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DA 315-7-2003 (MOD 5) Annual Review

Schedule 6 Condition 5

Prepared for Luddenham Operations Pty Ltd

September 2024

DA 315-7-2003 (MOD 5) Annual Review

Schedule 6 Condition 5

Luddenham Operations Pty Ltd

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September 2024

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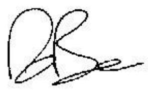

David Bone
Associate Director
27 September 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

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1 Introduction

Luddenham Operations Pty Ltd is the operator of the Luddenham Quarry situated at 275 Adams Road, Luddenham NSW 2745 (the site), which is approved to extract and transport up to 300,000 tonnes (t) per annum of clay and shale products in accordance with State significant development consent DA 315-7-2003 (MOD 5).

In accordance with Schedule 6, Condition 5 of DA 315-7-2003 (MOD 5), this Annual Review assesses the environmental performance of the site between the reporting period of 1 September 2023 to 31 August 2024.

Coombes Property Group engaged EMM Consulting Pty Ltd to complete the 2023–2024 Annual Review (AR) on their behalf.

2 Conditions of consent

Table 2.1 Conditions of consent and location within the Annual Review

Schedule	Condition	Description	Report location
Schedule 3	8	The Applicant must provide annual production data to the [Regional NSW – Mining, Exploration and Geoscience] MEG, in the manner required, on the standard form supplied for that purpose. These data are also to be included in the Annual Review.	Refer to Section 3.1
Schedule 4	11	The Applicant must regularly consult with adjoining property owners to ensure property management issues including maintenance of common fences, weed control measures, and bushfire management are coordinated. Details of this consultation are to be reported in the Annual Review.	Refer to Section 3.2
Schedule 4	21B	The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under any water licence.	Refer to Section 3.6.1vi
Schedule 4	30 (e)	Report on waste minimisation and management in the Annual Review.	Refer to Section 3.3
Schedule 4	42 (b)	Procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch) and publishing a summary of these records in the Annual Review.	Refer to Section 3.4
Schedule 6	5 (a)	**By the end of September 2016 and each year following, or other timing as may be agreed by the Planning Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:** • describe the development (including 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	Refer to Section 3.5
Schedule 6	5 (b)	• include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against: – the relevant statutory requirements, limits or performance measures/criteria – the monitoring results of previous years – the relevant predictions in the document/s listed in condition 2 of Schedule 3	Refer to Section 3.6 Refer to Section 3.7
Schedule 6	5 (c)	• identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance	Refer to Section 3.8 Refer to Chapter 4
Schedule 6	5 (d)	• identify any trends in the monitoring data over the life of the development	Refer to Section 3.6
Schedule 6	5 (e)	• identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies	Refer to Section 3.6
Schedule 6	5 (f)	• describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	Refer to Section 3.8
Schedule 6	6	Copies of the Annual Review must be made available to Council and any interested person upon request.	Refer to Section 3.9

Schedule	Condition	Description	Report location
Schedule 6	15 (a)	From 30 September 2016 and for the duration of the development, the Applicant must: • make copies of the following publicly available on its website: – the document/s listed in condition 2 of Schedule 3 – current statutory approvals for the development – approved strategies, plans and programs required under the conditions of this consent – a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs – a complaints register, which is to be updated monthly – the Annual Reviews of the development (for the last 5 years) – any Independent Environmental Audit of the development, and the Applicant’s response to the recommendations in any audit – any other matter required by the Planning Secretary	Refer to Section 3.9
Schedule 6	15 (b)	– keep this information up-to-date, to the satisfaction of the Planning Secretary.	Refer to Section 3.9

3 Annual Review conditions requirements

3.1 Mining, exploration and geoscience reporting

CPG are required to include MEG data within the Annual Review (development consent Schedule 3, Condition 8). Table 3.1 and Table 3.2 show the lease details and royalties related to the project respectively.

Table 3.1 Lease details

Lease detail	Description
Lease name	Mining Lease (ML) 1816 (1992)
Return type	Non-coal Mineral Annually (01/07/2023 – 30/06/2024)
Mineral/extraction	CLAY SHALE/ STRUCTURAL CLAY
Royalty regime	Quantum Royalty
Royalty rate	$0.35 per tonne

Table 3.2 Royalty (1 July 2023 – 30 June 2024)

Royalty	Tonnes	Australian Dollars ($AUD)
Productions		
Ore produced		
Concentrates produced		
Export sales		
Local sales and other disposals	225,224	731,967.00
Purchases		
Net disposals	225,224	731,967.00
Closing stock		
Opening stock		
Minerals recovered	225,224	731,967.00
Deductions		
Gross invoice value of contained mineral		
Invoiced off-site concentrate treatment charges		
Minerals recovered		731,967.00
Direct on-site treatment expenses		
Realisation		
On-site administration		
Depreciation		

Royalty	Tonnes	Australian Dollars ($AUD)
Total deductions		
Ex mine value		731,967.00
	Royalty Due	78,828.40

Refer to Appendix A for the report downloaded from the Royalty online services portal.

3.2 Stakeholder consultation

Continued consultation with surrounding sensitive receivers will be completed when required in accordance with Schedule 4, Condition 11 and the Environmental Management Strategy (EMS) (EMM 2021). Compliance against project requirements in shown in Table 3.3.

Table 3.3 Stakeholder consultation

Item	Requirement	Response (as advised by CPG)
1	Luddenham Operations will regularly consult with adjoining property owners to ensure property management issues including maintenance of common fences, weed control measures, and bushfire management are coordinated. Details of this consultation will be reported in the Annual Review.	No formal consultation undertaken this year – no issues raised by neighbours. Fences are all in good condition and no issues with weeds, noise and dust have been raised.
2	General enquiries from the local community will be recorded in a community engagement register, which will also include any copies of formal correspondence, and responded to by the site environmental representative or operations manager within 5 days of the enquiry.	No enquiries submitted from the public this year.
3	Luddenham Operations will consult with the wider local community on an 'as needs' basis. The need for this wider consultation will be determined based on queries or complaints made to the quarry.	As no queries and/or complaints were received from CPG within the reporting period, wider local community consultation was not considered necessary.

3.3 Waste management

Due to the nature of activities that occurred on-site during the reporting period, no industrial waste was produced within the year. Extracted quarry material was the only material transported from site.

Minor amounts of general waste were produced by employees (i.e. kitchen scraps and paper etc.) which were disposed of in co-mingle waste bins and removed under general council practices.

3.4 Traffic and material movement procedures

In accordance with Schedule 4, Condition 42 (b) CPG have developed a Road Transport Protocol (EMM 2021) which outlines procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch).

The transportation and recording of material, including incidents and reporting, must comply with the procedures outlined within the Luddenham Quarry Road Transport Protocol (EMM 2021). The transportation procedure is shown in Appendix B.

As per Section 8 of the Luddenham Quarry Road Transport Protocol (EMM 2021) Sections 3.4.1 to 3.4.7 detail elements specific to traffic management.

3.4.1 Amendments to statutory approvals

No amendments were made to statutory approvals during the Annual review period.

3.4.2 Total product haulage during the reporting period

A total of 217,059 tonnes of product were hauled from the site during the Annual review period.[1]

3.4.3 Summary of heavy vehicle movements

Heavy vehicle movements, comprising a total of 5,173 loads, generally complied with the Luddenham Quarry Road Transport Protocol (EMM 2021). All quarry trucks access the site from the north and travel north on leaving the site. The most northerly 280 metre (m) long section of Adams Road is the only additional section of road used by quarry trucks. Figure 3.1 shows a summary of the truckloads exporting material from the site.

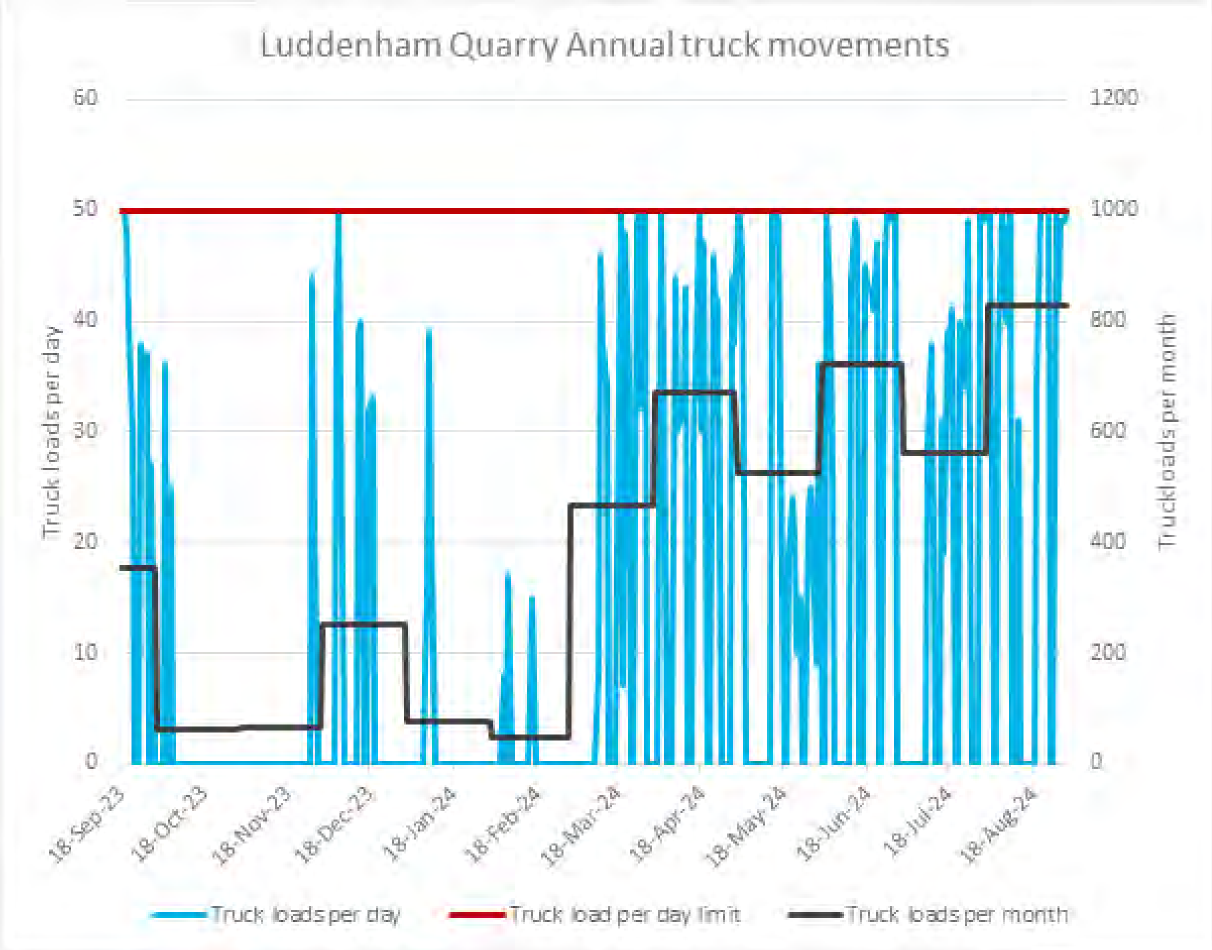

Figure 3.1 Summary of heavy vehicle movements at Luddenham Quarry

During the 2023-2024 annual monitoring round, the truck movements did not exceeded the maximum daily product truck movements allowed as per DA 315-7-2003 MOD 5.

3.4.4 Summary of complaints or incidents

No complaints or incidents relating haulage of quarry product or movement of quarry plant were received or reported over the reporting period.

1. The difference between the tonnage totals reported in Table 3.2 and Section 3.4.2 are a result of the variation in production from 1 July 2023 to 30 June 2024 and the amount of material exported from the site from 1 September 2023 to 30 August 2024.

3.4.5 Non-compliance and remedial actions

No non-compliance relating to truck loads per day was recorded during the reporting period and hence no actions required to ensure compliance.

3.4.6 Discrepancies between predicted and actual impacts of operations and potential cause

No discrepancies between the predicted and actual impacts of operations were identified.

3.4.7 Summary of management actions to be implemented

Management actions to be implemented over the next year include an internal review of traffic management plan and approved development consent approval conditions relating to operation to maintain the environmental performance of the site and ensure operations remain compliant with conditions. It is noted that an advanced resource recovery facility has been approved for the site under a separate development consent and the traffic management conditions will need to be compliant with this development consent for future operations.

3.5 Development and rehabilitation

Over the past 12 months, activities on site included:

- extraction of shale material
- stockpiling of extracted shale material
- removal of shale stockpiles
- no rehabilitation works were undertaken during this period.

Over the next 12 months, activities on site will consist of:

- extraction of shale material
- stockpiling of extracted shale material
- removal of shale stockpiles
- rehabilitation of the site, and dust mitigation measures.

Rehabilitation of the site will not commence until the end of extraction activities. This is anticipated to occur following the completion of quarrying operations in late 2024. Appendix C provides a progressive overview of the site in August 2023 when compared to February and May 2024.

Other than general maintenance activities, no weed control has been completed during the reporting period.

3.6 Environmental monitoring

This section summarises the findings of the environmental monitoring reports completed as part of the AR.

3.6.1 Water

i Monitoring program

A water quality monitoring program was developed for the Soil and Water Management Plan (SWMP) (EMM 2021) for the site. The program commenced in March 2022 and during the annual review period involved quarterly groundwater and annual surface water monitoring.

Appendix D details the monitoring completed for this Annual Review.

a Monitoring events

Three quarterly groundwater monitoring events and one annual surface water and groundwater monitoring event were undertaken for the annual review period. A summary of monitoring events, additional investigation measures and outcomes is provided in Table 3.4.

b Laboratory analytes

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Sydney, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

c Quality assurance/quality control

Surface and groundwater samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location
- collection of a field duplicate sample.

d Groundwater monitoring network

A groundwater monitoring bore network was installed before quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores were drilled and installed to a depth of approximately 30 m into the Bringelly Shale with the overlying unconsolidated material cased off. The monitoring bores were sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

During the 2021–2022 annual review, two sites (BSM1 and BSM2) were reported to be damaged and not producing representative results. It is noted that these sites were replaced with new bores, with the first sampling event from these locations being taken in August 2023. In accordance with the development consent, four monitoring rounds were undertaken as part of the 2023-2024 annual review period.

Table 3.4 Overview of completed monitoring including additional investigation measures undertaken

Monitoring event details	Additional measures undertaken	Summary of outcomes
Groundwater monitoring – 14 December 2023. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Air-compressor driven development works at BSM1 and BSM2 were undertaken prior to sampling based on anomalous results from the previous monitoring round.	Air-compressor driven development noted evidence of sediment and residual drilling material that was cleared from the monitoring wells. However, exceedances of high nutrients and oil and grease were noted in some monitoring wells. Additional surface water monitoring was recommended for future rounds.
Groundwater monitoring – 27 March 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Additional analysis was undertaken of the surface water within the quarry pit and the upgradient location at Oaky Creek, in order to determine potential sources of oil and grease and high nutrients identified in the previous groundwater monitoring rounds.	Oil and grease was noted slightly above detection limits in the quarry pit monitoring. However, nutrient exceedances not noted at the same concentrations. Extended hydrocarbon suite monitoring was recommended for future rounds.
Groundwater monitoring – 23 May 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Additional analysis was undertaken of the surface water within the quarry pit and groundwater monitoring locations for an extended hydrocarbon suite, in order to determine potential sources of oil and grease identified in the previous monitoring rounds.	Detection of heavier hydrocarbon fractions were noted, indicating the potential presence of lubricating oils or biogenic material (such as tree sap) in the monitoring wells. A silica gel clean stage was recommended for future monitoring.
	Detailed review of historic exceedances and development of timeseries water quality charts.	Analysis of timeseries data were inconclusive in determining ongoing trends.
Surface water and groundwater monitoring – 7 August 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling and four surface water sites were sampled as per the SWMP (EMM 2021).	Additional analysis was undertaken of all surface water and groundwater monitoring locations for targeted hydrocarbon suites, in order to determine potential sources of oil and grease identified in the previous monitoring rounds.	All hydrocarbons were noted below detection for post-silica gel cleanup samples, indicating that hydrocarbon sources are related to plant material and not site operations.
	Review of bore construction details (BSM1 and BSM2).	Bore construction details were available; however, no associated lithology from the time of drilling was available for review.

ii Surface water quality exceedances

The following receiving water downstream/impact site exceedances were noted:

- Ammonia exceeded the trigger value at the downstream/impact site. However, poorer water quality was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance.

- Copper exceeded trigger values at the downstream/impact site. An exceedance of equal magnitude was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance. Concentrations of copper recorded within Oaky Creek are the lower end of the recorded baseline range.

There were no downstream/impact site exceedances that are not consistent with the upstream/control site, indicating the quarry is not the source of surface water exceedances. Additionally, no discharge occurred from the site water management system during the AR period.

iii Groundwater levels

Key observations of groundwater levels during the annual review period include:

- Groundwater levels remain elevated compared to baseline trends.

- Groundwater levels in BSM1 and BSM2 were reduced from the elevated levels reported during the previous review period. Groundwater levels in BSM3 were comparable to levels reported during the previous review periods with the exception August 2024 which recorded its highest standing water levels to date.

iv Groundwater quality exceedances

a Toxicants

The following exceedances relative to default guideline trigger values and background concentrations reported in BSM1 were noted:

- Concentrations of chromium exceeded the trigger value at BSM2 in May with a concentration of 4 µg/L and at BSM3 in August with a concentration of 3 µg/L. It is noted the upgradient monitoring well, BSM1 reported a concentration of 3 µg/L in May and hence these concentrations are not likely to be attributable to site operations. Attention will be given to any developing trends for chromium concentrations in future groundwater monitoring.

- Concentrations of copper exceeded trigger values at BSM2 for all four monitoring rounds. With the exception of the August result of 5 µg/L, an exceedance of equal magnitude was noted at the upgradient/control site BSM1 during March and May. As both wells were reconstructed during the previous annual review period, these results may be related. Attention will be given to any developing trends for copper concentrations in future groundwater monitoring.

- Concentrations of iron exceeded the trigger value at BSM3 in March and in May with a maximum concentration of 1.89 mg/L. Upgradient location BSM1 recorded a concentration of 1.44 mg/L for iron in August. Iron is known to be present in groundwater near the site with the baseline data set median concentration noted as 8.5 mg/L.

- Concentrations of manganese exceeded trigger values at BSM2 for all four monitoring rounds with a maximum concentration of 2.84 mg/L. An exceedance of 2.01 mg/L was reported at the upgradient/control site BSM1 during March. Attention will be given to any developing trends for manganese concentrations in future groundwater monitoring.

- Concentrations of nickel exceeded the trigger value at BSM3 in March with a concentration of 0.071 mg/L. Upgradient location BSM1 recorded a concentration of 0.016 mg/L for nickel in March. Concentrations of nickel were reported below the trigger value at BSM3 during the two subsequent monitoring rounds.

- Zinc exceeded the trigger values at all three sites. A maximum concentration of 0.048 mg/L was noted at BSM1 and BSM2 which is below the baseline median of 0.06 mg/L.

Trigger value exceedances over default guideline values are consistent with baseline trends and are unlikely to be related to the project.

b Oil and grease

Concentrations of oil and grease were reported at concentrations below detectable limits for all locations and monitoring wells with the exception of:

- BSM1 in December 2023 and March 2024.

- BSM2 in May 2024.

- BSM3 reported detectable concentrations in March 2024.

Additional analysis was undertaken to assess source of the oil and grease detections including surface water locations and additional analysis of hydrocarbon suites to assess the composition of the detected oil and grease concentrations.

