicable to Stages 6,7 and 8) is discussed in Section 2.2, nestboxes (applicable to Stage 8) in Section 2.3, and woody debris (applicable to Stage 8) in Section 2.4 .

2 Observations

2.1 Rehabilitation/restoration

Menangle Sand and Soil have undertaken substantial rehabilitation works at the quarry, and commenced vegetation restoration works.

New/additional rehabilitation in parts of the Stage 6 and Stage 7 areas has commenced. These works were impacted by flooding of these areas in March 2021 and March–April 2022 during the La Nina cycle.

Recent rehabilitation works have included commencing new/additional rehabilitation in parts of the Stage 6 and Stage 7 areas. The early monitoring results described below will inform the wider additional rehabilitation of the Stage 6 and Stage 7 areas.

The initial phases of works in the Stage 8 Restoration Area 1 consist of the removal of extensive weeds and removal of topsoil ('scalping'). Menangle Sand and Soil have completed these works. Deep mulch has been applied across portions of this area.

Resource extraction from Substage 8A took approximately six months, with resource now being extracted from Substage 8B. The first phase of Substage 8A rehabilitation, land-forming, appears to be largely complete. The stabilisation, weed control and revegetation of these area has commenced.

Related works in these areas have included the armouring of drainage lines to minimise the potential for erosion, which is important prior to the establishment of mature vegetation and large stabilising roots.

The early rehabilitation monitoring results provide an opportunity to refine some aspects of the program that will assist Menangle Sand and Soil to progressively rehabilitate the quarry to provide a native vegetation community along the Nepean River.

2.1.1 Stage 6 rehabilitation area

The Stage 6 rehabilitation area was initially established over 15 years ago. As part of establishing a high-quality vegetation along the banks on the Nepean River, Menangle Sand and Soil have committed to reducing weed levels and enhancing native vegetation diversity in the Stage 6 rehabilitation area.

The landform appeared to be stable, with no signs of erosion visually observed.

Menangle Sand and Soil have commenced additional rehabilitation work with the establishment of two plots (Plot 6.1 and Plot 6.2) within the Stage 6 rehabilitation area. These initial rehabilitation plots do not coincide with the monitoring plots in Figure 6.1 of the BRMP.

It was observed that Plot 6.1 had had significant treatment works conducted including removal of debris, placement of a mulch layer, and plantation with tree guards erected around plantings (Photograph 5.1). The plantings were unsuccessful, due to unknown reasons. Mulch has also been applied, with the understood intent of suppressing weed growth, however the mulch is also likely to suppress native plant growth.

Heavy weed growth was observed in the remainder of the Stage 6 rehabilitation area (outside of the plots) where additional rehabilitation works, including weed control and seeding/planting, will be required (Photograph 5.2) to enhance the historical rehabilitation in this area.

It is understood that the Stage 6 area (as well as the other stages) experienced flooding in 2021 - 2022 due to significant rainfall events during the La Nina cycle. A pile of material was observed consisting of cut timbers, which are understood to have washed into the site during flooding. Flood deposited soil and other debris, was observed to the side of Plot 6.1.

2.1.2 Stage 7 rehabilitation area

The Stage 7 rehabilitation area along the Nepean River is being established, with land-forming activities (including filling some dams) undertaken in 2023. Some revegetation works commenced in other parts of the Stage 7 rehabilitation area prior to 2023.

The creek-line to the west (approximately 30 m to the west of Plot 7.1 established by Menangle Sand and Soil, to the north of the site access road) was observed to have been stabilised with large rocks (Photograph 5.3). This is likely to reduce the potential for scour and erosion. Consideration should be given to the long-term revegetation of this area, as establishing native species will further improve landform stability.

A large dam located between Plots 7.1 and 7.2 has been filled in, and levelled, and is now covered in grass (Photograph 5.4). The landform appeared to be stable, with no signs of erosion visually observed.