- All surface water samples reported concentrations of oil and grease below detection limits with the exception of a sample taken from the Quarry Pit in March 2024. Subsequent monitoring of the Quarry Pit reported concentrations below detectable limits.

- Concentrations of PAH in all groundwater and surface water samples were below detectable limits.

- Concentrations of total petroleum and recoverable hydrocarbons (TPH and TRH) were reported at concentrations above detectable limits at BSM1 and BSM2 in May and August, with all other locations below detectable limits. Concentrations of TPH and TRH were reported at concentrations below limits at BSM1 and BSM2 following the treatment of samples via silica gel cleanup, indicating the detected concentrations are potentially related to biogenic organic compounds as opposed to petroleum hydrocarbons.

c Physico-chemical properties

A review of water quality results from the monitoring bore network (BSM1, BSM2 and BSM3) showed water quality for some analytes that are not consistent with baseline data trends, notably:

- Electrical conductivity in BSM1 ranged from 6,714 to 23,375 µS/cm compared to a baseline median of 23,100 µS/cm. Results recorded at the lower range are considered to be anomalous and may contain inflows from a surface water or alluvial groundwater source.

- Total nitrogen in BSM1 ranged from 6 to 73.1 mg/L and in BSM2 ranged from 32.6 to 75 mg/L. Concentrations in BSM3 were elevated, but consistently below BSM1 levels. No baseline data exists for nitrogen; however, nitrogen levels have historically been less than 8.2 mg/L within bores on site during operation.
- Ammonia in BSM1 ranged from 0.2 to 5.46 mg/L and in BSM2/BSM3 ranged from 0.21 to 8.35 mg/L. No baseline data exists for ammonia; however, ammonia levels have been historically ranged from 0.03 to 8.2 mg/L within bores on site during operation.
- Reactive phosphorus in BSM1 ranged from below detection to 23.4 mg/L and in BSM2 ranged from 9.25 to 65.8 mg/L, compared to a baseline median of 0.4 mg/L.

It is suspected that the monitoring well network may be influenced by:

- monitoring well installation processes (for reconstructed bores BSM1 and BSM2)
- surface water ingress or potentially alluvial inflow, or
- offsite activities such as hydro-mulching and use of fertilizers for mass-reestablishment of groundcover at the Western Sydney Airport.

v Monitoring program recommendations

Considering the baseline data trends, physical and chemical results in the whole well network (both upgradient and downgradient) and results of additional investigative monitoring, it is unlikely that exceedances are related to operations at the quarry. The following recommendations are made for future monitoring rounds:

- Continued additional monitoring of oil and grease/hydrocarbon detections.
- Continued monitoring of trends in metals, nutrients and oil and grease/hydrocarbons to determine if the water quality results return to baseline levels over the next annual review period. Should unrepresentative results continue to be reported, review of the options for replacement of monitoring well network may be required.

vi Water extraction, usage and discharge

CPG are required to report on water extracted or discharged from the site within the reporting period (Schedule 4 Condition 21 (b)).

A summary of water use (confirmed by the water balance in Appendix D) is presented in Table 3.5.

Table 3.5 Summary of water use September 2023 – August 2024

Project Location	Volume	Comments	Water licensing
Water management dam	2.5 ML/year	Dust suppression water sourced from disturbed area runoff.	Exempt[1]
Quarry pit	19.8 ML/year	Dust suppression water sourced from disturbed area runoff.	Exempt[1]
	60 ML/year	Active water management of disturbed area runoff via evaporative misters.	Exempt[1]
	1.8 ML/year	Groundwater inflow to the quarry pit.	10MW119330 WAL34685[2]

Project Location	Volume	Comments	Water licensing
Discharge to Oaky Creek	0 ML/year	No discharge events occurred for the annual review period.	N/A

Table notes:

1. Under the Schedule 1, Item 3 of the Water Management (General) Regulation 2018.
2. Trading in the water market is currently underway to satisfy licensing requirements associated with groundwater inflows.

3.6.2 Air quality

The Air Quality Management Plan was updated during this annual review period. The updated version (revision 5) was issued to DPHI 4 June 2024 with approval issued 12 July 2024.

i Deposited Dust

The air quality monitoring network consists of three dust deposition gauges (DDGs) installed, operated and analysed in accordance with AS 3580. 10. 1 2003. Static dust monitoring sites were chosen at locations adjacent to sensitive receivers in proximity to the works in accordance with the approved Air Quality Management Plan (AQMP).

Appendix E.1 details the monitoring completed within the reporting period.

Dust deposition gauges were used to monitor deposited dust between the 26 October 2023 to 13 August 2024.

Table 3.7 outlines the results of the monitoring completed within the reporting period.

Table 3.6 Dust deposition gauge monitoring data

Dust deposition gauge	Installation date	Removal date	Number of days	Insoluble solids ($g/m^2/mth$)	Annual average dust criteria ($g/m^2/mth$)	Rolling average
DG01	26/10/2023	24/11/2023	29	**Nil**	4	0.4
	24/11/2023	21/12/2023	27	**4.4**		2.5
	21/12/2023	18/01/2024	28	3		1.7
	18/01/2024	19/02/2024	32	0.8		0.9
	19/02/2024	20/03/2024	30	0.5		0.5
	20/03/2024	23/04/2024	34	1.1		1.1
	23/04/2024	21/05/2024	28	0.8		1.0
	20/05/2024	18/06/2024	28	2.1		1.5
	18/06/2024	16/07/2024	28	1.2		1.7
	16/07/2024	13/08/2024	28	**5.7**		3.0
DG02	26/10/2023	24/11/2023	29	0.7	4	0.4
	24/11/2023	21/12/2023	27	1.6		2.5
	21/12/2023	18/01/2024	28	1.8		1.7
	18/01/2024	19/02/2024	32	1.2		0.9

Dust deposition gauge	Installation date	Removal date	Number of days	Insoluble solids ($g/m^2/mth$)	Annual average dust criteria ($g/m^2/mth$)	Rolling average
	19/02/2024	20/03/2024	30	0.8		0.5
	20/03/2024	23/04/2024	34	1.5		1.1
	23/04/2024	21/05/2024	28	1.5		1.0
	20/05/2024	18/06/2024	28	1.5		1.5
	18/06/2024	16/07/2024	28	3.6		1.7
	16/07/2024	13/08/2024	28	2.3		3.0
DG03	26/10/2023	24/11/2023	29	0.1	4	0.4
	24/11/2023	21/12/2023	27	1.4		2.5
	21/12/2023	18/01/2024	28	0.4		1.7
	18/01/2024	19/02/2024	32	0.6		0.9
	19/02/2024	20/03/2024	30	0.1		0.5
	20/03/2024	23/04/2024	34	0.8		1.1
	23/04/2024	21/05/2024	28	0.7		1.0
	20/05/2024	18/06/2024	28	0.8		1.5
	18/06/2024	16/07/2024	28	0.4		1.7
	16/07/2024	13/08/2024	28	0.9		3.0

Notes:

1. No monitoring was completed during the period between 30 September 2023 and 26 October 2023 due to technical difficulties.
2. The following periods did not comply with the sample exposure for *Australian Standard (AS) 3580.10.1 – 2016 Methods for sampling and analysis of ambient air, Method 10.1: Determination of particulate matter - Deposited matter - Gravimetric method* allowances for 30 days +/- 2 days:
   a. 24 November 2023 to 21 December 2023 due to Christmas break.
   b. 20 March 2024 to 23 April 2024 due to logistical and resourcing complications.
3. The monitoring results for DG01 between 26 October 2023 to 24 November 2023 were not available as the sample container was broken during transportation to the laboratory (by the courier) and the sample could not be recovered.
4. An update to the AQMP was approved on 12 July 2024. Monitoring was not completed beyond the 13 August 2024 as monitoring requirements for the 2023-2024 period had been met.

Figure 3.2 is a visual representation of the data presented in Table 3.6.

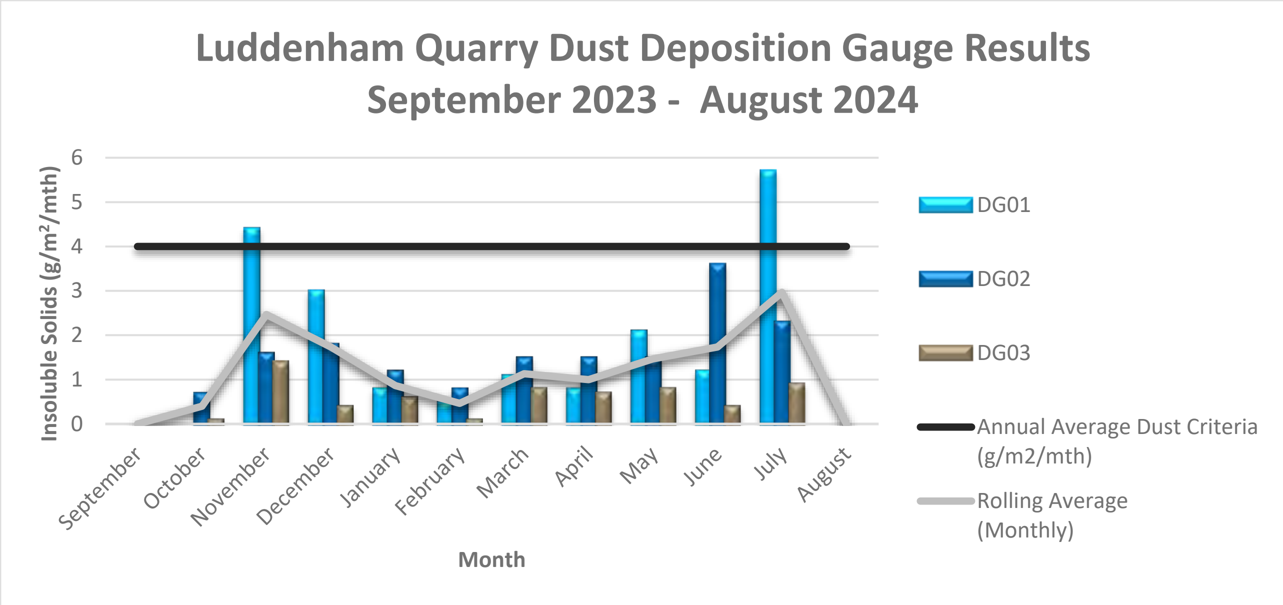

Figure 3.2 Dust deposition gauge results

All DDG monitoring completed over the reporting period was compliant with total dust deposition criteria (4.0 g/m^2/month) with the exception of DG01 between 24 November 2023 and 21 December 2023 and DG01 between 16 July 2024 and 13 August 2024.

Quary operations informed CPG that works occurred in the south-western corner, in the proximity of DG01, between 24 November 2023 and 21 December 2023. The south-western corner was used as a ramp to access the top of stockpiled material stored on the western side of the pit.

Quary operations informed CPG that the south-western corner of the site, in the proximity of DG01, is passed regularly by road trucks as per the Road Transport Protocol upon loading and also is access by dump trucks when mining a specific colour of shale. This was considered the likely cause of the total dust deposition criteria between 16 July 2024 and 13 August 2024.

Following both exceedances a review was undertaken by Quarry operations with recommendations made to increase water cart use, monitor wind conditions and air quality and temporarily cease works during high wind where required, and target mitigation measures to direct activity areas where feasible to do so. As per Figure 3.2 insoluble solids results for DG01 reduced following the recommendations in November 2023, with no monitoring conducted following the recommendations in August.

The rolling and annual averages are below the annual total dust deposition criteria of (4.0 g/m^2/month). The monitoring results were elevated compared to historical data at in November 2023 and July 2024 DG01, and in June at DG02. It was observed during June monitoring at DG02 the results were likely impacted by interference from overspray as a result of dust suppression works. All other monitoring results are consistent with historical data prior to this reporting period.

ii Real time monitoring

A four week monitoring program was completed during August 2024 using two continuous PM monitoring units (FDS PM monitoring system) to record concentrations of PM_{10} and $PM_{2.5}$ to comply with the Air Quality Management Plan (EMM, June 2024).

Appendix E.2 details the real time air quality monitoring.

Meteorological measurements for the monitoring period were sourced from the nearby Bureau of Meteorology (BoM) Badgerys Creek AWS. The onsite PM monitoring data was also compared with monitoring data for the same period from the DPE Bringelly AQMS.

Siting of equipment was conducted in accordance with AS/NZS 3580.1.1:2007, as much as practicable, taking the constraints of site into consideration. The monitoring equipment was deployed at the north-east and south-west corners of the site, with a specific focus of the monitoring study to record upwind and downwind concentrations.

A summary of the monitoring results are as follows:

- No exceedances of the 24 hour PM_{10} criterion of 50 µg/m^3 were recorded or derived at either of the onsite monitoring locations.
- No exceedances of the 24 hour $PM_{2.5}$ criterion of 25 µg/m^3 were recorded at either of the onsite monitoring locations.
- The PM_{10} concentrations at the quarry were higher than those recorded at the DCCEEW Bringelly AQMS on multiple occasions. It is noted that concentrations were generally higher at the AQM01, this is likely due to the monitors proximity to the main haul route.
- The $PM_{2.5}$ concentrations at the quarry were generally comparable with the concurrent measurements at the DCCEEW Bringelly AQMS for the same period.
- When upwind and downwind concentrations were considered, the contribution from the site did not result in an exceedance of the criteria specified.

It is inferred that no exceedances of the annual total solid particulates (TSP) criterion of 90 µg/m^3 would occur based on the recorded PM_{10} concentrations.

3.6.3 Noise and vibration

EMM conducted a bi-annual noise survey of operations at the site to comply with the Noise Management Plan (EMM, 2021). Environmental noise monitoring events were undertaken during the day periods of 11 and 12 April 2024, and 22 and 23 August 2024. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified EPL limits. Appendix F details the August 2024 noise monitoring.

The noise survey included attended noise monitoring which occurred during the day period at multiple receptors around the site. The duration of each measurement was 15 minutes. Where access to a property was not granted or measurement at assessment location was not practical due to localised construction activities, monitoring was completed at alternative representative locations and results were calculated back for the actual assessment location. This approach is consistent with the approved Luddenham Quarry Noise Management Plan (NMP) (EMM 2021) for the site and the NSW EPA 'Noise Policy for Industry' (NPfI). The attended monitoring was completed during the day period in accordance with Section M4.1 of the EPL.

Attended environmental noise monitoring was completed in general accordance with Australian Standard AS1055 *Acoustics, Description and Measurement of Environmental Noise* and relevant NSW requirements. Meteorological data was obtained from the Badgerys Creek automatic weather station (AWS) (station ID 067108) which allowed correlation of atmospheric parameters with measured site noise levels.

Noise levels from site complied with relevant limits at all monitoring locations during the April and August 2024 surveys. The monitoring completed was consistent with previous reporting periods with no exceedance of project criteria.

3.7 Complaints and incidents

No complaints have been received within the reporting period.

No environmental incidents have been recorded during the reporting period, excluding exceedance of the monitoring criteria identified in Section 3.6.

3.8 Proposed mitigation measures

Over the next 12 months, activities on site will continue to be managed to meet all relevant statutory requirements, limits, and performance measures/criteria. Mitigations proposed as part of the sites ongoing compliance include the following:

- Ongoing management of the site in accordance with the mitigation measures listed with relevant management plans.
- Monitoring is to be completed in accordance with relevant management plans.
- An internal review audit be completed to assess site compliance against relevant conditions and management plan requirements.

3.9 Report and document availability

Copies of the Annual Review will be made available to Council and any interested person upon request.

As required by Schedule 6, Condition 15(a), copies of the following documentation are publicly available on CPG's website (https://luddenhamquarry.com.au/).

3.9.1 Compliance against Schedule 6, Condition 15 (a)

As conditioned by Schedule 6, Condition 15 (a), this section demonstrates the availability of reports on CPG's website:

- The document/s listed in condition 2 of Schedule 3.

Table 3.7 Schedule 3, Condition 2 requirements

Condition	Description	On website
a	In compliance with these conditions of consent.	-
b	In accordance with all written directions of the Planning Secretary.	None received
c	Generally in accordance with EIS titled Proposed Clay/Shale Extraction Operation – Lot 3 – 275 Adams Road Luddenham, dated May 2003, and prepared by Douglas Nicolaisen & Associates.	Yes
d	Generally in accordance with correspondence from Douglas Nicolaisen & Associates to the Department dated 16 March 2004 relating to operating hours, location of environmental bunds and reduction in the proposed extraction area.	Yes
e	Generally in accordance with information accompanying modification application DA 315-7-2003-MOD 1 for the relocation of the access bridge across Oaky Creek, lodged 16 November 2005, and prepared by Stuart J Castle.	Yes (MOD 5)

Condition	Description	On website
f	Generally in accordance with Modification Application DA 315-7-2003 MOD 2 and the accompanying SEE titled *Section 96(1A) Modification Application, 275 Adams Road Luddenham* produced by Planning Direction Pty Ltd and dated 3 November 2009 and A*coustic Report – Clay/Shale Quarry at 275 Adams Road Luddenham* produced by Golders Associates Ltd and dated 15 December 2009.	Yes (MOD 5)
g	Generally in accordance with Modification Application DA 315-7-2003 MOD 3 and the accompanying Environmental Assessment titled Environmental Assessment Report for Epic Mining Pty Ltd: 275 Adams Road, Luddenham, NSW, prepared by Benbow Environmental and dated November 2014 relating to temporary stockpiling, extraction sequencing and other activities.	Yes (MOD 3)
h	Generally in accordance with Modification Application DA 315-7-2003 MOD 5 and the accompanying Modification Report titled Luddenham Quarry Modification Report DA 315-7-2003 MOD 5 Prepared for Coombs Property Group & KLF Holdings, prepared by EMM Consulting and dated August 2020; Submissions Report dated December 2020 and RFI Responses dated March 2021; as amended by the revised project description prepared by EMM Consulting and dated 16 April 2021.	Yes (MOD 5)

- Current statutory approvals for the development.

Table 3.8 Statutory approvals

Item	Approval	On website
1	Development Consent DA No. 315-7-2003	Yes
2	Environmental Protection Licence 21562	Yes
3	ML 1816	Yes

- Approved strategies, plans and programs required under the conditions of this consent.

Table 3.9 Strategies, plans and programs

Item	Strategies/plans/programs	On website
1	Air Quality Management Plan	Yes
2	Discharge Characterisation and Water Pollution Impact Assessment	Yes
3	Environmental Management Strategy	Yes
4	Final Land Use Plan	Yes
5	Irrigation Management Plan *As advised by CPG, no irrigation is currently proposed.*	No
6	Noise Management Plan	Yes
7	Road Transport Protocol	Yes
8	Site Rehabilitation Plan (inclusive of Biodiversity Management Plan)	Yes
9	Soil and Water Management Plan (inclusive Site Water Balance, Erosion and Sediment Control Plan, Surface Water Management Plan and Groundwater Management Plan)	Yes

Item	Strategies/plans/programs	On website
10	Traffic Management Plan *Matters addressed in the Road Transport Protocol plan.*	Yes

- 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.

Table 3.10 Summary of monitoring results

Item	Monitoring results	On website
1	Summary of monitoring results *This Annual Review provides a summary of monitoring results and will be uploaded to the website.*	Yes

- A complaints register, which is to be updated monthly.

Table 3.11 Complaints register

Year	Complaints Register	On website
2024	September 2021 to September 2024 (0 Complaints)	Yes

- The Annual Reviews of the development (for the last 5 years).

Table 3.12 Annual Reviews

Year	Annual Review	On website
2022	2022 Annual Review	Yes
2023	2023 Annual Review	Yes

- Any other matter required by the Planning Secretary.