Menangle Sand and Soil have commenced vegetation works with the establishment of five plots (Plots 7.1 to 7.5) within the Stage 7 rehabilitation area (Photograph 5.5 – Photograph 5.9). Revegetation works outside of these plots have not commenced. These plot locations do not coincide with the monitoring plots in Figure 6.2 of the BRMP. Stage 7 has been affected by the same flooding events outlined in Stage 6 (2021 and twice in 2022).

Plots 7.1 and 7.5 (at the western and eastern extent of the Stage 7 rehabilitation area, respectively) had a thick layer of mulch applied, and plantings within tree-guards, understood to have been installed approximately 3 weeks prior to the site inspection. From rapid visual inspection, all plantings were observed to have been unsuccessful.

Plots 7.2, 7.3, and 7.4 are in the central part of the Stage 7 rehabilitation area, immediately adjacent to each other. Better revegetation success was observed in these plots. It is understood that native seeds had been broad-cast by hand in 2022 after the floods.

2.1.3 Stage 8 Restoration Area 1 and substage 8A and 8B rehabilitation areas

The Stage 8 Restoration Area 1 provides biodiversity offsets for the substage 8A–8C extraction areas. Along with rehabilitation of the extraction area, Menangle Sand and Soil will restore River Flat Eucalypt Forest in Restoration Area 1 to provide high-quality vegetation along the Nepean River.

Within Restoration Area 1 it was observed that weeds have been removed, presumably via scalping. Grass cover has become established, though is not uniform with areas of bare earth. Some large logs have been placed within Restoration Area 1. Large logs were also observed to have been placed at the eastern edge of the access track close to the Hume Highway, along a distance of approximately 100–200 m.

Within Substage 8A, extraction and rehabilitation earthworks were observed to have occurred with some grass or weeds starting to become established. Some mulch and hydromulch was observed to have been applied, primarily on the western embankment. Mulch was observed on the upper slope of the western embankment. Menangle Sand and Soil stated that hydromulch was applied to the lower slope of the western embankment, and that there had been a learning that a higher rate of application was required. This is consistent with visual observations, with some small traces of hydromulch observed. Temporary watering infrastructure has also been

installed, including pipes, sprinklers, and tank (Photograph 5.13). A sediment fence was observed to have been installed on the Nepean Riverbank (Photograph 5.18). Large logs were observed to have been placed in this area.

A drainage line was observed to have been stabilised by introducing large rocks, with sheeting applied where a vehicle track passes over the drainage line (Photograph 5.19). This drainage line was visually estimated to be roughly around the substage 8A/8B boundary.

Within Substage 8B, extraction was observed to have started, with earth mostly present (ie. vegetation has not yet established). Hydromulch was observed to have been applied on ground surfaces, and was more apparent, perhaps due to the stated higher application rate, but this could also be because of the more recent application in this area. Mulch and hydromulch were observed to have been applied on the western embankment. Mulch was observed on the upper slope of the western embankment, and hydromulch was applied to the lower slope. A sediment fence was observed to also have been installed on the Nepean Riverbank. Large logs were observed to have been placed in this area. It is noted that extraction was in progress at the time of the site visit towards the southern end of substage 8B.

In addition, it was observed that additional lands had had treatment applied, with understorey removed, and mulch applied (Additional Restoration Areas 1 and 2 in the Progress Report). We understand that this was done for the purpose of preventing weeds spreading into restoration area 1, however, this is not documented in the BRMP so has not been reviewed. It is understood that Menangle Sand and Soil intend to install fencing around in Restoration Area 1 in April 2024. This will control accidental machinery access and prevent stock access.

The landform was observed to have been established, and to be broadly stable, across Stage 8 Restoration Area 1 and Substage 8A. However, some early signs of erosion were observed on the lower slope of the western embankment (Photograph 5.17). Early application of hydromulch and seeking to have native species establish as soon as possible will help to address these issues. As noted, it is understood that Menangle Sand and Soil have moved to a higher rate of hydromulch, which may assist to improve soil stability in the short term. It is recommended that close attention is paid to the western embankment for landform and soil stability, as it is this zone that is most likely for erosion to occur.

Weeds have predominately been removed from the Stage 8 Restoration Area 1 via scalping, and during resource extraction in Substage 8A and 8B. However, weeds were observed to becoming re-established within Restoration Area 1 and in Substage 8A. Significant weed coverage was also visually observed within the Nepean River Buffer Zone (NRBZ) and lower riverbank.

Within Stage 8, vegetation restoration actions to date appear to have concentrated on scalping, and the establishment of the plots. Plantings within tree-guards in Restoration Area 1 Plot R1.1 were observed to have survived (Photograph 5.10). Some plantings were observed outside of the plots, but were limited in extent. Weeds were observed to becoming reestablished within Stage 8 Restoration Area 1 and Substage 8A. Weeds had not yet taken hold in Stage 8B, due to the recent excavation and scalping. Weeds were also observed on the NRBZ and lower riverbank for Stages 8A and 8B. Sowing native seed mix containing species characteristic of River-Flat Eucalypt Forest as per Table 5.1 of the BRMP is strongly recommended to reduce opportunities for further weed establishment when accompanied by manual weed control measures.

A thick layer of mulch was observed to have been applied on the upper slopes to the west of the Nepean River. We believe that whilst this will inhibit weeds, it will also likely inhibit some native plant growth, particularly from seed. It recommended that the mulching strategy is reviewed.

It is understood that hydroseeding with River-Flat Eucalypt Forest species has been applied to Restoration Area 1. It was observed that in Stage 8 Restoration Area 1 and Substage 8A, have not in general, plantings, or spreading cuttings (ie. upper branches with leaves and seeds present) from trees applied. As a consequence weed species are becoming established and may out-compete and smother natives preventing their establishment. It is recommended that native species are established as early as possible to assist in establishing River-Flat Eucalypt Forest in the long term.

The BRMP Progress Report (Menangle Sand and Soil 2024) states that Koala food tree species have been planted in the Stage 8 area. A number of these species do not occur in the local vegetation communities, and thus these plantings will lead to vegetation communities trending to modified vegetation communities, rather than the intended River-flat Eucalypt Forest. It is recommended that all planting within rehabilitation and identified restoration areas follow the species list provided in the BRMP.

Koala food tree plantings can occur in the Koala tree planting zone in Stage 6 for supply of leaf cuttings to Symbio Zoo.

A number of nestboxes were observed to have been installed. Woody debris was present, mainly large logs.

2.2 Growth medium development

Menangle Sand and Soil have collected soil samples from the plots and submitted to a laboratory for multi-nutrient analysis. The laboratory reports (March 2024) are provided in Appendix C of the Progress Report (i.e. outside of the reporting period). These form a good baseline for future soil monitoring. It is recommended that additional soil samples are collected and analysed from area(s) containing River Flat Eucalypt Forest as an indicator of any soil ameliorants required in the restoration and rehabilitation areas. Ideally these would be collected from areas of River Flat Eucalypt Forest in good condition, but it is unlikely that it will be possible to locate these, so it is recommended to take samples from the southern extent of the Stage 8 lot where River Flat Eucalypt Forest occurs.

2.3 Nest boxes

Menangle Sand and Soil have commenced the installation of nest boxes (106 required in total). A number of these nestboxes were observed. It is understood that 35 have been installed to date.

Nextboxes are subject to weathering and fauna damage such as Brushtail Possums chewing on boxes. Installed nestboxes were observed to have been constructed of plywood (Photograph 5.21). The BRMP (Section 7.5.1) states that hardwood nestboxes will be installed due to the longer longevity. Monitoring of nestboxes to better endure weathering and fauna damage is recommended. It is also recommended that the 'habisure' method of attachment (used by hollow log homes) is utilised. This consists of wire which is bent into a concertina state, so that it can expand as the tree grows.