Table 3.13 Other matters required by the Planning Secretary

Item	Other matters	On website
1	RFI Responses	Yes
2	Submission Report	Yes

- Any Independent Environmental Audit of the development, and the Applicant’s response to the recommendations in any audit.

Table 3.14 Independent Environmental Audit

Audit	Description of audit and responses	On website
1	Audit to be undertaken following the lodgement and acceptance of this Annual Review in order to provide 3 years of monitoring and returns for audit.	No

3.9.2 Compliance against Schedule 6, Condition 15 (b)

All information is checked annually and is kept up-to-date to the satisfaction of the Planning Secretary.

4 Summary of results

Table 4.1 outlines a summary of the monitoring completed for the Annual Review period and results pertaining the relevant assessments.

Table 4.1 Summary of results

Annual review item	Monitoring completed	Exceedance/non-compliance (NC) identified	Comments
Development and rehabilitation	Site inspection		No rehabilitation was undertaken in the reporting period.
Traffic management	Review of truck movements	Truck movements were compliant with the traffic management plan and road transport protocol.	It is noted that an advanced resource recovery facility has been approved for the site under a separate development consent and the traffic management conditions will need to be compliant with this development consent for future operations.
Surface water	Water sampling	Elevated levels of physical and chemical analytes were recorded within monitoring.	Elevated levels were noted at both upstream and downstream monitoring sites.
Groundwater	Water sampling	Exceedance of metals. Anomalous nutrient results in reconstructed wells. Oil and grease was identified as above detection limits. Physical parameters indicating potential alluvial or surface water inflow.	Groundwater monitoring schedule and scope compliant with water management plan. Additional monitoring completed throughout the annual review period to determine source of anomalies. No connection between anomalous results and onsite activities. Increased levels of contaminates may have been a result of offsite activities and/or monitoring well installation processes.
Air quality	Dust deposition gauge	All rolling average monthly and annual average monitoring was compliant against project criteria.	Two exceedances identified above the 4 g/m2/month guideline. The project specific criterion for dust deposition is an annual average and the results remain below as an annual average. An updated air quality management plan with reduced monitoring requirements was approved 12 July 2024. The monitoring program over the annual period is compliant with the updated AQMP.
	Realtime ($PM_{2.5}$ and PM_{10})	All monitoring completed was compliant against project criteria.	No exceedances identified. An updated air quality management plan with reduced monitoring requirements was approved 12 July 2024. The monitoring program over the annual period is compliant with the updated AQMP.
Noise and vibration	Noise monitoring	All monitoring completed was compliant against project criteria.	No exceedances identified.
Complaints			CPG advised that no complaints were received within the reporting period.
Incidents	Field inspections		CPG advised that no incidents were identified during the reporting period.

Annual review item	Monitoring completed	Exceedance/non-compliance (NC) identified	Comments
Independent Environmental Audit	Nil	Independent Environmental Audit not undertaken within the annual review period.	Audit to be undertaken following the lodgement and acceptance of this Annual Review in order to provide 3 years of monitoring and returns for audit.

Appendix A

New South Wales Government Revenue

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2023-2024 (CLAY SHALE)

▸ Client History

Royalty online services

Welcome Danielle Murphy

Logout

Lease details

Lease name:	ML 1816 (1992)
Return type:	Non-coal Mineral Annually (01/07/2023 - 30/06/2024)
Mineral / Extraction:	CLAY SHALE
Royalty regime:	Quantum Royalty
Royalty rate:	$0.35 per tonne

Royalty

Production

	Tonnes	$AUD
Ore produced:		
Concentrates produced:		
Export sales:		
Local sales & other disposals:	99,656	323,877.00
Purchases:		
Net disposals:	99,656	323,877.00
Closing stock:		
Opening stock:		
Minerals recovered:	99,656	323,877.00

Deductions

	$AUD
Gross invoice value of contained mineral:	
Invoiced off-site concentrate treatment charges:	
Minerals recovered:	323,877.00
Direct on-site treatment expenses:	
Realisation:	
On-site administration:	
Depreciation:	
Total deductions:	
Ex Mine value:	323,877.00

Royalty due: $AUD 34,879.60

Cancel

2023-2024 (STRUCTURAL CLAY)

Royalty online services

Welcome Danielle Murphy

Logout

Lease details

Lease name:	ML 1816 (1992)
Return type:	Non-coal Mineral Annually (01/07/2023 - 30/06/2024)
Mineral / Extraction:	STRUCTURAL CLAY
Royalty regime:	Quantum Royalty
Royalty rate:	$0.35 per tonne

Royalty

Production

	Tonnes	$AUD
Ore produced:		
Concentrates produced:		
Export sales:		
Local sales & other disposals:	125,568	408,090.00
Purchases:		
Net disposals:	125,568	408,090.00
Closing stock:		
Opening stock:		
Minerals recovered:	125,568	408,090.00

Deductions

	$AUD
Gross invoice value of contained mineral:	
Invoiced off-site concentrate treatment charges:	
Minerals recovered:	408,090.00
Direct on-site treatment expenses:	
Realisation:	
On-site administration:	
Depreciation:	
Total deductions:	
Ex Mine value:	408,090.00

Royalty due: $AUD 43,948.80

Cancel

Appendix B
Material transportation

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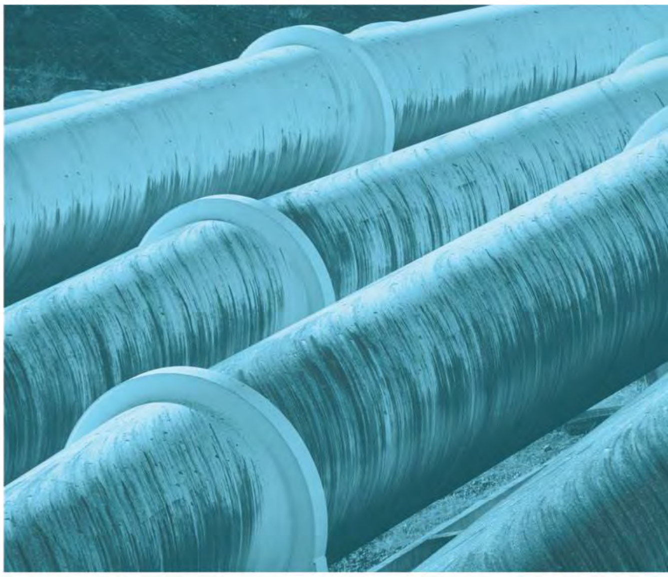
B.1 Road Transport Protocol Plan


Luddenham Quarry

Road Transport Protocol

Prepared for Luddenham Operations Pty Ltd
August 2021

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Level 6, 191 St Georges Terrace
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PO Box 9148
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Luddenham Quarry

Road Transport Protocol

Prepared for Luddenham Operations Pty Ltd

August 2021

EMM Sydney
Ground floor, 20 Chandos Street
St Leonards NSW 2065

T 02 9493 9500
E info@emmconsulting.com.au

www.emmconsulting.com.au

Luddenham Quarry

Road Transport Protocol

Report Number

J190749 RP45

Client

Luddenham Operations Pty Ltd

Date

4 August 2021

Version

V2

Prepared by

Eric Lei
Traffic Engineer
4/08/2021

Approved by

Abdullah Uddin
Associate Traffic Engineer
4/08/2021

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1 Introduction

1.1 Project Overview

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by state significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd (Luddenham Operations) will reactivate and operate the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003 which was granted on 24 May 2021.

DA 315-7-2003 (as modified) permits the production and transportation of up to 300,000 tonnes per annum (tpa) of clay and shale product up to 31 December 2024.

The location of the Luddenham Quarry is shown in Figure 1.1.

1.2 Objectives

This Road and Transport Protocol (RTP) has been prepared to satisfy DA No. 315-7-2003 (as modified), Schedule 4, Condition 42. This RTP has been prepared with reference to the following documentation, where applicable:

- *Luddenham Quarry Modification 5 – Modification Report* (EMM Consulting 2020); and
- *Luddenham Quarry Modification 5 – Traffic Impact Assessment* (EMM Consulting 2020a).

This RTP outlines how traffic generated during construction and general operations of the quarry will be managed within the requirements of Transport for NSW (TfNSW) and Liverpool City Council (Council). This RTP outlines management protocols to manage potential traffic impacts associated with:

- the nature and extent of construction works proposed;
- the routes to be used by raw material haulage traffic, types and mass of traffic vehicles and periods of operation;
- the existing traffic use of the roads in the vicinity of the site; and
- over-size vehicle movements of heavy earth moving machinery to and from the quarry.

1.3 Consent conditions

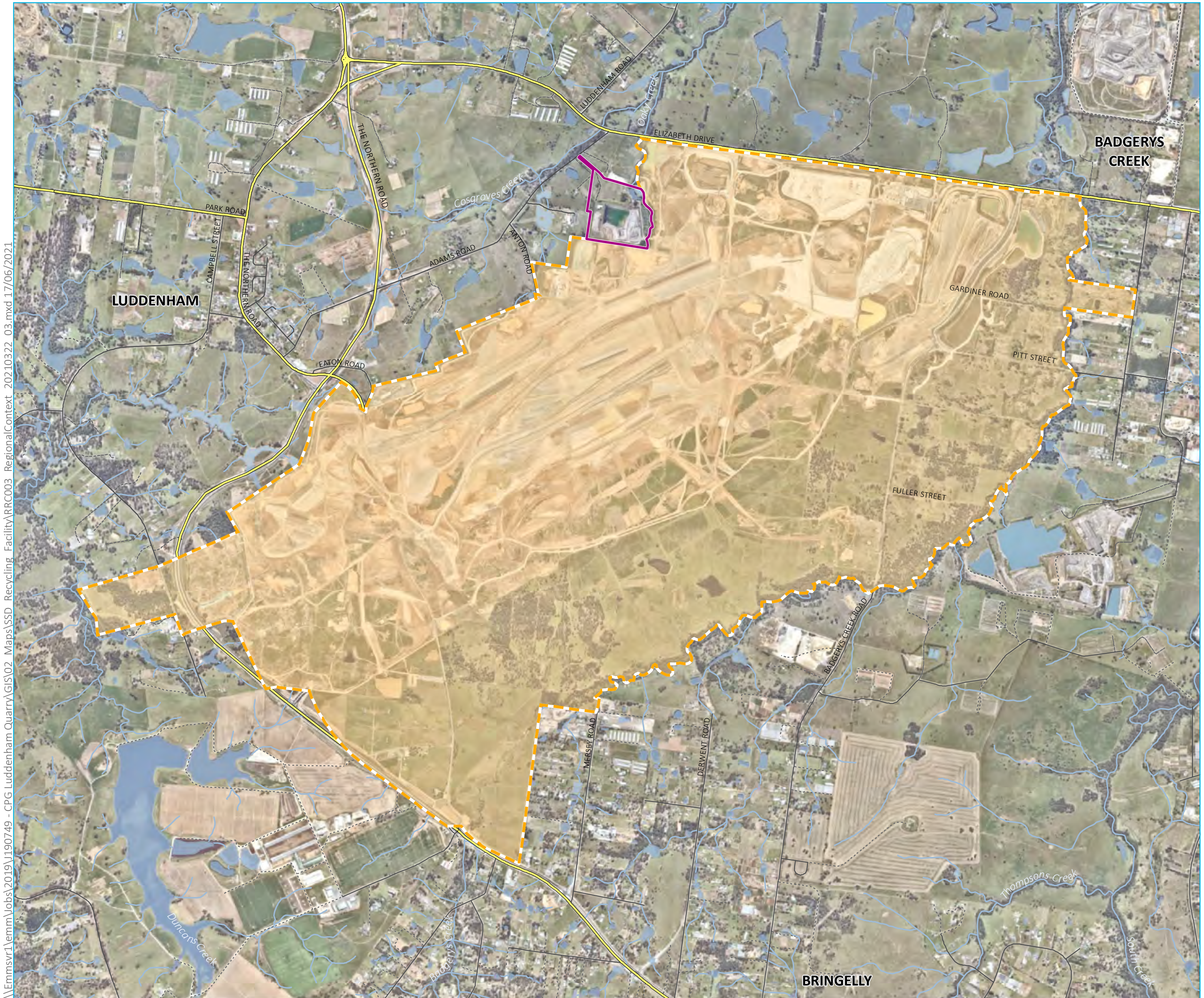
Schedule 4, Condition 42, of DA 315-7-2003 (as modified) requires the preparation of the RTP in accordance with the requirements outlined in Table 1.1.

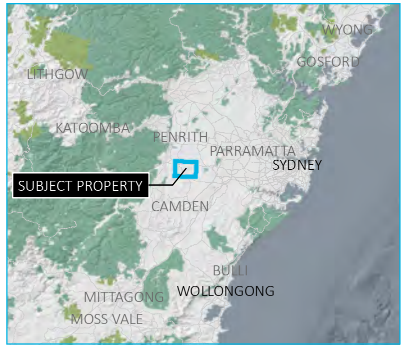
Table 1.1 Schedule 4 Condition 42 Road Transport Protocol requirements

DA 315-7-2003 Schedule 4, Condition 42		Relevant section of this RTP
Condition 42	Prior to recommencing quarrying operations approved under Modification 5, the Applicant must develop a Road Transport Protocol, in consultation with TfNSW and Council, and to the satisfaction of the Planning Secretary. This protocol must:	Section 3
(a)	specify the haulage route(s) to be used, the maximum number of road movements and the haulage hours;	Section 4.2
(b)	include a Traffic Management Plan which addresses:	
	procedures to ensure that drivers adhere to the designated haulage route(s) as required under this Protocol;	Section 4.2 and 5.2
	measures to achieve a low-frequency, regular trucking schedule rather than a high-frequency, campaign trucking schedule;	Section 4.2.1
	contingency plans where, for example, any designated transport route is disrupted. This must also address procedures for notifying relevant agencies and affected communities by the implementation of any such contingency plan;	Sections 4.2.2
	procedures to ensure that all haulage vehicles associated with the quarry are clearly distinguishable as being related to the development;	Section 4.2.3
	procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch) and publishing a summary of these records in the Annual Review;	Section 4.2.4
	procedures for covering of all loads and ensuring that trucks do not track material onto public roads;	Sections 5.6 and 5.7.
	details for procedures for receiving and addressing complaints from the community concerning traffic issues associated with haulage from the quarry or return of unladen trucks to the quarry; and	Section 6
	measures to ensure the provisions of the traffic management plan are implemented, for example, education of drivers and any contractual agreements with operators of heavy vehicles which serve the quarry.	Section 5.
(c)	include a Code of Conduct for drivers which addresses:	
	travelling speeds;	Section 5.3.
	staggering of truck departures to ensure a regular trucking schedule throughout the day;	Section 5.2.
	instructions to drivers not to overtake each other on the haulage route(s), as far as practicable, and to maintain appropriate distances between vehicles;	Section 5.2.
	instructions to drivers to adhere to the designated haulage route(s);	Section 5.2.
	instructions to drivers to be especially safety conscious and to ensure that traffic regulations are obeyed strictly;	Section 5

Table 1.1 Schedule 4 Condition 42 Road Transport Protocol requirements

DA 315-7-2003 Schedule 4, Condition 42		Relevant section of this RTP
	driver training in the Code to ensure that all drivers are made aware and adhere to the Code; and	Section 5
	procedures for ensuring compliance with and enforcement of the Code.	Section 5





KEY

- Subject property
- Western Sydney International (Nancy-Bird Walton) Airport
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line

Source: EMM (2021); DFSI (2017); Nearmap (2021)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

\\Emmsvr1\emm\Jobs\2019\J190749 - CPG Luddenham Quarry\GIS\02_Maps\SSD_Recycling_Facility\RRC003_RegionalContext_20210322_03.mxd 17/06/2021

Regional context

Luddenham Quarry
Road Transport Protocol
Figure 1.1

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2 Approved operations

2.1 Summary

Extractive operations are limited to 300,000 tonnes per annum (tpa), approved to 31 December 2024. The approved quarrying method involves extraction, crushing and stockpiling using a bulldozer, excavators, dump trucks and loading materials onto road trucks with a front-end loader.

The approved site access for the quarry is off Adams Road, approximately 250 metres (m) from the Elizabeth Drive/Adams Road intersection. An overview of the approved quarry layout is provided in Figure 2.1.

2.2 Hours of operation and workforce numbers

The approved hours of operation for the development are as follows:

- 7 00 am – 6 00 pm Monday to Friday (no haulage vehicles may enter or leave the site between 6 pm and 7 am Monday to Friday and on public holidays); and

- 7 00 am – 1 00 pm on Saturdays for maintenance activities only (no other work is to be undertaken on Saturday, Sunday and public holidays).]

The quarry site will support around 12 employees during normal operating conditions, with a maximum of 15 employees during peak operating times.

2.3 Haulage and haulage routes

The quarry is approved to generate a maximum of 100 daily truck movements.

Unless otherwise agreed by the Planning Secretary, the following restrictions apply to quarry related vehicles:

- quarry heavy vehicles are restricted to a maximum length of 19 m;

- all quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection; and

- quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access.

2.4 Road upgrades

Prior to recommencing quarrying operations approved under MOD 5, Luddenham Operations will:

- carry out pavement upgrades on the portion of Adams Road between Elizabeth Drive to approximately 40 m south of the site access road;

- prepare and implement a signage and line marking plan for the Elizabeth Drive/Adams Road intersection to restrict and manage truck access; and

- seal the internal site access road between Adams Road and the site access infrastructure area.

A section 138 approval under *the Roads Act 1938* will be obtained from Council prior to the start of pavement upgrade works on Adams Road.

Source: EMM (2021); DFSI (2017); GA (2011); Nearmap (2020)

KEY

- Study area
- Cadastral boundary

Proposed site modifications

- Approved extraction footprint
- Existing noise bunds
- Existing stockpiling area
- Extended stockpiling area
- Internal road
- Site entry infrastructure (incl. offices, amenities, weighbridge)
- Equipment laydown area

Approved site layout

Luddenham Quarry
Road Transport Protocol
Figure 2.1

EMM
creating opportunities

3 Consultation

This RTP has been prepared in consultation with TfNSW and Council. Outcomes of consultation with these agencies are summarised in the following subsections with consultation records contained in Attachment A.

Table 3.1 Consultation

Agency	Matters raised	Where addressed in RTP
TfNSW	The response from TfNSW raised no comments in relation to the RTP however noted that the signage and line marking plan required under Schedule 4 Condition 41(b) of the consent submitted to development.sco@transport.nsw.gov.au for review and approval. TfNSW also requested the signage and line marking plan be included in the RTP.	The signage and line marking plan is included in Attachment B of this RTP. The signage and line marking plan has also been forwarded to development.sco@transport.nsw.gov.au for review.
Council	Council requested the following information/comments be addressed/included in the RTP:	
	1. A haulage route map which shows travel routes from the origins to the subject site in a wide road network	An overview of heavy vehicle destinations and routes is provided in Figure 4.1.
	2. Parking provision and designated area for construction work	During the construction phase an equipment laydown area and light vehicle parking area will be established in the site entry infrastructure area as shown in Figure 1.2 (refer Section 4.1).
	3. Timeframe for the planned construction and operation activities, including the required Adams Road improvement works	The anticipated duration of the construction phase, including pavement upgrades on Adams Road will be around 4-8 weeks (refer Section 4.1).
	4. A notice with contact phone number and email details for community to make contacts regarding work activities, and installed at the site, during construction.	The construction traffic management plan prepared as part of the Section 138 application for the pavement upgrade works on Adams Road will contain the contact details for the community to make contact during pavement upgrades. This will be installed at the site entry during the construction phase.

Table 3.1 Consultation

Agency	Matters raised	Where addressed in RTP
	5. Access Arrangement - The report indicates that vehicle movements to the subject site would be restricted to left in/right out only at the Elizabeth Drive/Adams Road intersection. Elizabeth Drive is being used by significant construction vehicles, due to major construction works in the local area including the Western Sydney Airport and other major transport projects, such as The Northern Road upgrade, the M12 Motorway and Sydney Metro – WSA. With the expected increasing traffic movements along Elizabeth Drive close to its intersection with Adams Road, right turn movements out of Adams Road to Elizabeth Drive would experience delays which could result in right turn crashes at the intersection. Hence, consideration is to be given to restrict traffic movements at the intersection to left in/left out only, subject to Transport for NSW (TfNSW) approval.	Schedule 4 Condition 40 of the consent restricts all quarry-related traffic to left-in, right-out movements at the intersection of Elizabeth Drive and Adams Road, accordingly a left in/left out restriction of quarry vehicle traffic movements has not been considered further.
	6. Construction Traffic Management Plan - The CTMP is to include a requirement for Road Occupancy Permit and Road opening approval issued by Council or Road Occupancy License issued by the Transport Management Centre to be obtained before road works on the adjoining public roads. Works within the road reserve shall not commence until the construction traffic management plan has been endorsed.	This comment is noted and will be addressed in the CTMP prepared as part of the s138 application.

4 Traffic management plan

Traffic management for the quarry can generally be categorised into two stages as follows:

- Stage 1: construction including road upgrades and establishment of site entry infrastructure area prior to recommencement of quarrying operations as approved by MOD 5; and
- Stage 2: quarry operation including dispatch of quarry product.

A summary of the expected traffic impact in each stage is provided below, along with how that impact will be managed and minimised.

4.1 Stage One - Construction traffic management

The construction phase will involve sealing of the internal access roads, upgrades to Adams Road (as outlined in Section 2.4) and establishment of the site entry infrastructure area. Construction traffic will consist of earth moving plant and trucks, road pavement/asphalt trucks, heavy vehicles delivering site infrastructure (ie wheel wash and demountable site buildings) and light to medium commercial vehicles.

During the construction phase, a construction equipment laydown area and light vehicle parking would be provided in the site entry infrastructure area as shown in Figure 1.2. The anticipated duration of the construction phase, including pavement upgrades on Adams Road will be around 4-8 weeks.

4.1.1 Traffic route

The most significant traffic groups in this stage are site infrastructure deliveries, movement of road plant and road pavement/asphalt deliveries. These heavy vehicles will access Adams Road and the site via Elizabeth Drive east.

There will be no necessity for route restrictions as there will be no concentrated traffic activity from any one location during the construction phase and construction will occur during standard construction hours Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm.

4.1.2 Notification

Affected residents along Adams Road and Western Sydney Airport will be notified prior to the start of pavement upgrade works on Adams Road.

4.1.3 Road upgrades closure

Road closures may be required for the Adams Road pavement upgrade work, with appropriate Traffic Control Plans to be prepared by the road works contractor. Council approval will be sought prior to any road closure.

4.2 Stage Two - operational quarry traffic management

The operational quarry traffic stage encompasses the dispatch of clay and shale quarry products to local brick works. It also encompasses the delivery and removal as required of quarry related plant and equipment.

4.2.1 Haulage routes and schedule

Quarry trucks have fixed origins, destinations and transport routes with trucks predominately traveling between the quarry and the following locations:

- PGH Bricks Cecil Rd, Cecil Park;
- PGH Bricks Townson Road, Schofields; and
- Mulgoa Quarries 44 Tyrone Place Erskine Park.

All of the above locations are accessed via Elizabeth Road, east of the Elizabeth Drive/Adams Road intersection with all heavy vehicles travelling to and from the quarry via Elizabeth Drive east of the Elizabeth Drive/Adams Road intersection.

As outlined in Section 2.3, all quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection and quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access

All dispatch of quarry product will occur during the hours 7.00 am – 6.00 pm Monday to Friday. Haulage vehicles will not arrive at the quarry prior to 7.00 am.

Arrival of haulage vehicles and dispatch of quarry product is scheduled to ensure a low frequency regular trucking schedule with a maximum of 10 heavy vehicle movements scheduled per hour.

Plant and equipment will generally be transported to site from the quarry contractors' other operations. Oversize over mass (OSOM) permits will not be required as plant will be transported within curfew times and via approved heavy transport routes. An overview of designated haulage routes is shown in Figure 4.1.

4.2.2 Alternative routes

Consideration of alternative haulage routes, in the event of road closures, incidents or unforeseen events are addressed on an as occurs basis. Site truck drivers are instructed to use the arterial road network as much as possible and only use local roads where there is no alternative to reach to their destination.

If required, alternative haulage route notices are issued by Luddenham Operations to affected cartage-transport drivers.

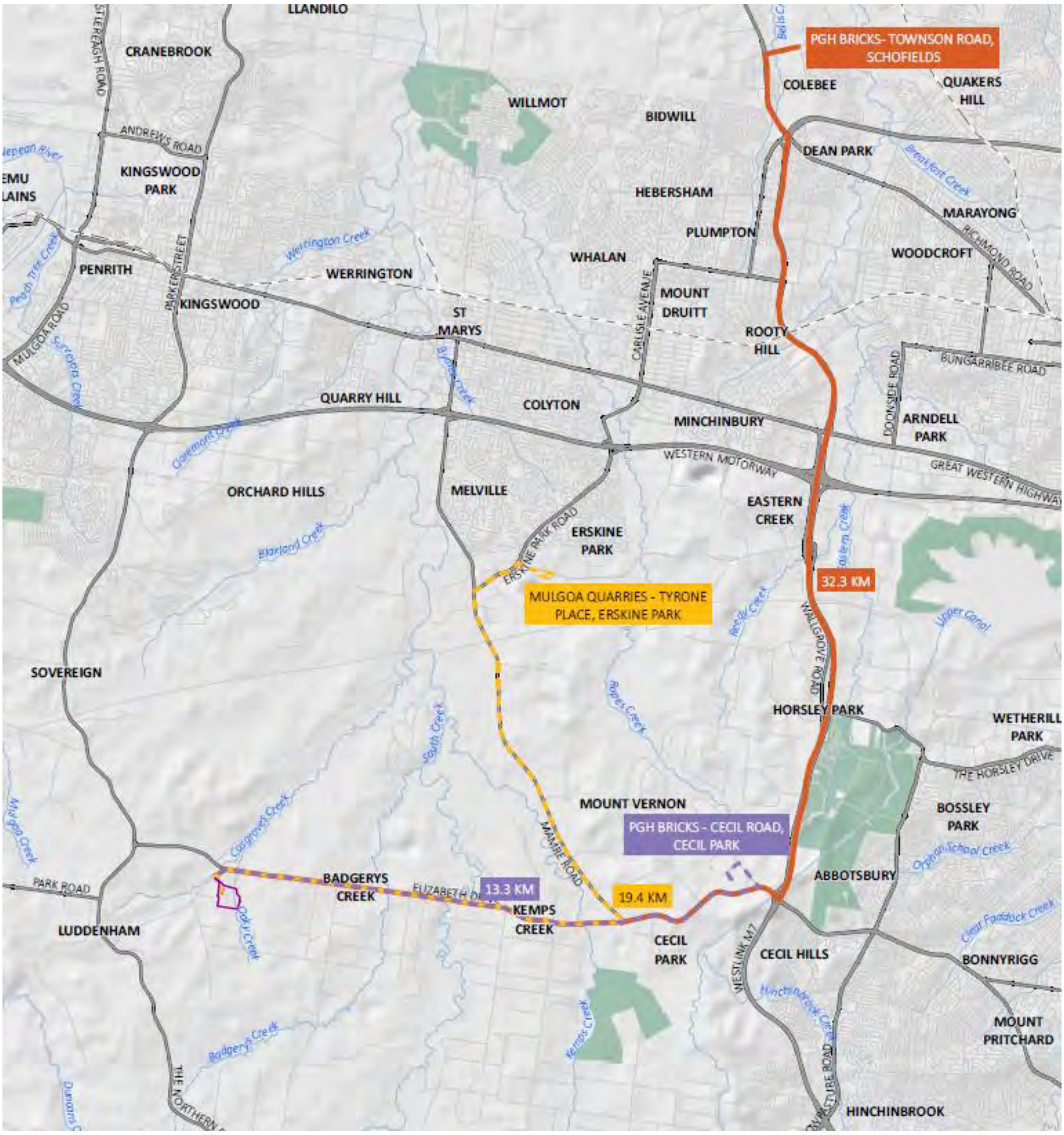
4.2.3 Quarry heavy vehicles

Quarry heavy vehicles hauling quarry product for Luddenham Operations will be limited to up to 19 m-in-length and are to display a sign in the windscreen to identify the heavy vehicle as being associated with Luddenham Operations.

4.2.4 Monitoring and reporting

Accurate records of all dispatch of quarry product are recorded including time of dispatch from the site and time of arrival at destination. Product is currently weighed on arrival at the brickworks and reported to Luddenham Operations. In addition, all haulage vehicles have in built scales to ensure they are carrying legal loads. A summary of truck movements and product dispatch is included in the annual review.

Figure 4.1 Heavy vehicle destinations and routes



5 Driver code of conduct

5.1 Purpose of the code

The Driver Code of Conduct (Code) outlines procedures to ensure that truck drivers adhere to the designated transport routes and that truck drivers implement safe driving practices.

Luddenham Operations ensure that all transport contractors are aware of the Code and that they drive responsibly and adhere to the code. All drivers are trained in the requirements of the Code and audits of the compliance with the Code are regularly conducted. All drivers reported or found to be acting in a manner contrary to the Code are subject to disciplinary action.

5.2 General requirements

Heavy vehicle drivers accessing the site must:

- abide by the conditions of consent;
- undertake a site induction carried out by an approved member of the quarry staff or suitably qualified person under the direction of Luddenham Operations. The site induction will outline:
  - the maximum daily traffic movements approved by the consent;
  - quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection;
  - quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access; and
  - scheduling of arrivals and departures to ensure a regular trucking schedule throughout the day (ie no move than 10 movements per hour).
- hold a valid driver’s licence for the class of vehicle they are driving;
- operate the vehicle in a safe manner within and external to the site;
- adhere to designated transport routes;
- not overtake each other on the haulage route, as far as practicable, and maintain appropriate distances between vehicles;
- not park on street, verges, or footpaths in the vicinity of the site or when accessing the site; and
- comply with all directions of authorised site personnel when within the site.

5.3 Heavy vehicle speed

A speed limit of 20 km/h is applied within the site for all vehicles with the exception of the sealed internal access road which has a speed limit of 40 km/h.

Drivers are to observe the posted speed limits on all public roads with speed adjusted appropriately to suit the road environment and prevailing weather conditions to comply with Australian road rules. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

Heavy vehicle operators and drivers are subject to the Heavy Vehicle National Law and Regulations. TfNSW also has a heavy vehicle rating system which centralises all road offences so repeat driver and operator offences can be identified (https://roads-waterways.transport.nsw.gov.au/roads/demerits-offences/heavy-vehicle-offences.html)

5.4 Driver fatigue

Fatigue is one of the biggest causes of crashes for heavy vehicle drivers. The National Heavy Vehicle Accreditation Scheme allows heavy vehicle operators the choice of operating under three fatigue management schemes: Standard Hours of Operation; Basic Fatigue Management (BFM); and Advanced Fatigue Management (AFM). All heavy vehicle drivers operating at the site must be aware of their adopted fatigue management scheme and operate within its requirements.

Fatigue includes (but is not limited to) the following:

- feeling sleepy;
- feeling physically or mentally tired, weary or drowsy;
- feeling exhausted or lacking energy; and
- behaving in a way consistent with any of the above.

5.5 Heavy vehicle control

In order to minimise the impact of noise from truck transport, the following controls will apply to truck operators:

- compression brakes not to be used in the vicinity of residential areas;
- tailgates must be locked and secured to avoid noise or spillage;
- always observe the posted speed on site and the local road network;
- no tailgating is permitted – a 3 second gap is to be observed at all times;
- equipment to be used must be fit for the purpose; and
- drivers to obey the operating hours outlined in Section 2.2.

5.6 Load covering

Loose material on the road surface has the potential to cause road crashes and vehicle damage. All loaded vehicles leaving the quarry must be covered prior to leaving the site and remain covered as required under NSW law for the duration of the trip. The load cover may be removed upon arrival at the delivery site. All care is to be taken to ensure that all loose debris from the vehicle body and wheels is removed prior to leaving the site and again after unloading.

Drivers must ensure that the tailgate is locked before leaving the site. Luddenham Operations is to monitor for presence of loose material on the side of the vehicle route from facility operations and take appropriate action (removal or suppression of loose materials) regularly.

5.7 Cleanliness

All loaded vehicles are to be inspected prior to leaving the site for cleanliness. Any materials that could fall on the road should be removed prior to leaving the site. All outgoing vehicles will traverse through a wheel wash to avoid tracking of soil off site.

5.8 Breakdown and incidents

In the case of a breakdown the vehicle must be towed to the nearest breakdown point as soon as possible. All breakdowns must be reported to Luddenham Operations and the vehicle protected in accordance with the Heavy Vehicle Drivers handbook.

6 Complaints management

During operating hours, a telephone complaints line will be available for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by vehicle or mobile plant connected with the operation. The telephone number will be made available on the Luddenham Operations website.

A complaints register will be made publicly available on the Luddenham Operations website, updated monthly.

A record must be kept of any complaints made to any employee or contractor in relation to activities conducted at the site. The record of complaint must be kept for at least four years after the date of the complaint, and include the following details:

- date and time of the complaint;
- method by which the complaint was made;
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a not the that effect;
- nature of the complaint;
- action taken in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was undertaken in relation to the complaint, the reasons why no action was taken.

7 Incidents

Any incident that occurs within the site boundary or is associated with Luddenham Quarry's operations must be reported by the employee or contractor who has been associated with or witnessed the incident to the Site Supervisor. An incident is defined by development consent DA 315-7-2003 as a set of circumstances that:

- causes, or threatens to cause, material harm to the environment; and/or
- breaches or exceeds the limits or performance measures/criteria in the development consent.

DPIE is required to be notified as soon as practicable following an incident. Where an incident results in a non-compliance with development consent DA 315-7-2003, DPIE and any relevant agencies are required to be notified with the following information within seven days:

- the non-compliance;
- the reasons for the non-compliance (if known); and
- what actions have been taken, or will be taken, to address the non-compliance.

In accordance with the requirements of the Environment Protection Licence and *Protection of the Environment Operations Act 1997* (POEO Act), any employee or contractor must notify the NSW Environment Protection Authority (EPA) and any relevant agencies of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident. Notifications must be made by telephoning the Environmental Line service on 131 555. Written details of the notification to the EPA must be provided within seven days of the incident.

8 Reporting and access to information

8.1 Annual review

Luddenham Quarry prepares an annual review that reviews the performance of operations against the requirements of consent and the quarry's respective management plans and provides an overview of environmental management actions taken. The annual review typically includes the following elements specific to traffic management:

- any amendments to statutory approvals;
- total product haulage during the reporting period;
- summary of heavy vehicle movements;
- a summary of complaints or incidents relating haulage of quarry product or movement of quarry plant over the reporting period;
- any non-compliance recorded during the reporting period and the actions taken to ensure compliance;
- identification of any discrepancies between the predicted and actual impacts of operations and an analysis of the potential cause of any significant discrepancies; and
- a summary of management actions to be implemented over the next year to improve the environmental performance of the site.

8.2 Access to information

For the duration of the development Luddenham Operations will ensure the website keeps up-to-date information on the following:

- Environmental assessment reports;
- current statutory approvals for the development;
- approved strategies, plans and programs required under the conditions of the consent;
- a complaints register, which is to be updated monthly;
- the annual reviews of the development (from the recommencement of quarrying under MOD 5);
- any independent environmental audit of the development, and response to the recommendations in any audit; and
- any other matter required by the Secretary.

9 Review

This RTP, including traffic management plan and driver code of conduct, will be reviewed, and if necessary revised to the satisfaction of the Secretary within 3 months of a modification to DA 315-7-2004 or following the submission of an:

- annual review:
- incident report; or
- audit report

Revisions to this RTP will be distributed to the relevant internal and external stakeholders.

References

EMM Consulting. 2021. “Luddenham Advanced Resource Recovery Centre Addendum Traffic Impact Assessment.”

EMM Consulting. 2020. “Luddenham Quarry Modification Report DA 315-7-2003 MOD5.”

EMM Consulting. 2020. “Luddenham Quarry Scoping Report MOD5.”

EMM Consulting. 2020. “Luddenham Quarry Traffic Impact Assessment DA 315-7-2003 MOD5.”

NSW TfNSW Heavy Vehicle offences website visited 8 June 2021
https://roads-waterways.transport.nsw.gov.au/roads/demerits-offences/heavy-vehicle-offences.html

Attachment A

Consultation

Janet Krick

From: Charles Wiafe <WiafeC@liverpool.nsw.gov.au>
Sent: Sunday, 18 July 2021 10:59 PM
To: Janet Krick
Cc: Christopher Jattan; Stella Qu
Subject: RE: Luddenham Quarry - Road Transport Protocol

Follow Up Flag: FollowUp
Flag Status: Completed

CAUTION: This email originated outside of the Organisation.

Hi Janet,

Council has reviewed the Road Transport Protocol report (RTPR) prepared for Luddenham Quarry and requests that the following information/comments are to be addressed and included in the report:

1. A haulage route map which shows travel routes from the origins to the subject site in a wide road network;

2. Parking provision and designated area for construction work;

3. Timeframe for the planned construction and operation activities, including the required Adams Road improvement works;

4. A notice with contact phone number and email details for community to make contacts regarding work activities, and installed at the site, during construction.

5. Access Arrangement - The report indicates that vehicle movements to the subject site would be restricted to left in/right out only at the Elizabeth Drive/Adams Road intersection.

   Elizabeth Drive is being used by significant construction vehicles, due to major construction works in the local area including the Western Sydney Airport and other major transport projects, such as The Northern Road upgrade, the M12 Motorway and Sydney Metro – WSA.

   With the expected increasing traffic movements along Elizabeth Drive close to its intersection with Adams Road, right turn movements out of Adams Road to Elizabeth Drive would experience delays which could result in right turn crashes at the intersection.

   Hence, consideration is to be given to restrict traffic movements at the intersection to left in/left out only, subject to Transport for NSW (TfNSW) approval.

6. Construction Traffic Management Plan - The CTMP is to include a requirement for Road Occupancy Permit and Road opening approval issued by Council or Road Occupancy License issued by the Transport Management Centre to be obtained before road works on the adjoining public roads. Works within the road reserve shall not commence until the construction traffic management plan has been endorsed.

   The road occupancy application is to include a traffic control plan to minimise construction impacts. The Traffic Control Plan is to be prepared in accordance with AS1742.3 “Traffic Control Devices for Works on Roads” and the Roads and Maritime Services publication “Traffic Control at Worksites” and certified by an appropriately accredited Roads and TfNSW Traffic Controller and submitted to Council and the PCA for approval. Application forms for Road Occupancy Permit and Road opening approval are available on Council’s website or can be requested from Council’s Customer Services.

Should you require clarification, please contact us again.