2.4 Woody debris

Large logs were observed to have been placed in both the restoration and rehabilitated extraction areas. Large logs have also been applied near the track edge close to the Hume Highway to prevent accidental machinery access to Restoration Area 1. Consideration should be given to extending the placement of logs at track edges to control vehicle movements.

This is a positive action that will enhance the structural complexity and range of microhabitats present. The length of woody debris placed was not measured, but based on visual observation is likely to be short of that stated in the BRMP (Section 7.5.2), particularly for thinner woody debris (branches/small logs). This would likely be resolved by adding branches from felled trees, including leaf and seed material that will assist with the re-establishment of species characteristic of River-Flat Eucalypt Forest.

3 Closing

The monitoring of landform establishment and stability; growth medium development; weeds; nest-box and woody debris reported in the BRMP Progress Report (Menangle Sand and Soil 2024) corresponds with the observations made during the site inspection.

The new/additional rehabilitation in the Stage 6 and 7 areas commenced following approval of the extraction in the Stage 8 area. While rehabilitation was set back by flooding in 2021 and 2022, additional rehabilitation is underway that can be expanded within the broader Stage 6 and 7 rehabilitation areas, informed by the successes (and failures) in the initial plots.

The Stage 8 extraction, restoration and rehabilitation program is in its first year.

There have been substantial restoration works in the Stage 8 Restoration Area 1 and rehabilitation works in the Substage 8A extraction area. The volume (biomass) of large wood weeds, consisting of Lantana, Large-leaved Privet and Small-leaved Privet has been very substantially reduced, which is a positive outcome.

While in their early stages, the monitoring indicates that the use of thick mulch to suppress weeds appears to be also suppressing native vegetation growth so the mulching strategy should be amended.

The quarry's early rehabilitation monitoring program results provide an opportunity to refine some aspects of the program that will assist Menangle Sand and Soil to progressively rehabilitate the quarry to provide a high-quality vegetation community along the Nepean River.

4 References

EMM 2022, Biodiversity and Rehabilitation Management Plan, Report prepare for Menangle Sand and Soil.

Menangle Sand and Soil Pty Ltd 2024, Rehabilitation and Restoration Site Annual Progress Report. V5, Draft document dated 19/3/2024.

Yours sincerely

Dr Steven Ward
Associate Ecologist
sward@emmconsulting.com.au

5 Photographs

5.1 Stage 6 area

Photograph 5.1 Stage 6 Plot 6.1

Photograph 5.2 **Stage 6 Plot 6.1 – looking past plot to Nepean Riverbank (red triangles and rope is the plot tape)**

5.2 Stage 7 area

Photograph 5.3 **Drainage line to the west of Stage 7 Plot 7.1**

Photograph 5.4 Stage 7 area where a dam which has been filled in

Photograph 5.5 Stage 7 Plot 7.1

Photograph 5.6 Stage 7 Plot 7.1 – example of unsuccessful planting

Photograph 5.7 **Stage 7 Plot 7.5 – unsucessful plantings**

Photograph 5.8 **Stage 7 Plot 7.2**

Photograph 5.9 **Stage 7 Plot 7.2 – mix of native and exotic growth, vegetation along the Nepean Riverbank is visible in the rear of the photo.**

5.3 Stage 8 area

Photograph 5.10 **Stage 8 Plot 8.1**

Photograph 5.11 **Stage 8 Plot 8.1 – example planting survival**

Photograph 5.12 **Stage 8 – access track close to Hume Highway, note large logs at the edge of the track to control vehicle movements**