Regards

Charles

Charles Wiafe
Service Manager Transport Management

LIVERPOOL CITY COUNCIL

02 8711 7452 | 0417 175 763 | WiafeC@liverpool.nsw.gov.au
Customer Service: 1300 36 2170 | 33 Moore Street Liverpool, NSW 2170, Australia
www.liverpool.nsw.gov.au

From: Janet Krick <jkrick@emmconsulting.com.au>
Sent: Wednesday, June 30, 2021 8:47 AM
To: Stella Qu <QuS@liverpool.nsw.gov.au>; Charles Wiafe <WiafeC@liverpool.nsw.gov.au>
Cc: Phil Towler <ptowler@emmconsulting.com.au>
Subject: Luddenham Quarry - Road Transport Protocol

Good morning Stella and Charles,

As you may be aware, Modification 5 (MOD 5) of DA 315-7-2003 to allow for the reactivation of quarrying at Luddenham Quarry was approved on 24 May 2021.

As part of the revised conditions of consent (CoC), Luddenham Operations Pty Ltd (Luddenham Operations), a joint venture between Coombes Property Group and KLF Recycling must prepare updated management plans prior to the recommencement of quarrying operations. The CoC require the preparation of a Road Transport Protocol in consultation for Transport for NSW (TfNSW) and Council.

Accordingly please find the draft Road Transport Protocol attached for your review and comment.

Please note that the protocol addresses operational traffic management for the quarry as per the consent requirements. A separate construction traffic management plan will be prepared and submitted to Council as part of the Section 138 approval to carry out pavement upgrades on Adams Road required prior to the recommencement of quarrying.

Any comments would be appreciated by 14 July 2021. Please do not hesitate to give me a call with any questions/comments you may have.

Many thanks in advance

Janet Krick
Associate Environmental Planner

T 02 4907 4800
M 0456 664 212
D 02 4907 4811
Connect with us

NEWCASTLE | Level 3, 175 Scott Street, Newcastle NSW 2300

Please note my working days are Monday to Thursday

Janet Krick

From:	Felix Liu <Felix.Liu@transport.nsw.gov.au>
Sent:	Tuesday, 13 July 2021 10:02 AM
To:	Janet Krick
Cc:	Phil Towler; Abdullah Uddin
Subject:	20210713 - TfNSW response - Luddenham Quarry - Road Transport Protocol - SYD09/00807/14
Follow Up Flag:	Follow up
Flag Status:	Flagged

CAUTION: This email originated outside of the Organisation.

Hi Janet,

Thank you for sending the Road Transport Protocol and the signage and linemarking plan to TfNSW for review.

TfNSW has reviewed the information and raises no further comments. However, it should be noted that the signage and linemarking plan should form part of the requested Road Transport Protocol / Operation Traffic Management Plan (OTMP) to be submitted to TfNSW for review and approval. The documents should be submitted to development.sco@transport.nsw.gov.au.

I hope this has been of assistance.

Kind regards

Felix Liu

Land Use Planner
Sydney Roads
Greater Sydney
Transport for NSW

Tel: 02 8849 2113
Level 5/27 Argyle Street Parramatta NSW 2150

Use public transport... plan your trip at transportnsw.info

From: Janet Krick [mailto:jkrick@emmconsulting.com.au]
Sent: Wednesday, 30 June 2021 8:43 AM
To: Felix Liu <Felix.Liu@transport.nsw.gov.au>
Cc: Phil Towler <ptowler@emmconsulting.com.au>
Subject: Luddenham Quarry - Road Transport Protocol

CAUTION: This email is sent from an external source. Do not click any links or open attachments unless you recognise the sender and know the content is safe.

Good morning Felix,

As you may be aware, Modification 5 (MOD 5) of DA 315-7-2003 to allow for the reactivation of quarrying at Luddenham Quarry was approved on 24 May 2021.

As part of the revised conditions of consent (CoC), Luddenham Operations Pty Ltd (Luddenham Operations), a joint venture between Coombes Property Group and KLF Recycling must prepare updated management plans prior to the recommencement of quarrying operations. The CoC require the preparation of a Road Transport Protocol in consultation for Transport for NSW (TfNSW) and Council.

Accordingly please find the draft Road Transport Protocol attached for your review and comment.

Please note that the protocol addresses operational traffic management for the quarry as per the consent requirements. A separate construction traffic management plan will be prepared as part of the Section 138 approval to carry out pavement upgrades on Adams Road required prior to the recommencement of quarrying.

Any comments would be appreciated by 14 July 2021. Please do not hesitate to give me a call with any questions/comments you may have.

Many thanks in advance

Janet Krick
Associate Environmental Planner

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T 02 4907 4800
M 0456 664 212
D 02 4907 4811
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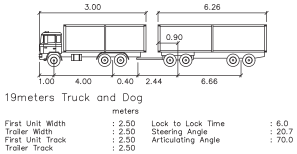
Please note my working days are Monday to Thursday

Attachment B

Signage and line marking plan



VEHICLE

LEGEND

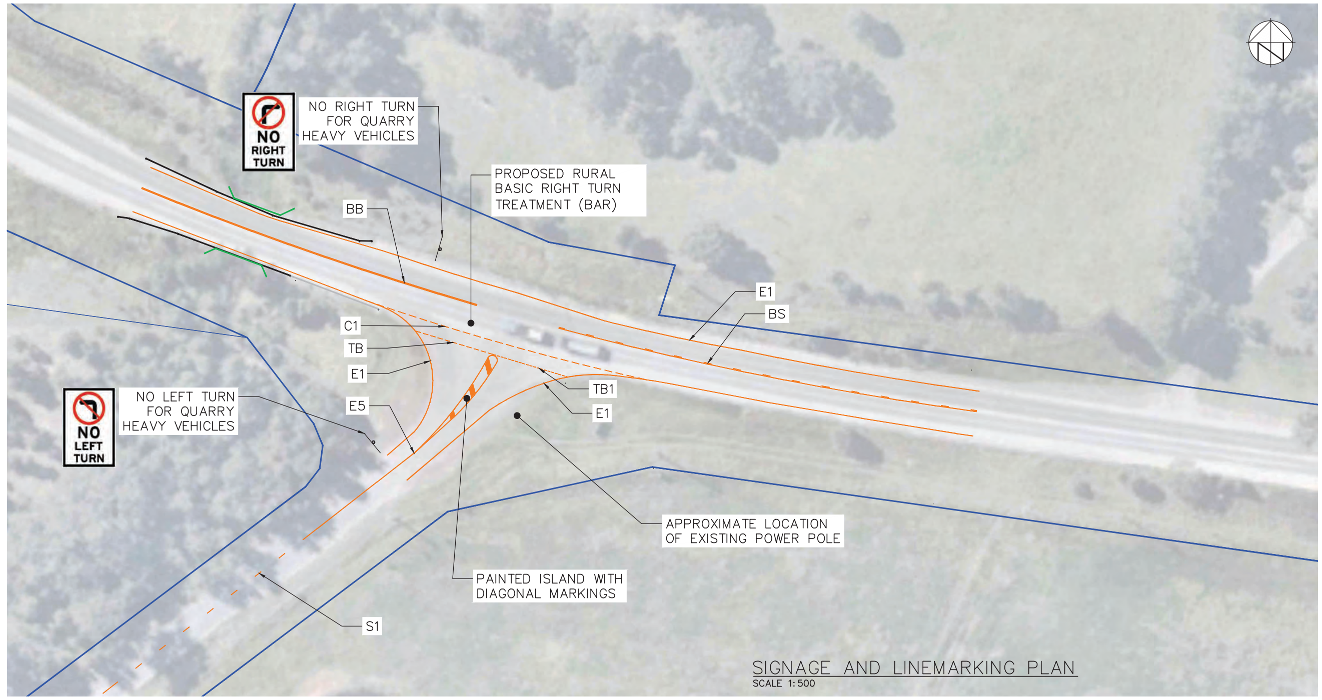
CIVIL WORKS

- EXISTING BOUNDARY BASED ON EXISTING ILP
- LINEMARKING LEFT EDGE LINE (E1)
- LINEMARKING DOUBLE BARRIER LINE (BB)
- LINEMARKING GIVE WAY LINE (TB)
- LINEMARKING GIVE WAY LINE (TB1)
- LINEMARKING BARRIER RESTRICTED OVERTAKING LINE (BS)
- LINEMARKING DIVIDING LINE (S1)
- LINEMARKING PAINTED MEDIAN (E5)
- LINEMARKING CONTINUITY LINE (C1)

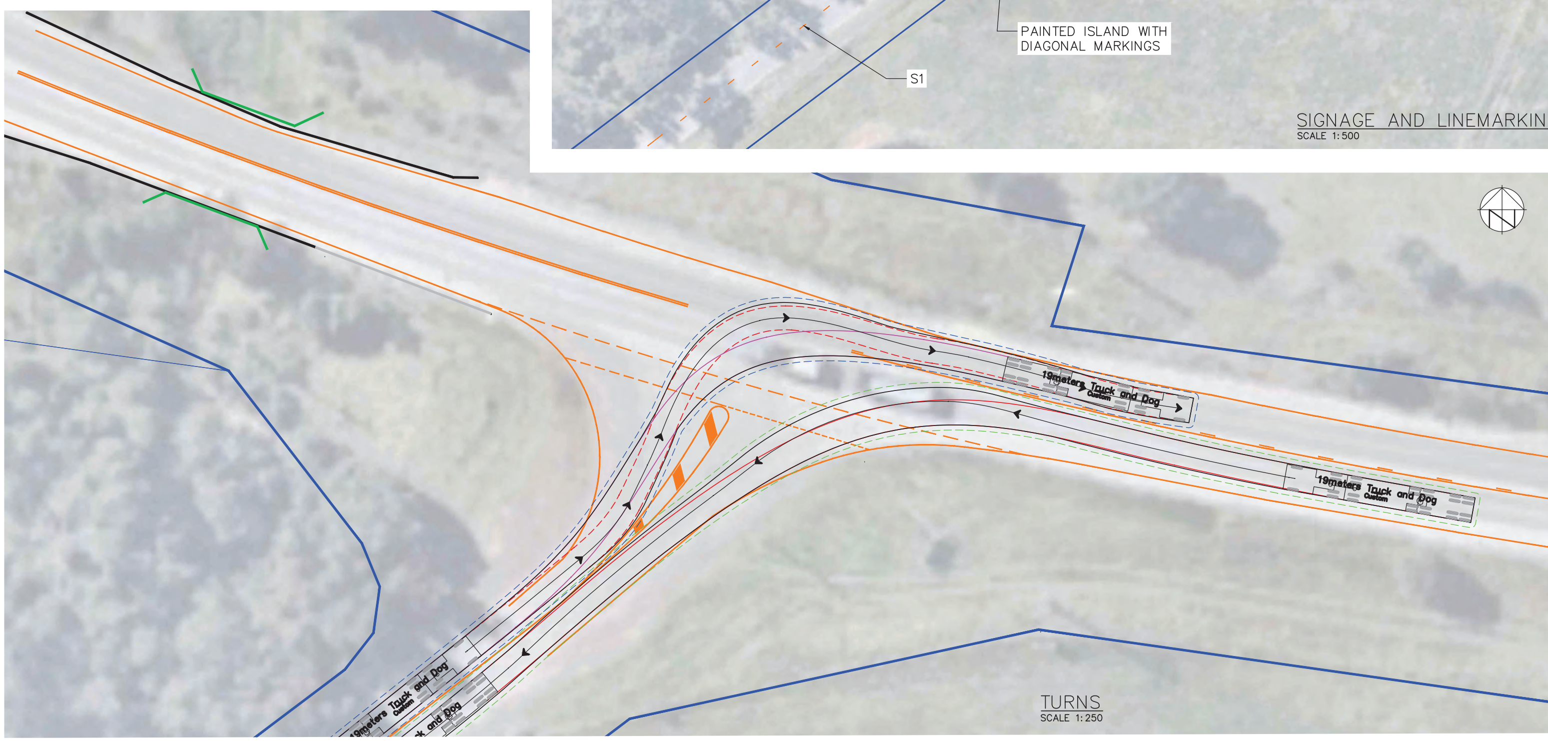
LEGEND

TURNING PATHS (19m TRUCK & DOG)

- BODY CLEARANCE 0.5M
- TRUCK DIRECTION
- FRONT TIRES
- REAR TIRES



SIGNAGE AND LINEMARKING PLAN
SCALE 1:500



TURNS
SCALE 1:250

A1 PLOT 250 0 2.5 5.0 7.5 10 A3 PLOT 500

A1 PLOT 500 0 5 10 15 20 A3 PLOT 1000

SK01

DESCRIPTION: ADAMS RD AND ELIZABETH DR INTERSECTION IMPROVEMENT: SIGNAGE AND LINEMARKING PLAN

DATE: 01.07.2021

PROJECT: 275 ADAMS ROAD, LUDDENHAM

PROJECT NUMBER: 7472

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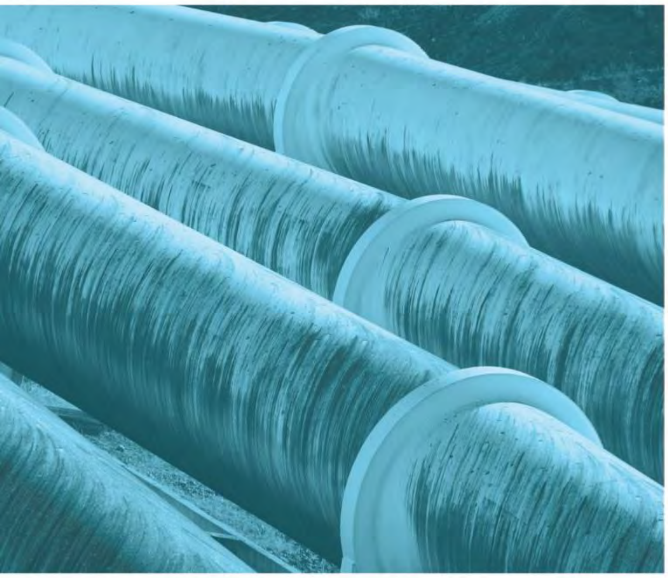


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B.2 Traffic and material register

Phase	ActualDate	Description	PostedUM	PostedUnits	Loads	Loc	MSTicket
4900. .	12/08/2024	Cream Shale	T	111.3	3	J1069	307863
4900. .	12/08/2024	Cream Shale	T	136.9	3	J1069	306430
4900. .	12/08/2024	Cream Shale	T	114.3	3	J1069	307602
4900. .	12/08/2024	Cream Shale	T	137.7	4	J1069	305879
4900. .	12/08/2024	Cream Shale	T	137.6	4	J1069	305965
4900. .	19/08/2024	Coombes Brown Shale	T	45.6	1	J1069	308209
4900. .	19/08/2024	Coombes Brown Shale	T	91.8	2	J1069	305967
4900. .	19/08/2024	Coombes Brown Shale	T	45.7	1	J1069	306432
4900. .	19/08/2024	Coombes Brown Shale	T	39.4	1	J1069	308262
4900. .	19/08/2024	Coombes Brown Shale	T	39.5	1	J1069	307312
4900. .	19/08/2024	Coombes Brown Shale	T	73	1	J1069	307774
4900. .	19/08/2024	Coombes Brown Shale	T	37.1	1	J1069	307865
4900. .	19/08/2024	Cream Shale	T	321.1	7	J1069	305966
4930. .	11/07/2024	Coombes Apricot Shale	T	228.18	6	J1069	299093
4930. .	11/07/2024	Coombes Apricot Shale	T	229.1	6	J1069	305389
4930. .	12/07/2024	Cream Shale	T	196.9	5	J1069	305817
4930. .	12/07/2024	Cream Shale	T	228.45	6	J1069	299094
4930. .	12/07/2024	Cream Shale	T	112.7	3	J1069	302348
4930. .	12/07/2024	Cream Shale	T	112.1	3	J1069	304837
4930. .	12/07/2024	Cream Shale	T	197.1	5	J1069	306827
4930. .	12/07/2024	Cream Shale	T	75.4	2	J1069	300588
4930. .	12/07/2024	Cream Shale	T	76.1	2	J1069	304625
4930. .	12/07/2024	Cream Shale	T	182.7	4	J1069	306768
4930. .	15/07/2024	Cream Shale	T	79	2	J1069	305820
4900. .	15/07/2024	Cream Shale	T	274.9	6	J1069	305392
4900. .	16/07/2024	Cream Shale	T	365.9	8	J1069	306275
4900. .	16/07/2024	Cream Shale	T	45.6	1	J1069	306772
4900. .	16/07/2024	Cream Shale	T	39.4	1	J1069	306831
4900. .	16/07/2024	Cream Shale	T	149.4	4	J1069	300592
4900. .	16/07/2024	Cream Shale	T	336	8	J1069	307455
4900. .	17/07/2024	Cream Shale	T	72.9	1	J1069	306587
4900. .	17/07/2024	Cream Shale	T	75	2	J1069	300594
4930. .	15/07/2024	Cream Shale	T	45.7	1	J1069	306770
4930. .	15/07/2024	Cream Shale	T	188.9	4	J1069	306274
4930. .	15/07/2024	Cream Shale	T	228.22	5	J1069	299096
4930. .	15/07/2024	Cream Shale	T	45.8	1	J1069	305394
4930. .	16/07/2024	Cream Shale	T	229	5	J1069	305393
4930. .	16/07/2024	Cream Shale	T	180.9	4	J1069	306771
4930. .	17/07/2024	Cream Shale	T	182.6	4	J1069	306276
4930. .	17/07/2024	Cream Shale	T	182.26	4	J1069	299098
4930. .	18/07/2024	Cream Shale	T	126	3	J1069	307459
4930. .	18/07/2024	Cream Shale	T	125.5	3	J1069	306951
4930. .	18/07/2024	Cream Shale	T	36.5	1	J1069	306589
4930. .	18/07/2024	Cream Shale	T	182.9	4	J1069	306774
4930. .	18/07/2024	Cream Shale	T	78.5	2	J1069	305825
4900. .	22/07/2024	Cream Shale	T	378	10	J1069	307464
4900. .	23/07/2024	Cream Shale	T	42	1	J1069	306958
4900. .	23/07/2024	Cream Shale	T	42	1	J1069	307466
4900. .	23/07/2024	Cream Shale	T	38.5	1	J1069	304643
4900. .	23/07/2024	Cream Shale	T	78.8	2	J1069	305835
4900. .	23/07/2024	Cream Shale	T	254	6	J1069	306187
4900. .	23/07/2024	Cream Shale	T	217.6	5	J1069	306598
4900. .	24/07/2024	Cream Shale	T	150.6	4	J1069	307569
4900. .	24/07/2024	Cream Shale	T	37.5	1	J1069	306301
4900. .	24/07/2024	Cream Shale	T	37.4	1	J1069	302139
4900. .	24/07/2024	Cream Shale	T	366.4	9	J1069	305856
4900. .	18/09/2023	Coombes Brown Shale	T	217.9	4	J1069	299813
4900. .	18/09/2023	Coombes Brown Shale	T	297.3	6	J1069	302977
4900. .	18/09/2023	Coombes Brown Shale	T	411.7	7	J1069	296218
4900. .	18/09/2023	Coombes Brown Shale	T	300.36	6	J1069	299858
4900. .	18/09/2023	Coombes Brown Shale	T	362.98	7	J1069	295270
4900. .	18/09/2023	Coombes Brown Shale	T	300.7	6	J1069	298963
4900. .	19/09/2023	Coombes Brown Shale	T	259.85	7	J1069	302933