Photograph 5.13 Stage 8 area irrigation infrastructure

Photograph 5.14 Works to the north of Stage 8 Restoration Area 1

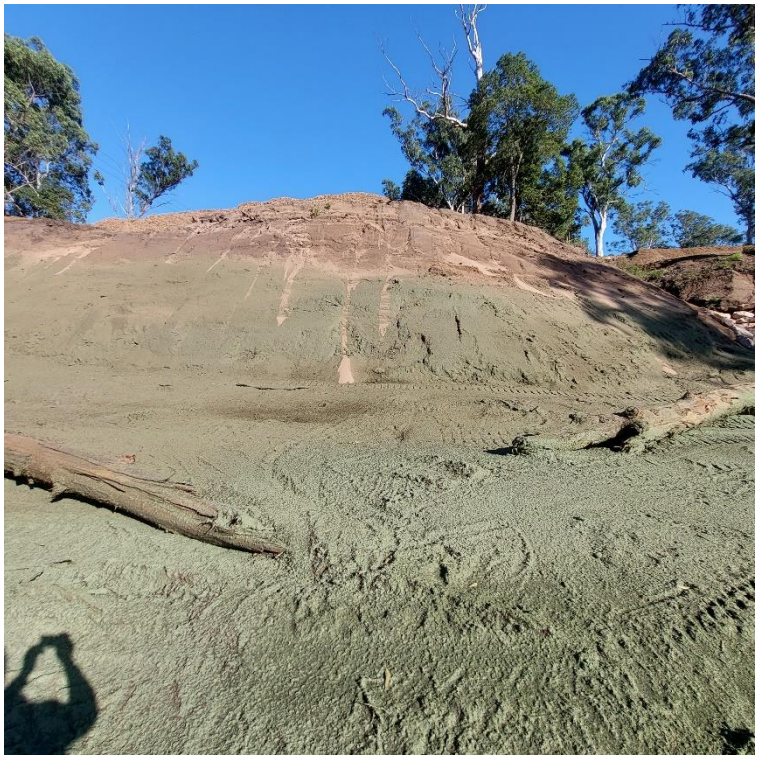
Photograph 5.15 Stage 8 Restoration Area 1

Photograph 5.16 Stage 8 Restoration Area 1/northern portion of Substage 8A

Photograph 5.17 **Stage 8 Restoration Area 1/northern portion of Substage 8A (different locations) – Note mulch at top of slope, and some minor erosion at the base of the slope**

Photograph 5.18 **Stage 8A – sediment fencing**

Photograph 5.19 Stage 8A/8B – Ddainage line with scour protection works



Photograph 5.20 Stage 8A/8B – hydromulching (dark green colouration) after extraction

Photograph 5.21 Stage 8 example nestboxes – note plywood used for the bat box B1

Menangle Sand and Soil Quarry - scheduled compliance actions

Scheduled actions	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Actions for 2024, with varying frequencies thereafter												
Road Safety and Condition Audit							X[a]	X[a]	Due 4 Sept 2024[a]			
Nest-box installation	X	X	X	X	X	X	X	X	By 4 Sept 2024			
Independent Environmental Audit									Commission by 4 Sept 2024[b]	X[b]	Submit within 3 months[b]	
Dust deposition gauge monitoring review								4 Sept 2024[c]				
Noise compliance assessment preparation (completed 2023)												
Monthly												
Monthly dust deposition gauge monitoring	X	X	X	X	X	X	X	X	X	X	X	X
Record process water use	X	X	X	X	X	X	X	X	X	X	X	X
Monthly complaints register update	X	X	X	X	X	X	X	X	X	X	X	X
Monthly erosion and sediment control measures review	X	X	X	X	X	X	X	X	X	X	X	X
Monthly surface water quality sampling (2024), then quarterly			X	X	X	X	X	X	X	X	X	X
Quarterly												
Quarterly attended noise monitoring			X			X			X			X
Quarterly groundwater logger download and bore inspection			X			X			X			X
Quarterly EMS review			X			X			X			X
Six-monthly												
Truck records to website		X					X					
Annual Review tasks												
Annual groundwater quality sampling and analysis	X	X										X
Annual water review preparation								X				
Landform establishment and stability assessment report preparation	X	X										
Growth medium development assessment report preparation	X	X										
Floristic monitoring report preparation	X	X										
Weed monitoring report preparation	X	X										
Nest-box and woody debris report preparation	X	X										
Rehabilitation and Restoration Site Annual Progress Report	X	X	X									
Annual Review preparation	X	X	Due 31 March									
Annual Return tasks												
Annual Return preparation						X	Due 9 August					
Other annual tasks												
Annual production data to MEG	Due 30 January											
Review management plans (if not otherwise triggered)						Due 31 June[d]						
Annual EMS internal audit						X						
Actions for 2026, and then every three years												
Air quality monitoring program review									4 Sept 2026[c]			
Noise monitoring program review									4 Sept 2026[c]			

a. then every 5 years.
b. then every 3 years.
c. not required for compliance.
d. if not otherwise triggered by a modification, audit or incident

Mandatory date
Date not specified by a condition

Calendar does not include ongoing, triggered or one-off requirements.

S91i Log Book

Request ID: 394821

Applicant Name:	Michael Holz			**Comments:**	**Conditions on the access licence are met for extracting water**	
Work Approval:	10WA104627					
Work Approval Holder:	Menangle sand &soil					
Extraction site ID:	56540					
Size of the meter:	100mm					
Date meter broken:	14/07/2020					
Meter reading as at date meter broken:	Unknown					
Meter reading as at date meter repaired:	Unknown			**Additional information required:**		
Alternate read at the Break Down Date:						
Alternate Read when meter repaired/replaced:						
Calibration Factor for no alternate device or meter:	engine hours - 100,00 litres/fill					
Purpose the water is used for:	industrial - dust suppression					
If irrigating, what is the size of area that is irrigated :						
Expiry Date of S91i:	30/09/2020					

Date	Truck fills / day	Run Minutes(5min/Fill)	10000L/Fill truck	ML Used - 1000000L				
Eg. (enter fills per day)		*5*	*10000*	*1000000*	☐	Yes	☐	No
Friday, 1 December 2023	5	25	50000	0.050	☐	Yes	☐	No
Saturday, 2 December 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 3 December 2023		0	0	0.000	☐	Yes	☐	No
Monday, 4 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 5 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 6 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 7 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Friday, 8 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Saturday, 9 December 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 10 December 2023		0	0	0.000	☐	Yes	☐	No
Monday, 11 December 2023	4	20	40000	0.040	☐	Yes	☐	No
Tuesday, 12 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 13 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 14 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Friday, 15 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Saturday, 16 December 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 17 December 2023		0	0	0.000	☐	Yes	☐	No
Monday, 18 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 19 December 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 20 December 2023		0	0	0.000	☐	Yes	☐	No
Thursday, 21 December 2023		0	0	0.000	☐	Yes	☐	No
Friday, 22 December 2023		0	0	0.000	☐	Yes	☐	No
Saturday, 23 December 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 24 December 2023		0	0	0.000	☐	Yes	☐	No
Monday, 25 December 2023		0	0	0.000	☐	Yes	☐	No
Tuesday, 26 December 2023		0	0	0.000	☐	Yes	☐	No
Wednesday, 27 December 2023		0	0	0.000	☐	Yes	☐	No
Thursday, 28 December 2023		0	0	0.000	☐	Yes	☐	No

Friday, 29 December 2023		0	0	0.000	☐	Yes	☐	No
Saturday, 30 December 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 31 December 2023		0	0	0.000	☐	Yes	☐	No
Totals:	**75**	**375**	**750000**	0.750	☐		☐	

S91i Log Book

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Meter reading as at date meter broken:	Unknown					
Meter reading as at date meter repaired:	Unknown			**Additional information required:**		
Alternate read at the Break Down Date:						
Alternate Read when meter repaired/replaced:						
Calibration Factor for no alternate device or meter:	engine hours - 100,00 litres/fill					
Purpose the water is used for:	industrial - dust suppression					
If irrigating, what is the size of area that is irrigated :						
Expiry Date of S91i:	30/09/2020					