4900. .	19/09/2023	Coombes Brown Shale	T	316.99	8	J1069	295272
4900. .	19/09/2023	Coombes Brown Shale	T	224.78	6	J1069	299860
4900. .	19/09/2023	Coombes Brown Shale	T	224.89	6	J1069	295983
4900. .	19/09/2023	Coombes Brown Shale	T	225.6	6	J1069	299168
4900. .	19/09/2023	Coombes Brown Shale	T	37.8	1	J1069	299560
4900. .	19/09/2023	Coombes Brown Shale	T	266.18	6	J1069	295790
4900. .	20/09/2023	Coombes Brown Shale	T	229.2	6	J1069	302982
4900. .	20/09/2023	Coombes Brown Shale	T	300.6	8	J1069	298966
4900. .	20/09/2023	Coombes Brown Shale	T	112.52	3	J1069	299863
4900. .	20/09/2023	Coombes Brown Shale	T	75.15	2	J1069	299562
4900. .	20/09/2023	Coombes Brown Shale	T	118.4	3	J1069	298541
4900. .	20/09/2023	Coombes Brown Shale	T	37.5	1	J1069	295930
4900. .	20/09/2023	Coombes Brown Shale	T	319.9	8	J1069	296220
4900. .	20/09/2023	Coombes Brown Shale	T	112.25	3	J1069	295244
4900. .	20/09/2023	Coombes Brown Shale	T	316.94	8	J1069	295274
4900. .	21/09/2023	Coombes Brown Shale	T	254.8	6	J1069	296078
4900. .	21/09/2023	Coombes Brown Shale	T	259.6	7	J1069	302938
4900. .	21/09/2023	Coombes Brown Shale	T	224.82	6	J1069	299865
4900. .	21/09/2023	Coombes Brown Shale	T	319.9	8	J1069	296222
4900. .	21/09/2023	Coombes Brown Shale	T	316.02	8	J1069	295276
4900. .	25/09/2023	Coombes Brown Shale	T	39.5	1	J1069	298547
4900. .	26/09/2023	Coombes Brown Shale	T	45.8	1	J1069	296230
4900. .	26/09/2023	Coombes Brown Shale	T	38.5	1	J1069	296384
4900. .	27/09/2023	Coombes Brown Shale	T	46	1	J1069	296232
4900. .	27/09/2023	Coombes Brown Shale	T	37.1	1	J1069	299121
4900. .	27/09/2023	Coombes Brown Shale	T	38	1	J1069	296293
4900. .	27/09/2023	Coombes Brown Shale	T	37.5	1	J1069	298973
4900. .	27/09/2023	Coombes Brown Shale	T	37.8	1	J1069	299183
4900. .	29/09/2023	Coombes Brown Shale	T	37.5	1	J1069	295936
4900. .	29/09/2023	Coombes Brown Shale	T	38.5	1	J1069	296389
4900. .	29/09/2023	Coombes Brown Shale	T	36.5	1	J1069	296088
4900. .	29/09/2023	Coombes Brown Shale	T	37.3	1	J1069	302999
4900. .	29/09/2023	Coombes Brown Shale	T	74.75	2	J1069	302950
4900. .	6/10/2023	Coombes Brown Shale	T	37	1	J1069	299257
4900. .	27/11/2023	Coombes Brown Shale	T	304.24	8	J1069	298687
4900. .	27/11/2023	Coombes Brown Shale	T	290.5	7	J1069	300203
4900. .	27/11/2023	Coombes Brown Shale	T	37.2	1	J1069	299958
4900. .	27/11/2023	Coombes Brown Shale	T	36.3	1	J1069	299791
4900. .	27/11/2023	Coombes Brown Shale	T	315.2	8	J1069	298901
4900. .	27/11/2023	Coombes Brown Shale	T	314.4	8	J1069	298590
4900. .	27/11/2023	Coombes Brown Shale	T	336.75	9	J1069	297069
4900. .	27/11/2023	Coombes Brown Shale	T	37.4	1	J1069	296918
4900. .	27/11/2023	Coombes Brown Shale	T	35.6	1	J1069	298709
4900. .	28/11/2023	Coombes Brown Shale	T	37.3	1	J1069	303715
4900. .	28/11/2023	Coombes Brown Shale	T	36.2	1	J1069	299793
4900. .	28/11/2023	Coombes Brown Shale	T	38.1	1	J1069	304287
4900. .	28/11/2023	Coombes Brown Shale	T	38.5	1	J1069	298688
4900. .	6/12/2023	Coombes Brown Shale	T	225.7	6	J1069	300323
4900. .	6/12/2023	Coombes Brown Shale	T	191.5	5	J1069	304295
4900. .	6/12/2023	Coombes Brown Shale	T	109.3	2	J1069	300212
4900. .	6/12/2023	Coombes Brown Shale	T	149.45	4	J1069	297673
4900. .	6/12/2023	Coombes Brown Shale	T	274.2	7	J1069	296196
4900. .	6/12/2023	Coombes Brown Shale	T	271.1	7	J1069	300113
4900. .	7/12/2023	Coombes Brown Shale	T	38.3	1	J1069	298698
4900. .	7/12/2023	Coombes Brown Shale	T	271.16	5	J1069	300115
4900. .	7/12/2023	Coombes Brown Shale	T	187.8	4	J1069	300326
4900. .	7/12/2023	Coombes Brown Shale	T	273.8	5	J1069	296198
4900. .	7/12/2023	Coombes Brown Shale	T	187.5	4	J1069	296605
4900. .	7/12/2023	Coombes Brown Shale	T	187.82	4	J1069	299535
4900. .	7/12/2023	Coombes Brown Shale	T	190.3	4	J1069	304298
4900. .	14/12/2023	Coombes Brown Shale	T	108.8	2	J1069	296664
4900. .	11/04/2024	Cream Shale	T	75.1	2	J1069	300648
4900. .	17/05/2024	Cream Shale	T	37.8	1	J1069	305664
4900. .	17/05/2024	Cream Shale	T	41.8	1	J1069	298391

4900. .	17/05/2024	Cream Shale	T	42	1	J1069	301602
4900. .	17/05/2024	Cream Shale	T	39.5	1	J1069	302466
4900. .	17/05/2024	Cream Shale	T	45.9	1	J1069	306123
4900. .	17/05/2024	Cream Shale	T	45.7	1	J1069	306216
4900. .	17/05/2024	Cream Shale	T	37.8	1	J1069	304779
4900. .	17/05/2024	Cream Shale	T	37.4	1	J1069	297026
4900. .	20/05/2024	Cream Shale	T	149	4	J1069	298149
4900. .	20/05/2024	Cream Shale	T	37.4	1	J1069	305592
4900. .	20/05/2024	Cream Shale	T	39.4	1	J1069	301919
4900. .	20/05/2024	Cream Shale	T	39.4	1	J1069	302469
4900. .	20/05/2024	Cream Shale	T	45.8	1	J1069	306219
4900. .	20/05/2024	Cream Shale	T	225.1	5	J1069	305667
4900. .	20/05/2024	Cream Shale	T	218.1	5	J1069	306019
4900. .	20/05/2024	Cream Shale	T	226.1	5	J1069	304782
4900. .	20/05/2024	Cream Shale	T	60	1	J1069	305209
4900. .	20/05/2024	Cream Shale	T	59.7	1	J1069	305532
4900. .	20/05/2024	Cream Shale	T	181.6	3	J1069	305028
4900. .	20/05/2024	Cream Shale	T	188	3	J1069	306061
4900. .	21/05/2024	Cream Shale	T	151.2	4	J1069	301806
4900. .	21/05/2024	Cream Shale	T	227.7	4	J1069	306130
4900. .	21/05/2024	Cream Shale	T	182.8	3	J1069	306221
4900. .	21/05/2024	Cream Shale	T	38.5	1	J1069	304520
4900. .	21/05/2024	Cream Shale	T	168	3	J1069	301606
4900. .	21/05/2024	Cream Shale	T	167.3	3	J1069	298395
4900. .	21/05/2024	Cream Shale	T	137.9	3	J1069	305401
4900. .	21/05/2024	Cream Shale	T	45.8	1	J1069	302051
4900. .	21/05/2024	Cream Shale	T	39.4	1	J1069	302471
4900. .	21/05/2024	Cream Shale	T	37.8	1	J1069	297032
4900. .	21/05/2024	Cream Shale	T	37.8	1	J1069	304786
4900. .	22/05/2024	Cream Shale	T	188.1	5	J1069	297034
4900. .	22/05/2024	Cream Shale	T	228.8	6	J1069	305403
4900. .	22/05/2024	Cream Shale	T	210	5	J1069	301608
4900. .	22/05/2024	Cream Shale	T	45.5	1	J1069	306132
4900. .	22/05/2024	Cream Shale	T	38.1	1	J1069	301808
4900. .	22/05/2024	Cream Shale	T	37.3	1	J1069	301921
4900. .	22/05/2024	Cream Shale	T	229.2	6	J1069	304522
4900. .	22/05/2024	Cream Shale	T	137.5	3	J1069	302053
4900. .	23/05/2024	Cream Shale	T	38	1	J1069	304526
4900. .	23/05/2024	Cream Shale	T	263.1	6	J1069	306062
4900. .	23/05/2024	Cream Shale	T	336	8	J1069	301610
4900. .	23/05/2024	Cream Shale	T	334.02	8	J1069	298399
4900. .	23/05/2024	Cream Shale	T	319.7	7	J1069	306225
4900. .	23/05/2024	Cream Shale	T	225.2	5	J1069	297036
4900. .	23/05/2024	Cream Shale	T	37.4	1	J1069	304790
4900. .	23/05/2024	Cream Shale	T	157.6	3	J1069	302475
4900. .	22/05/2024	Cream Shale	T	41.42	1	J1069	298397
4900. .	24/05/2024	Cream Shale	T	275.4	6	J1069	302478
4900. .	24/05/2024	Cream Shale	T	367.3	8	J1069	305407
4900. .	24/05/2024	Cream Shale	T	320	7	J1069	302057
4900. .	24/05/2024	Cream Shale	T	319.8	7	J1069	306227
4900. .	24/05/2024	Cream Shale	T	275.8	6	J1069	301924
4900. .	27/05/2024	Cream Shale	T	251.04	5	J1069	297453
4900. .	27/05/2024	Cream Shale	T	210	4	J1069	301614
4900. .	27/05/2024	Cream Shale	T	136.04	3	J1069	306139
4900. .	27/05/2024	Cream Shale	T	236.2	4	J1069	301927
4900. .	27/05/2024	Cream Shale	T	275.2	6	J1069	305410
4900. .	27/05/2024	Cream Shale	T	225.2	5	J1069	305674
4900. .	28/05/2024	Cream Shale	T	227.3	5	J1069	301811
4900. .	28/05/2024	Cream Shale	T	91.7	2	J1069	305412
4900. .	28/05/2024	Cream Shale	T	91.5	2	J1069	302062
4900. .	28/05/2024	Cream Shale	T	90.66	2	J1069	306140
4900. .	28/05/2024	Cream Shale	T	236.1	5	J1069	302481
4900. .	28/05/2024	Cream Shale	T	274.5	6	J1069	306232
4900. .	29/05/2024	Cream Shale	T	274.6	6	J1069	302065

4900. .	29/05/2024	Cream Shale	T	272.9	6	J1069	306144
4900. .	29/05/2024	Cream Shale	T	39.5	1	J1069	302484
4900. .	29/05/2024	Cream Shale	T	37.5	1	J1069	297043
4900. .	29/05/2024	Cream Shale	T	274.5	6	J1069	306234
4900. .	29/05/2024	Cream Shale	T	251.54	5	J1069	297456
4900. .	29/05/2024	Cream Shale	T	252	5	J1069	301617
4900. .	30/05/2024	Cream Shale	T	301	8	J1069	297046
4900. .	30/05/2024	Cream Shale	T	366.6	9	J1069	305417
4900. .	30/05/2024	Cream Shale	T	315.4	8	J1069	302487
4900. .	30/05/2024	Cream Shale	T	320.5	8	J1069	302066
4900. .	30/05/2024	Cream Shale	T	274.5	7	J1069	306236
4900. .	31/05/2024	Cream Shale	T	224.2	5	J1069	300553
4900. .	31/05/2024	Cream Shale	T	338.1	8	J1069	305679
4900. .	31/05/2024	Cream Shale	T	46	1	J1069	302073
4900. .	5/06/2024	Cream Shale	T	229	6	J1069	306247
4900. .	5/06/2024	Cream Shale	T	30.5	1	J1069	306047
4900. .	5/06/2024	Cream Shale	T	38.1	1	J1069	301821
4900. .	5/06/2024	Cream Shale	T	183	4	J1069	305430
4900. .	5/06/2024	Cream Shale	T	229	6	J1069	306247
4900. .	5/06/2024	Cream Shale	T	30.5	1	J1069	306047
4900. .	5/06/2024	Cream Shale	T	38.1	1	J1069	301821
4900. .	5/06/2024	Cream Shale	T	183	4	J1069	305430
4900. .	12/06/2024	Cream Shale	T	111.1	3	J1069	305611
4900. .	12/06/2024	Cream Shale	T	39.2	1	J1069	302495
4900. .	12/06/2024	Cream Shale	T	45.7	1	J1069	302086
4900. .	12/06/2024	Cream Shale	T	37.9	1	J1069	304545
4900. .	13/06/2024	Cream Shale	T	38.4	1	J1069	304548
4900. .	14/06/2024	Cream Shale	T	36.2	1	J1069	306154
4900. .	14/06/2024	Cream Shale	T	36.5	1	J1069	306551
4900. .	17/06/2024	Cream Shale	T	39.4	1	J1069	301938
4900. .	17/06/2024	Cream Shale	T	45.7	1	J1069	302093
4900. .	17/06/2024	Cream Shale	T	36.5	1	J1069	306554
4900. .	17/06/2024	Cream Shale	T	36.3	1	J1069	306157
4900. .	18/06/2024	Cream Shale	T	36.4	1	J1069	306159
4900. .	18/06/2024	Cream Shale	T	45.7	1	J1069	299068
4900. .	18/06/2024	Cream Shale	T	42	1	J1069	301635
4900. .	18/06/2024	Cream Shale	T	42	1	J1069	297473
4900. .	18/06/2024	Cream Shale	T	36.5	1	J1069	306556
4900. .	19/06/2024	Cream Shale	T	36.3	1	J1069	306161
4900. .	19/06/2024	Cream Shale	T	45.8	1	J1069	305365
4900. .	19/06/2024	Cream Shale	T	36.3	1	J1069	306558
4900. .	19/06/2024	Cream Shale	T	45.6	1	J1069	305447
4900. .	19/06/2024	Cream Shale	T	45.6	1	J1069	299071
4900. .	20/06/2024	Cream Shale	T	36	1	J1069	306561
4900. .	20/06/2024	Cream Shale	T	45.8	1	J1069	305450
4900. .	20/06/2024	Cream Shale	T	45.8	1	J1069	305368
4900. .	20/06/2024	Cream Shale	T	42	1	J1069	297477
4900. .	20/06/2024	Cream Shale	T	45.6	1	J1069	306251
4900. .	20/06/2024	Cream Shale	T	42	1	J1069	301639
4900. .	20/06/2024	Cream Shale	T	37.7	1	J1069	300572
4900. .	21/06/2024	Cream Shale	T	46	1	J1069	306254
4900. .	21/06/2024	Cream Shale	T	46	1	J1069	299076
4920. .	19/09/2023	Coombes Apricot Shale	T	45.3	1	J1069	295271
4920. .	19/09/2023	Coombes Apricot Shale	T	37.1	1	J1069	302932
4920. .	19/09/2023	Coombes Apricot Shale	T	41.74	1	J1069	299859
4920. .	19/09/2023	Coombes Apricot Shale	T	41.96	1	J1069	295982
4920. .	19/09/2023	Coombes Apricot Shale	T	37.7	1	J1069	299167
4920. .	19/09/2023	Coombes Apricot Shale	T	37.7	1	J1069	295789
4920. .	20/09/2023	Coombes Apricot Shale	T	38.3	1	J1069	302981
4920. .	20/09/2023	Coombes Apricot Shale	T	37.5	1	J1069	298965
4920. .	20/09/2023	Coombes Apricot Shale	T	45.36	1	J1069	295273
4920. .	20/09/2023	Coombes Apricot Shale	T	45.7	1	J1069	296219
4920. .	20/09/2023	Coombes Apricot Shale	T	37.4	1	J1069	295243
4920. .	21/09/2023	Coombes Apricot Shale	T	36.5	1	J1069	296077

4920. .	21/09/2023	Coombes Apricot Shale	T	37.2	1	J1069	302937
4920. .	21/09/2023	Coombes Apricot Shale	T	41.7	1	J1069	299864
4920. .	21/09/2023	Coombes Apricot Shale	T	45.7	1	J1069	296221
4920. .	21/09/2023	Coombes Apricot Shale	T	45.18	1	J1069	295275
4920. .	22/09/2023	Coombes Apricot Shale	T	41.82	1	J1069	299866
4920. .	22/09/2023	Coombes Apricot Shale	T	41.9	1	J1069	295986
4920. .	22/09/2023	Coombes Apricot Shale	T	45.14	1	J1069	295277
4920. .	22/09/2023	Coombes Apricot Shale	T	45.5	1	J1069	296223
4920. .	22/09/2023	Coombes Apricot Shale	T	37.3	1	J1069	295798
4920. .	22/09/2023	Coombes Apricot Shale	T	39.5	1	J1069	298542
4920. .	25/09/2023	Coombes Apricot Shale	T	45.8	1	J1069	296225
4920. .	25/09/2023	Coombes Apricot Shale	T	39.5	1	J1069	298545
4920. .	25/09/2023	Coombes Apricot Shale	T	38.5	1	J1069	296380
4920. .	25/09/2023	Coombes Apricot Shale	T	41.74	1	J1069	299868
4920. .	25/09/2023	Coombes Apricot Shale	T	41.76	1	J1069	295988
4920. .	25/09/2023	Coombes Apricot Shale	T	45.36	1	J1069	295279
4920. .	26/09/2023	Coombes Apricot Shale	T	37.1	1	J1069	302944
4920. .	26/09/2023	Coombes Apricot Shale	T	37.5	1	J1069	299652
4920. .	26/09/2023	Coombes Apricot Shale	T	37.4	1	J1069	302991
4920. .	26/09/2023	Coombes Apricot Shale	T	36.5	0	J1069	296084
4920. .	26/09/2023	Coombes Apricot Shale	T	38.5	1	J1069	296382
4920. .	26/09/2023	Coombes Apricot Shale	T	36.2	0	J1069	299823
4920. .	27/09/2023	Coombes Apricot Shale	T	37.2	1	J1069	302946
4920. .	27/09/2023	Coombes Apricot Shale	T	39.5	1	J1069	299601
4920. .	27/09/2023	Coombes Apricot Shale	T	37.4	1	J1069	299119
4920. .	27/09/2023	Coombes Apricot Shale	T	37.85	1	J1069	296291
4920. .	27/09/2023	Coombes Apricot Shale	T	37.5	1	J1069	298971
4920. .	27/09/2023	Coombes Apricot Shale	T	37.7	1	J1069	299181
4920. .	4/10/2023	Coombes Apricot Shale	T	38.1	1	J1069	296390
4920. .	4/10/2023	Coombes Apricot Shale	T	39.5	1	J1069	299605
4920. .	4/10/2023	Coombes Apricot Shale	T	45.8	1	J1069	296234
4920. .	4/10/2023	Coombes Apricot Shale	T	41.82	1	J1069	295993
4920. .	4/10/2023	Coombes Apricot Shale	T	41.66	1	J1069	299873
4920. .	4/10/2023	Coombes Apricot Shale	T	39.4	1	J1069	298554
4920. .	6/10/2023	Coombes Apricot Shale	T	37.5	1	J1069	298976
4920. .	6/10/2023	Coombes Apricot Shale	T	39.5	1	J1069	299608
4920. .	6/10/2023	Coombes Apricot Shale	T	37	1	J1069	300355
4920. .	6/10/2023	Coombes Apricot Shale	T	36.5	1	J1069	296089
4920. .	6/10/2023	Coombes Apricot Shale	T	36.5	1	J1069	299833
4920. .	28/11/2023	Coombes Apricot Shale	T	149.55	4	J1069	303716
4920. .	28/11/2023	Coombes Apricot Shale	T	144.9	3	J1069	299794
4920. .	28/11/2023	Coombes Apricot Shale	T	152.3	4	J1069	304288
4920. .	28/11/2023	Coombes Apricot Shale	T	74.8	2	J1069	297072
4920. .	28/11/2023	Coombes Apricot Shale	T	152.36	4	J1069	298689
4920. .	6/12/2023	Coombes Apricot Shale	T	76.7	2	J1069	304294
4920. .	6/12/2023	Coombes Apricot Shale	T	75.3	2	J1069	300324
4920. .	6/12/2023	Coombes Apricot Shale	T	75.1	2	J1069	297672
4920. .	6/12/2023	Coombes Apricot Shale	T	91.1	2	J1069	296195
4920. .	6/12/2023	Coombes Apricot Shale	T	90.4	2	J1069	300112
4920. .	7/12/2023	Coombes Apricot Shale	T	135.84	3	J1069	300114
4920. .	7/12/2023	Coombes Apricot Shale	T	112.6	2	J1069	300325
4920. .	7/12/2023	Coombes Apricot Shale	T	137	3	J1069	296197
4920. .	7/12/2023	Coombes Apricot Shale	T	112.6	3	J1069	296604
4920. .	7/12/2023	Coombes Apricot Shale	T	112.6	3	J1069	299534
4920. .	7/12/2023	Coombes Apricot Shale	T	114.4	3	J1069	304297
4920. .	8/12/2023	Coombes Apricot Shale	T	317.3	8	J1069	300116
4920. .	8/12/2023	Coombes Apricot Shale	T	319.1	8	J1069	296199
4920. .	14/12/2023	Coombes Apricot Shale	T	71.9	1	J1069	297361
4920. .	14/12/2023	Coombes Apricot Shale	T	112.7	3	J1069	296587
4920. .	14/12/2023	Coombes Apricot Shale	T	74.6	2	J1069	297761
4920. .	14/12/2023	Coombes Apricot Shale	T	73	1	J1069	300223
4920. .	14/12/2023	Coombes Apricot Shale	T	75.1	2	J1069	300336
4920. .	14/12/2023	Coombes Apricot Shale	T	39.5	1	J1069	299709
4920. .	14/12/2023	Coombes Apricot Shale	T	74.1	2	J1069	299978