Date	Truck fills / day	Run Minutes(5min/Fill)	10000L/Fill truck	ML Used - 1000000L				
Eg. (enter fills per day)		*5*	*10000*	*1000000*	☐	Yes	☐	No
Wednesday, 1 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 2 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Friday, 3 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Saturday, 4 November 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 5 November 2023		0	0	0.000	☐	Yes	☐	No
Monday, 6 November 2023		0	0	0.000	☐	Yes	☐	No
Tuesday, 7 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 8 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 9 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Friday, 10 November 2023	4	20	40000	0.040	☐	Yes	☐	No
Saturday, 11 November 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 12 November 2023		0	0	0.000	☐	Yes	☐	No
Monday, 13 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 14 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 15 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 16 November 2023	9	45	90000	0.090	☐	Yes	☐	No
Friday, 17 November 2023	2	10	20000	0.020	☐	Yes	☐	No
Saturday, 18 November 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 19 November 2023		0	0	0.000	☐	Yes	☐	No
Monday, 20 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 21 November 2023	3	15	30000	0.030	☐	Yes	☐	No
Wednesday, 22 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Thursday, 23 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Friday, 24 November 2023	2	10	20000	0.020	☐	Yes	☐	No
Saturday, 25 November 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 26 November 2023		0	0	0.000	☐	Yes	☐	No
Monday, 27 November 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 28 November 2023	1	5	10000	0.010	☐	Yes	☐	No

Wednesday, 29 November 2023		0	0	0.000	☐	Yes	☐	No
Thursday, 30 November 2023		0	0	0.000	☐	Yes	☐	No
Friday, 1 December 2023		0	0	0.000	☐	Yes	☐	No
Totals:	**99**	**495**	**990000**	0.990	☐		☐	

S91i Log Book

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Size of the meter:	100mm					
Date meter broken:	14/07/2020					
Meter reading as at date meter broken:	Unknown					
Meter reading as at date meter repaired:	Unknown			**Additional information required:**		
Alternate read at the Break Down Date:						
Alternate Read when meter repaired/replaced:						
Calibration Factor for no alternate device or meter:	engine hours - 100,00 litres/fill					
Purpose the water is used for:	industrial - dust suppression					
If irrigating, what is the size of area that is irrigated :						
Expiry Date of S91i:	30/09/2020					

Date	Truck fills / day	Run Minutes(5min/Fill)	10000L/Fill truck	ML Used - 1000000L				
Eg. (enter fills per day)		*5*	*10000*	*1000000*	☐	Yes	☐	No
Sunday, 1 October 2023		0	0	0.000	☐	Yes	☐	No
Monday, 2 October 2023		0	0	0.000	☐	Yes	☐	No
Tuesday, 3 October 2023		0	0	0.000	☐	Yes	☐	No
Wednesday, 4 October 2023	5	25	25000	0.025	☐	Yes	☐	No
Thursday, 5 October 2023	6	30	30000	0.030	☐	Yes	☐	No
Friday, 6 October 2023	8	40	40000	0.040	☐	Yes	☐	No
Saturday, 7 October 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 8 October 2023		0	0	0.000	☐	Yes	☐	No
Monday, 9 October 2023	1	5	5000	0.005	☐	Yes	☐	No
Tuesday, 10 October 2023		0	0	0.000	☐	Yes	☐	No
Wednesday, 11 October 2023	2	10	20000	0.020	☐	Yes	☐	No
Thursday, 12 October 2023	5	25	50000	0.050	☐	Yes	☐	No
Friday, 13 October 2023	8	40	80000	0.080	☐	Yes	☐	No
Saturday, 14 October 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 15 October 2023		0	0	0.000	☐	Yes	☐	No
Monday, 16 October 2023	8	40	80000	0.080	☐	Yes	☐	No
Tuesday, 17 October 2023		0	0	0.000	☐	Yes	☐	No
Wednesday, 18 October 2023		0	0	0.000	☐	Yes	☐	No
Thursday, 19 October 2023		0	0	0.000	☐	Yes	☐	No
Friday, 20 October 2023	9	45	90000	0.090	☐	Yes	☐	No
Saturday, 21 October 2023	4	20	40000	0.040	☐	Yes	☐	No
Sunday, 22 October 2023		0	0	0.000	☐	Yes	☐	No
Monday, 23 October 2023	6	30	60000	0.060	☐	Yes	☐	No
Tuesday, 24 October 2023	6	30	60000	0.060	☐	Yes	☐	No
Wednesday, 25 October 2023	8	40	80000	0.080	☐	Yes	☐	No
Thursday, 26 October 2023	7	35	70000	0.070	☐	Yes	☐	No
Friday, 27 October 2023		0	0	0.000	☐	Yes	☐	No
Saturday, 28 October 2023		0	0	0.000	☐	Yes	☐	No