4920. .	15/12/2023	Coombes Apricot Shale	T	36	1	J1069	297364
4920. .	15/12/2023	Coombes Apricot Shale	T	148.9	4	J1069	299980
4920. .	15/12/2023	Coombes Apricot Shale	T	145	3	J1069	300225
4920. .	15/12/2023	Coombes Apricot Shale	T	150.1	4	J1069	296589
4920. .	15/12/2023	Coombes Apricot Shale	T	149.9	4	J1069	300338
4920. .	15/12/2023	Coombes Apricot Shale	T	150.4	4	J1069	297762
4920. .	18/12/2023	Coombes Apricot Shale	T	229	6	J1069	300053
4920. .	18/12/2023	Coombes Apricot Shale	T	112.3	3	J1069	296591
4920. .	18/12/2023	Coombes Apricot Shale	T	225.5	6	J1069	297764
4920. .	18/12/2023	Coombes Apricot Shale	T	224.65	6	J1069	297689
4920. .	18/12/2023	Coombes Apricot Shale	T	37.6	1	J1069	300342
4920. .	4/04/2024	Cream Shale	T	74.96	2	J1069	298116
4920. .	4/04/2024	Cream Shale	T	76.5	2	J1069	302232
4920. .	4/04/2024	Cream Shale	T	32	1	J1069	297282
4920. .	4/04/2024	Cream Shale	T	42	1	J1069	293817
4920. .	4/04/2024	Cream Shale	T	41.74	1	J1069	300744
4920. .	4/04/2024	Cream Shale	T	39.4	1	J1069	298777
4920. .	4/04/2024	Cream Shale	T	39.5	1	J1069	305155
4920. .	4/04/2024	Cream Shale	T	75.2	2	J1069	298267
4920. .	4/04/2024	Cream Shale	T	74.3	2	J1069	305562
4920. .	17/04/2024	Cream Shale	T	150.7	4	J1069	302298
4920. .	17/04/2024	Cream Shale	T	118	3	J1069	298789
4920. .	17/04/2024	Cream Shale	T	75.1	2	J1069	302158
4920. .	17/04/2024	Cream Shale	T	137.2	3	J1069	302026
4920. .	17/04/2024	Cream Shale	T	118.3	3	J1069	305168
4920. .	17/04/2024	Cream Shale	T	136.6	3	J1069	306103
4920. .	17/04/2024	Cream Shale	T	115.12	3	J1069	298370
4920. .	17/04/2024	Cream Shale	T	117.25	3	J1069	293827
4920. .	30/04/2024	Cream Shale	T	195.45	5	J1069	293837
4920. .	30/04/2024	Cream Shale	T	191.6	5	J1069	298378
4920. .	1/05/2024	Cream Shale	T	118.4	3	J1069	298799
4920. .	1/05/2024	Cream Shale	T	79.3	2	J1069	305181
4920. .	1/05/2024	Cream Shale	T	111.9	3	J1069	297010
4920. .	1/05/2024	Cream Shale	T	136.4	3	J1069	306112
4920. .	1/05/2024	Cream Shale	T	90.5	2	J1069	305089
4920. .	1/05/2024	Cream Shale	T	111.8	3	J1069	305603
4920. .	1/05/2024	Cream Shale	T	136.8	3	J1069	302034
4920. .	1/05/2024	Cream Shale	T	136.3	3	J1069	306207
4920. .	2/05/2024	Cream Shale	T	45.4	1	J1069	305091
4920. .	2/05/2024	Cream Shale	T	39.14	1	J1069	298380
4920. .	2/05/2024	Cream Shale	T	75.1	2	J1069	297013
4920. .	2/05/2024	Cream Shale	T	78.7	2	J1069	305183
4920. .	2/05/2024	Cream Shale	T	78.9	2	J1069	302452
4920. .	2/05/2024	Cream Shale	T	90.9	2	J1069	306114
4920. .	2/05/2024	Cream Shale	T	91.1	2	J1069	306209
4920. .	2/05/2024	Cream Shale	T	91.4	2	J1069	302036
4920. .	2/05/2024	Cream Shale	T	39	1	J1069	293839
4920. .	3/05/2024	Cream Shale	T	137.3	3	J1069	302038
4920. .	3/05/2024	Cream Shale	T	112.3	3	J1069	305656
4920. .	3/05/2024	Cream Shale	T	78.8	2	J1069	305185
4920. .	3/05/2024	Cream Shale	T	91.1	2	J1069	306211
4920. .	3/05/2024	Cream Shale	T	91.6	2	J1069	305094
4920. .	3/05/2024	Cream Shale	T	78.1	2	J1069	293841
4920. .	3/05/2024	Cream Shale	T	91.2	2	J1069	306116
4920. .	3/05/2024	Cream Shale	T	78.8	2	J1069	302454
4920. .	3/05/2024	Cream Shale	T	78.14	2	J1069	298382
4920. .	20/05/2024	Cream Shale	T	149	4	J1069	298147
4920. .	20/05/2024	Cream Shale	T	150.2	4	J1069	305666
4920. .	20/05/2024	Cream Shale	T	72.8	1	J1069	306018
4920. .	20/05/2024	Cream Shale	T	188.5	4	J1069	304781
4920. .	20/05/2024	Cream Shale	T	145.1	3	J1069	305027
4920. .	20/05/2024	Cream Shale	T	150.7	3	J1069	298285
4920. .	21/05/2024	Cream Shale	T	152.4	3	J1069	301805
4920. .	21/05/2024	Cream Shale	T	182.9	4	J1069	306129

4920. .	21/05/2024	Cream Shale	T	183.2	4 J1069	306220
4920. .	21/05/2024	Cream Shale	T	155.16	4 J1069	301605
4920. .	21/05/2024	Cream Shale	T	156.22	4 J1069	298394
4920. .	21/05/2024	Cream Shale	T	229.1	5 J1069	305100
4920. .	22/05/2024	Cream Shale	T	182.5	4 J1069	306222
4920. .	22/05/2024	Cream Shale	T	155.75	4 J1069	301607
4920. .	22/05/2024	Cream Shale	T	182.9	4 J1069	305402
4920. .	22/05/2024	Cream Shale	T	152.6	4 J1069	304521
4920. .	22/05/2024	Cream Shale	T	182.7	4 J1069	302052
4920. .	23/05/2024	Cream Shale	T	37	1 J1069	298288
4920. .	23/05/2024	Cream Shale	T	38.94	1 J1069	301609
4920. .	23/05/2024	Cream Shale	T	45.8	1 J1069	305404
4920. .	23/05/2024	Cream Shale	T	91.46	2 J1069	306133
4920. .	23/05/2024	Cream Shale	T	91.6	2 J1069	302054
4920. .	23/05/2024	Cream Shale	T	39.08	1 J1069	298398
4920. .	23/05/2024	Cream Shale	T	91.3	2 J1069	306224
4920. .	24/05/2024	Cream Shale	T	78.7	2 J1069	302477
4920. .	24/05/2024	Cream Shale	T	74.7	2 J1069	304792
4920. .	24/05/2024	Cream Shale	T	90.7	2 J1069	306135
4920. .	24/05/2024	Cream Shale	T	76.1	2 J1069	304527
4920. .	24/05/2024	Cream Shale	T	46	1 J1069	305406
4920. .	24/05/2024	Cream Shale	T	91.4	2 J1069	302056
4920. .	24/05/2024	Cream Shale	T	91.3	2 J1069	306226
4920. .	24/05/2024	Cream Shale	T	78.7	2 J1069	301923
4920. .	27/05/2024	Cream Shale	T	77.9	2 J1069	297452
4920. .	27/05/2024	Cream Shale	T	117.15	3 J1069	301613
4920. .	27/05/2024	Cream Shale	T	136.3	3 J1069	306138
4920. .	27/05/2024	Cream Shale	T	136.8	3 J1069	306229
4920. .	27/05/2024	Cream Shale	T	137.9	3 J1069	302059
4920. .	27/05/2024	Cream Shale	T	118.1	3 J1069	301926
4920. .	27/05/2024	Cream Shale	T	136.8	3 J1069	305409
4920. .	27/05/2024	Cream Shale	T	112.6	3 J1069	305673
4920. .	28/05/2024	Cream Shale	T	118.2	3 J1069	302482
4920. .	28/05/2024	Cream Shale	T	137.3	3 J1069	302061
4920. .	28/05/2024	Cream Shale	T	90.7	2 J1069	306141
4920. .	28/05/2024	Cream Shale	T	113.2	3 J1069	301810
4920. .	28/05/2024	Cream Shale	T	91.7	2 J1069	305411
4920. .	28/05/2024	Cream Shale	T	112	3 J1069	304797
4920. .	28/05/2024	Cream Shale	T	114.4	3 J1069	304531
4920. .	28/05/2024	Cream Shale	T	112.3	3 J1069	297040
4920. .	28/05/2024	Cream Shale	T	137.1	3 J1069	306231
4920. .	29/05/2024	Cream Shale	T	137.2	3 J1069	302064
4920. .	29/05/2024	Cream Shale	T	91.2	2 J1069	306143
4920. .	29/05/2024	Cream Shale	T	136.8	3 J1069	305414
4920. .	29/05/2024	Cream Shale	T	112.6	3 J1069	305599
4920. .	29/05/2024	Cream Shale	T	137.4	3 J1069	306233
4920. .	29/05/2024	Cream Shale	T	117.02	3 J1069	297455
4920. .	29/05/2024	Cream Shale	T	116.24	3 J1069	301616
4920. .	30/05/2024	Cream Shale	T	75	2 J1069	297045
4920. .	30/05/2024	Cream Shale	T	45.8	1 J1069	305416
4920. .	30/05/2024	Cream Shale	T	39.5	1 J1069	302486
4920. .	30/05/2024	Cream Shale	T	38.1	1 J1069	301813
4920. .	30/05/2024	Cream Shale	T	45.7	1 J1069	306145
4920. .	30/05/2024	Cream Shale	T	45.8	1 J1069	302067
4920. .	30/05/2024	Cream Shale	T	91.5	2 J1069	306235
4920. .	31/05/2024	Cream Shale	T	75.3	2 J1069	300552
4920. .	31/05/2024	Cream Shale	T	37.7	1 J1069	298295
4920. .	31/05/2024	Cream Shale	T	37.6	1 J1069	305712
4920. .	31/05/2024	Cream Shale	T	37.4	1 J1069	305678
4920. .	5/06/2024	Cream Shale	T	234	5 J1069	297462
4920. .	5/06/2024	Cream Shale	T	233.92	6 J1069	301624
4920. .	5/06/2024	Cream Shale	T	234	5 J1069	297462
4920. .	5/06/2024	Cream Shale	T	233.92	5 J1069	301624
4920. .	12/06/2024	Cream Shale	T	77.84	2 J1069	301626

4920. .	12/06/2024	Cream Shale	T	77.92	2	J1069	297464
4920. .	12/06/2024	Cream Shale	T	73.8	1	J1069	298298
4920. .	12/06/2024	Cream Shale	T	156.9	4	J1069	302493
4920. .	12/06/2024	Cream Shale	T	113.3	3	J1069	304543
4920. .	12/06/2024	Cream Shale	T	111.1	3	J1069	300559
4920. .	12/06/2024	Cream Shale	T	111.9	3	J1069	304813
4920. .	13/06/2024	Cream Shale	T	156.2	4	J1069	302497
4920. .	13/06/2024	Cream Shale	T	226.4	6	J1069	305438
4920. .	13/06/2024	Cream Shale	T	157.8	4	J1069	301934
4920. .	13/06/2024	Cream Shale	T	179.6	4	J1069	305356
4920. .	13/06/2024	Cream Shale	T	114	3	J1069	304547
4920. .	13/06/2024	Cream Shale	T	151.3	4	J1069	301824
4920. .	14/06/2024	Cream Shale	T	186.2	5	J1069	302307
4920. .	14/06/2024	Cream Shale	T	228.2	5	J1069	302089
4920. .	14/06/2024	Cream Shale	T	225.7	6	J1069	305439
4920. .	14/06/2024	Cream Shale	T	227.5	6	J1069	299062
4920. .	14/06/2024	Cream Shale	T	226.9	6	J1069	305357
4920. .	17/06/2024	Cream Shale	T	90.8	2	J1069	305442
4920. .	17/06/2024	Cream Shale	T	75.4	2	J1069	302123
4920. .	17/06/2024	Cream Shale	T	118.5	3	J1069	301937
4920. .	17/06/2024	Cream Shale	T	45.9	1	J1069	305360
4920. .	17/06/2024	Cream Shale	T	78.6	2	J1069	302500
4920. .	17/06/2024	Cream Shale	T	137.4	3	J1069	302092
4920. .	17/06/2024	Cream Shale	T	38.3	1	J1069	301830
4920. .	17/06/2024	Cream Shale	T	91.5	2	J1069	299065
4920. .	18/06/2024	Cream Shale	T	113.1	3	J1069	301832
4920. .	18/06/2024	Cream Shale	T	137.4	3	J1069	305362
4920. .	18/06/2024	Cream Shale	T	136.5	3	J1069	305444
4920. .	18/06/2024	Cream Shale	T	136.6	3	J1069	299067
4920. .	18/06/2024	Cream Shale	T	183.4	4	J1069	302095
4920. .	18/06/2024	Cream Shale	T	117	3	J1069	301634
4920. .	18/06/2024	Cream Shale	T	116.96	3	J1069	297472
4920. .	19/06/2024	Cream Shale	T	229	6	J1069	305364
4920. .	19/06/2024	Cream Shale	T	273.8	7	J1069	305446
4920. .	19/06/2024	Cream Shale	T	183.1	4	J1069	302097
4920. .	19/06/2024	Cream Shale	T	39.5	1	J1069	306804
4920. .	19/06/2024	Cream Shale	T	45.6	1	J1069	299070
4920. .	19/06/2024	Cream Shale	T	188.1	5	J1069	305690
4920. .	20/06/2024	Cream Shale	T	136.9	3	J1069	305448
4920. .	20/06/2024	Cream Shale	T	137.4	3	J1069	305366
4920. .	20/06/2024	Cream Shale	T	117.21	3	J1069	297475
4920. .	20/06/2024	Cream Shale	T	45.8	1	J1069	302099
4920. .	20/06/2024	Cream Shale	T	137.1	3	J1069	299072
4920. .	20/06/2024	Cream Shale	T	117	3	J1069	301637
4920. .	20/06/2024	Cream Shale	T	150.5	4	J1069	300570
4920. .	21/06/2024	Cream Shale	T	118.3	3	J1069	301943
4920. .	21/06/2024	Cream Shale	T	112.7	3	J1069	305692
4920. .	21/06/2024	Cream Shale	T	183.3	4	J1069	306252
4920. .	21/06/2024	Cream Shale	T	136.9	3	J1069	299074
4920. .	21/06/2024	Cream Shale	T	118.1	3	J1069	306806
4930. .	18/09/2023	Coombes Brown Shale	T	197.3	4	J1069	303390
4930. .	18/09/2023	Coombes Brown Shale	T	197.2	4	J1069	298535
4930. .	18/09/2023	Coombes Brown Shale	T	112.35	3	J1069	295238
4930. .	18/09/2023	Coombes Brown Shale	T	112.1	3	J1069	299101
4930. .	19/09/2023	Coombes Brown Shale	T	74.6	2	J1069	302980
4930. .	19/09/2023	Coombes Brown Shale	T	39.5	1	J1069	298538
4930. .	19/09/2023	Coombes Brown Shale	T	37.7	1	J1069	299559
4930. .	20/09/2023	Coombes Brown Shale	T	37.2	1	J1069	302936
4930. .	22/09/2023	Cream Shale	T	166.78	4	J1069	299867
4930. .	22/09/2023	Cream Shale	T	128.7	3	J1069	295987
4930. .	22/09/2023	Cream Shale	T	180.96	4	J1069	295278
4930. .	22/09/2023	Cream Shale	T	182.8	4	J1069	296224
4930. .	22/09/2023	Cream Shale	T	149.8	4	J1069	295799
4930. .	22/09/2023	Cream Shale	T	197.4	5	J1069	298543