Sunday, 29 October 2023		0	0	0.000	☐	Yes	☐	No
Monday, 30 October 2023	2	10	20000	0.020	☐	Yes	☐	No
Tuesday, 31 October 2023	7	35	70000	0.070	☐	Yes	☐	No
Totals:	**92**	**460**	**820000**	0.820	☐		☐	

S91i Log Book

Request ID: 394821

Applicant Name:	Michael Holz			**Comments:**	**Conditions on the access licence are met for extracting water**	
Work Approval:	10WA104627					
Work Approval Holder:	Menangle sand &soil					
Extraction site ID:	56540					
Size of the meter:	100mm					
Date meter broken:	14/07/2020					
Meter reading as at date meter broken:	Unknown					
Meter reading as at date meter repaired:	Unknown			**Additional information required:**		
Alternate read at the Break Down Date:						
Alternate Read when meter repaired/replaced:						
Calibration Factor for no alternate device or meter:	engine hours - 100,00 litres/fill					
Purpose the water is used for:	industrial - dust suppression					
If irrigating, what is the size of area that is irrigated :						
Expiry Date of S91i:	30/09/2020					

Date	Truck fills / day	Run Minutes(5min/Fill)	5000L/Fill Hire truck	ML Used - 1000000L				
Eg. (enter fills per day)		*5*	*5000*	*1000000*	☐	Yes	☐	No
Friday, 1 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Saturday, 2 September 2023	7	35	35000	0.035	☐	Yes	☐	No
Sunday, 3 September 2023		0	0	0.000	☐	Yes	☐	No
Monday, 4 September 2023	7	35	35000	0.035	☐	Yes	☐	No
Tuesday, 5 September 2023	5	25	25000	0.025	☐	Yes	☐	No
Wednesday, 6 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Thursday, 7 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Friday, 8 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Saturday, 9 September 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 10 September 2023		0	0	0.000	☐	Yes	☐	No
Monday, 11 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Tuesday, 12 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Wednesday, 13 September 2023	4	20	20000	0.020	☐	Yes	☐	No
Thursday, 14 September 2023	8	40	40000	0.040	☐	Yes	☐	No
Friday, 15 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Saturday, 16 September 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 17 September 2023		0	0	0.000	☐	Yes	☐	No
Monday, 18 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Tuesday, 19 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Wednesday, 20 September 2023	9	45	45000	0.045	☐	Yes	☐	No
Thursday, 21 September 2023	1	5	5000	0.005	☐	Yes	☐	No
Friday, 22 September 2023	2	10	10000	0.010	☐	Yes	☐	No
Saturday, 23 September 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 24 September 2023		0	0	0.000	☐	Yes	☐	No
Monday, 25 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Tuesday, 26 September 2023	6	30	30000	0.030	☐	Yes	☐	No
Wednesday, 27 September 2023	5	25	25000	0.025	☐	Yes	☐	No
Thursday, 28 September 2023	1	5	5000	0.005	☐	Yes	☐	No

Friday, 29 September 2023	1	5	5000	0.005	☐	Yes	☐	No
Saturday, 30 September 2023		0	0	0.000	☐	Yes	☐	No
Sunday, 1 October 2023		0	0	0.000	☐	Yes	☐	No
Totals:	**116**	**580**	**580000**	0.580	☐		☐	