4930. .	25/09/2023	Cream Shale	T	228.7	6	J1069	296226
4930. .	25/09/2023	Cream Shale	T	158	4	J1069	298546
4930. .	25/09/2023	Cream Shale	T	191.6	5	J1069	296381
4930. .	25/09/2023	Cream Shale	T	207.82	5	J1069	299869
4930. .	25/09/2023	Cream Shale	T	208.14	5	J1069	295989
4930. .	25/09/2023	Cream Shale	T	225.86	6	J1069	295280
4930. .	26/09/2023	Cream Shale	T	185.7	5	J1069	302945
4930. .	26/09/2023	Cream Shale	T	188.75	5	J1069	299653
4930. .	26/09/2023	Cream Shale	T	186.4	5	J1069	302992
4930. .	26/09/2023	Cream Shale	T	91.4	2	J1069	296229
4930. .	26/09/2023	Cream Shale	T	181.6	4	J1069	296085
4930. .	26/09/2023	Cream Shale	T	152.9	4	J1069	296383
4930. .	26/09/2023	Cream Shale	T	181.4	4	J1069	299824
4930. .	27/09/2023	Cream Shale	T	185.75	5	J1069	302947
4930. .	27/09/2023	Cream Shale	T	197.5	5	J1069	299602
4930. .	27/09/2023	Cream Shale	T	149.9	4	J1069	299120
4930. .	27/09/2023	Cream Shale	T	151.8	4	J1069	296292
4930. .	27/09/2023	Cream Shale	T	150.4	4	J1069	298972
4930. .	27/09/2023	Cream Shale	T	150.4	4	J1069	299182
4930. .	29/09/2023	Cream Shale	T	153.2	4	J1069	296296
4930. .	29/09/2023	Cream Shale	T	152.7	4	J1069	296388
4930. .	29/09/2023	Cream Shale	T	37.3	1	J1069	302998
4930. .	29/09/2023	Cream Shale	T	197.35	5	J1069	299604
4930. .	29/09/2023	Cream Shale	T	148.4	4	J1069	302949
4930. .	29/09/2023	Cream Shale	T	145.3	3	J1069	299829
4930. .	4/10/2023	Cream Shale	T	152.8	4	J1069	296391
4930. .	4/10/2023	Cream Shale	T	75.2	2	J1069	299125
4930. .	4/10/2023	Cream Shale	T	157.95	4	J1069	299606
4930. .	4/10/2023	Cream Shale	T	229	6	J1069	296235
4930. .	4/10/2023	Cream Shale	T	207.96	5	J1069	295994
4930. .	4/10/2023	Cream Shale	T	207.8	5	J1069	299874
4930. .	4/10/2023	Cream Shale	T	157.8	4	J1069	298555
4930. .	6/10/2023	Cream Shale	T	150.65	4	J1069	298977
4930. .	6/10/2023	Cream Shale	T	157.6	4	J1069	299609
4930. .	6/10/2023	Cream Shale	T	148.85	4	J1069	300356
4930. .	6/10/2023	Cream Shale	T	36.5	1	J1069	296094
4930. .	6/10/2023	Cream Shale	T	145.5	3	J1069	299834
4930. .	6/10/2023	Cream Shale	T	111.85	3	J1069	299256
4930. .	7/12/2023	Coombes Brown Shale	T	74.75	2	J1069	296931
4930. .	7/12/2023	Coombes Brown Shale	T	39.5	1	J1069	298911
4930. .	7/12/2023	Coombes Brown Shale	T	112.4	3	J1069	297678
4930. .	14/12/2023	Coombes Brown Shale	T	108	2	J1069	297362
4930. .	14/12/2023	Coombes Brown Shale	T	112.5	3	J1069	296588
4930. .	14/12/2023	Coombes Brown Shale	T	149.8	4	J1069	297803
4930. .	14/12/2023	Coombes Brown Shale	T	145.2	3	J1069	300224
4930. .	14/12/2023	Coombes Brown Shale	T	38.2	1	J1069	297604
4930. .	14/12/2023	Coombes Brown Shale	T	150.5	4	J1069	300337
4930. .	14/12/2023	Coombes Brown Shale	T	157.7	4	J1069	299708
4930. .	14/12/2023	Coombes Brown Shale	T	148.5	4	J1069	299979
4930. .	15/12/2023	Coombes Brown Shale	T	72.2	1	J1069	297365
4930. .	15/12/2023	Coombes Brown Shale	T	37.7	1	J1069	297090
4930. .	15/12/2023	Coombes Brown Shale	T	111.8	3	J1069	299981
4930. .	15/12/2023	Coombes Brown Shale	T	74.6	2	J1069	296947
4930. .	15/12/2023	Coombes Brown Shale	T	73	1	J1069	300226
4930. .	15/12/2023	Coombes Brown Shale	T	45.7	1	J1069	296507
4930. .	15/12/2023	Coombes Brown Shale	T	112.75	3	J1069	296590
4930. .	15/12/2023	Coombes Brown Shale	T	39.5	1	J1069	298923
4930. .	15/12/2023	Coombes Brown Shale	T	112.8	3	J1069	300339
4930. .	15/12/2023	Coombes Brown Shale	T	45.4	1	J1069	300124
4930. .	15/12/2023	Coombes Brown Shale	T	113.1	3	J1069	297804
4930. .	18/12/2023	Coombes Brown Shale	T	76.2	2	J1069	300054
4930. .	18/12/2023	Coombes Brown Shale	T	74.7	2	J1069	296592
4930. .	18/12/2023	Coombes Brown Shale	T	45.6	1	J1069	296200
4930. .	18/12/2023	Coombes Brown Shale	T	75.1	2	J1069	297805

4930. .	18/12/2023	Coombes Brown Shale	T	45.4	1	J1069	300129
4930. .	18/12/2023	Coombes Brown Shale	T	75.1	2	J1069	297690
4930. .	19/12/2023	Coombes Brown Shale	T	186.6	5	J1069	299985
4930. .	19/12/2023	Coombes Brown Shale	T	112.3	3	J1069	297098
4930. .	19/12/2023	Coombes Brown Shale	T	108.8	2	J1069	297371
4930. .	19/12/2023	Coombes Brown Shale	T	150.2	4	J1069	297806
4930. .	19/12/2023	Coombes Brown Shale	T	112.05	3	J1069	298054
4930. .	19/12/2023	Coombes Brown Shale	T	149.9	4	J1069	296594
4930. .	19/12/2023	Coombes Brown Shale	T	136.9	3	J1069	296514
4930. .	19/12/2023	Coombes Brown Shale	T	145.3	3	J1069	300231
4930. .	19/12/2023	Coombes Brown Shale	T	153	4	J1069	300056
4930. .	19/12/2023	Coombes Brown Shale	T	90.4	2	J1069	300132
4930. .	8/01/2024	Coombes Brown Shale	T	137	3	J1069	296517
4930. .	8/01/2024	Coombes Brown Shale	T	89.5	2	J1069	296770
4930. .	8/01/2024	Coombes Brown Shale	T	136	3	J1069	300135
4930. .	8/01/2024	Coombes Brown Shale	T	108.9	2	J1069	296674
4930. .	8/01/2024	Coombes Brown Shale	T	112.5	3	J1069	297767
4930. .	8/01/2024	Coombes Brown Shale	T	111.8	3	J1069	299989
4930. .	9/01/2024	Coombes Brown Shale	T	274.2	7	J1069	296518
4930. .	9/01/2024	Coombes Brown Shale	T	272.3	7	J1069	300136
4930. .	9/01/2024	Coombes Brown Shale	T	218	5	J1069	300236
4930. .	9/01/2024	Coombes Brown Shale	T	188.1	5	J1069	297768
4930. .	9/01/2024	Coombes Brown Shale	T	37.5	1	J1069	303740
4930. .	9/01/2024	Coombes Brown Shale	T	36.3	0	J1069	296678
4930. .	9/01/2024	Coombes Brown Shale	T	37.5	1	J1069	298406
4930. .	9/01/2024	Coombes Brown Shale	T	37.4	1	J1069	300347
4930. .	9/01/2024	Coombes Brown Shale	T	179.9	4	J1069	296771
4930. .	9/01/2024	Coombes Brown Shale	T	158	4	J1069	299717
4930. .	9/01/2024	Coombes Brown Shale	T	148.8	4	J1069	299990
4930. .	10/01/2024	Coombes Brown Shale	T	37.6	1	J1069	296598
4930. .	10/01/2024	Coombes Brown Shale	T	74.9	2	J1069	298408
4930. .	10/01/2024	Coombes Brown Shale	T	37.6	1	J1069	300350
4930. .	10/01/2024	Coombes Brown Shale	T	91.3	2	J1069	296520
4930. .	10/01/2024	Coombes Brown Shale	T	59.8	1	J1069	296773
4930. .	10/01/2024	Coombes Brown Shale	T	90.6	2	J1069	300138
4930. .	10/01/2024	Coombes Brown Shale	T	75	2	J1069	297807
4930. .	10/01/2024	Coombes Brown Shale	T	75.1	2	J1069	303742
4930. .	10/01/2024	Coombes Brown Shale	T	38.3	1	J1069	297616
4930. .	10/01/2024	Coombes Brown Shale	T	37.45	1	J1069	298062
4930. .	10/01/2024	Coombes Brown Shale	T	37.6	1	J1069	300757
4930. .	10/01/2024	Coombes Brown Shale	T	39.3	1	J1069	299723
4930. .	10/01/2024	Coombes Brown Shale	T	111.8	3	J1069	299992
4930. .	5/02/2024	Coombes Brown Shale	T	37.6	1	J1069	300787
4930. .	5/02/2024	Coombes Brown Shale	T	42	1	J1069	296639
4930. .	5/02/2024	Coombes Brown Shale	T	41.78	1	J1069	298164
4930. .	5/02/2024	Coombes Brown Shale	T	90.3	2	J1069	299011
4930. .	5/02/2024	Coombes Brown Shale	T	74.4	2	J1069	296120
4930. .	5/02/2024	Coombes Brown Shale	T	73	1	J1069	298212
4930. .	7/02/2024	Coombes Brown Shale	T	37	1	J1069	298435
4930. .	7/02/2024	Coombes Brown Shale	T	78.7	2	J1069	301754
4930. .	7/02/2024	Coombes Brown Shale	T	108	2	J1069	297388
4930. .	7/02/2024	Coombes Brown Shale	T	75.4	2	J1069	300790
4930. .	7/02/2024	Coombes Brown Shale	T	74.7	2	J1069	299351
4930. .	7/02/2024	Coombes Brown Shale	T	150.3	4	J1069	297784
4930. .	7/02/2024	Coombes Brown Shale	T	78.4	2	J1069	297401
4930. .	7/02/2024	Coombes Brown Shale	T	37.5	1	J1069	300664
4930. .	7/02/2024	Coombes Brown Shale	T	37.9	1	J1069	297649
4930. .	15/02/2024	Coombes Brown Shale	T	38.2	1	J1069	298311
4930. .	15/02/2024	Coombes Brown Shale	T	36	1	J1069	297398
4930. .	15/02/2024	Coombes Brown Shale	T	36.9	1	J1069	297326
4930. .	15/02/2024	Coombes Brown Shale	T	38	1	J1069	298616
4930. .	15/02/2024	Coombes Brown Shale	T	37.2	1	J1069	297793
4930. .	15/02/2024	Coombes Brown Shale	T	37.4	1	J1069	297511
4930. .	15/02/2024	Coombes Brown Shale	T	37.5	1	J1069	300520

4930. .	16/02/2024	Coombes Brown Shale	T	74.5	2	J1069	297328
4930. .	16/02/2024	Coombes Brown Shale	T	39.5	1	J1069	297418
4930. .	16/02/2024	Coombes Brown Shale	T	36.3	1	J1069	298023
4930. .	16/02/2024	Coombes Brown Shale	T	36.5	1	J1069	298232
4930. .	16/02/2024	Coombes Brown Shale	T	41.54	1	J1069	298187
4930. .	16/02/2024	Coombes Brown Shale	T	42	1	J1069	303212
4930. .	16/02/2024	Coombes Brown Shale	T	39.3	1	J1069	301774
4930. .	16/02/2024	Coombes Brown Shale	T	75.3	2	J1069	297794
4930. .	16/02/2024	Coombes Brown Shale	T	74.5	2	J1069	300522
4930. .	16/02/2024	Coombes Brown Shale	T	75.1	2	J1069	300295
4930. .	16/02/2024	Coombes Brown Shale	T	37.4	1	J1069	300671
4930. .	11/03/2024	Coombes Brown Shale	T	45.9	1	J1069	297240
4930. .	11/03/2024	Coombes Brown Shale	T	114.7	3	J1069	302210
4930. .	11/03/2024	Coombes Brown Shale	T	45.2	1	J1069	288318
4930. .	11/03/2024	Coombes Brown Shale	T	112.5	3	J1069	302258
4930. .	12/03/2024	Coombes Brown Shale	T	145.2	3	J1069	301869
4930. .	12/03/2024	Coombes Brown Shale	T	180.5	4	J1069	301798
4930. .	12/03/2024	Coombes Brown Shale	T	153	4	J1069	305051
4930. .	12/03/2024	Coombes Brown Shale	T	225.4	6	J1069	302259
4930. .	12/03/2024	Coombes Brown Shale	T	91.7	2	J1069	297244
4930. .	12/03/2024	Coombes Brown Shale	T	186.3	5	J1069	297262
4930. .	12/03/2024	Coombes Brown Shale	T	78.7	2	J1069	301904
4930. .	12/03/2024	Coombes Brown Shale	T	90.9	2	J1069	288322
4930. .	12/03/2024	Coombes Brown Shale	T	167.56	4	J1069	303244
4930. .	12/03/2024	Coombes Brown Shale	T	167.18	4	J1069	300722
4930. .	12/03/2024	Coombes Brown Shale	T	187.9	5	J1069	301576
4930. .	12/03/2024	Coombes Brown Shale	T	188	5	J1069	302391
4930. .	13/03/2024	Coombes Brown Shale	T	73	1	J1069	301666
4930. .	13/03/2024	Coombes Brown Shale	T	188	5	J1069	301577
4930. .	13/03/2024	Coombes Brown Shale	T	125.66	3	J1069	303245
4930. .	13/03/2024	Coombes Brown Shale	T	125.24	3	J1069	300723
4930. .	13/03/2024	Coombes Brown Shale	T	197.2	5	J1069	301905
4930. .	13/03/2024	Coombes Brown Shale	T	114.7	3	J1069	305053
4930. .	13/03/2024	Coombes Brown Shale	T	228.4	6	J1069	297245
4930. .	13/03/2024	Coombes Brown Shale	T	224.7	6	J1069	300625
4930. .	13/03/2024	Coombes Brown Shale	T	227.8	6	J1069	288323
4930. .	14/03/2024	Coombes Brown Shale	T	149.9	4	J1069	302393
4930. .	14/03/2024	Coombes Brown Shale	T	91.9	2	J1069	297248
4930. .	14/03/2024	Coombes Brown Shale	T	187.8	5	J1069	301579
4930. .	14/03/2024	Coombes Brown Shale	T	167.66	4	J1069	303247
4930. .	14/03/2024	Coombes Brown Shale	T	187.7	5	J1069	300698
4930. .	14/03/2024	Coombes Brown Shale	T	166.82	4	J1069	300721
4930. .	14/03/2024	Coombes Brown Shale	T	197	5	J1069	301906
4930. .	14/03/2024	Coombes Brown Shale	T	90.5	2	J1069	288326
4930. .	14/03/2024	Coombes Brown Shale	T	36.3	1	J1069	301873
4930. .	14/03/2024	Coombes Brown Shale	T	37.5	1	J1069	302262
4930. .	14/03/2024	Coombes Brown Shale	T	72.3	1	J1069	298364
4930. .	18/03/2024	Coombes Brown Shale	T	114.8	3	J1069	305056
4930. .	18/03/2024	Coombes Brown Shale	T	37	1	J1069	297268
4930. .	18/03/2024	Coombes Brown Shale	T	36.1	1	J1069	298366
4930. .	18/03/2024	Coombes Brown Shale	T	83.54	2	J1069	300729
4930. .	18/03/2024	Coombes Brown Shale	T	84	2	J1069	293802
4930. .	18/03/2024	Coombes Brown Shale	T	149.2	4	J1069	299422
4930. .	18/03/2024	Coombes Brown Shale	T	45.64	1	J1069	288330
4930. .	18/03/2024	Coombes Brown Shale	T	36.1	1	J1069	301875
4930. .	18/03/2024	Coombes Brown Shale	T	36.5	1	J1069	301671
4930. .	18/03/2024	Coombes Brown Shale	T	150.4	4	J1069	301581
4930. .	19/03/2024	Coombes Brown Shale	T	187.7	4	J1069	300628
4930. .	19/03/2024	Coombes Brown Shale	T	37.4	1	J1069	299424
4930. .	19/03/2024	Coombes Brown Shale	T	186.55	4	J1069	300548
4930. .	19/03/2024	Coombes Brown Shale	T	208.9	5	J1069	293803
4930. .	19/03/2024	Coombes Brown Shale	T	208.9	5	J1069	300730
4930. .	19/03/2024	Coombes Brown Shale	T	187.9	4	J1069	297836
4930. .	19/03/2024	Coombes Brown Shale	T	112.9	3	J1069	305551

4930. .	19/03/2024	Coombes Brown Shale	T	75.1	2	J1069	301583
4930. .	19/03/2024	Coombes Brown Shale	T	76.6	2	J1069	302218
4930. .	19/03/2024	Coombes Brown Shale	T	137.4	3	J1069	302003
4930. .	19/03/2024	Coombes Brown Shale	T	37.5	1	J1069	302266
4930. .	19/03/2024	Coombes Brown Shale	T	45.1	1	J1069	288332
4930. .	19/03/2024	Coombes Brown Shale	T	191.6	5	J1069	305057
4930. .	19/03/2024	Coombes Brown Shale	T	39.2	1	J1069	301910
4930. .	19/03/2024	Coombes Brown Shale	T	223.4	5	J1069	297269
4930. .	19/03/2024	Coombes Brown Shale	T	179.9	4	J1069	298367
4930. .	20/03/2024	Coombes Brown Shale	T	38.5	1	J1069	302219
4930. .	20/03/2024	Coombes Brown Shale	T	39.5	1	J1069	301911
4930. .	20/03/2024	Coombes Brown Shale	T	37.6	1	J1069	300629
4930. .	20/03/2024	Coombes Brown Shale	T	37.4	1	J1069	305552
4930. .	20/03/2024	Coombes Brown Shale	T	38.4	1	J1069	305058
4930. .	20/03/2024	Coombes Brown Shale	T	37.4	1	J1069	302267
4930. .	20/03/2024	Coombes Brown Shale	T	37.6	1	J1069	301584
4930. .	21/03/2024	Cream Shale	T	45.7	1	J1069	302005
4930. .	21/03/2024	Cream Shale	T	136.4	3	J1069	288335
4930. .	21/03/2024	Cream Shale	T	148.8	4	J1069	305701
4930. .	21/03/2024	Cream Shale	T	118.1	3	J1069	301913
4930. .	21/03/2024	Cream Shale	T	187.7	5	J1069	305554
4930. .	21/03/2024	Cream Shale	T	208.84	5	J1069	293805
4930. .	21/03/2024	Cream Shale	T	209.44	5	J1069	300732
4930. .	21/03/2024	Cream Shale	T	181.2	4	J1069	301880
4930. .	21/03/2024	Cream Shale	T	188.3	5	J1069	297838
4930. .	21/03/2024	Cream Shale	T	36.5	0	J1069	301676
4930. .	21/03/2024	Cream Shale	T	75.3	2	J1069	301587
4930. .	21/03/2024	Cream Shale	T	149.4	4	J1069	299426
4930. .	21/03/2024	Cream Shale	T	38.3	1	J1069	305061
4930. .	21/03/2024	Cream Shale	T	38	1	J1069	302220
4930. .	21/03/2024	Cream Shale	T	74.7	2	J1069	297271
4930. .	21/03/2024	Coombes Brown Shale	T	111.8	3	J1069	297272
4930. .	22/03/2024	Cream Shale	T	224.6	6	J1069	300631
4930. .	22/03/2024	Cream Shale	T	37.4	1	J1069	302275
4930. .	22/03/2024	Cream Shale	T	235.6	6	J1069	301914
4930. .	22/03/2024	Cream Shale	T	223.4	6	J1069	297273
4930. .	22/03/2024	Cream Shale	T	36.5	1	J1069	298368
4930. .	22/03/2024	Cream Shale	T	191.3	5	J1069	305062
4930. .	22/03/2024	Cream Shale	T	187.9	5	J1069	297839
4930. .	22/03/2024	Cream Shale	T	187	5	J1069	305703
4930. .	25/03/2024	Cream Shale	T	37.3	1	J1069	302278
4930. .	25/03/2024	Cream Shale	T	109.3	2	J1069	301882
4930. .	25/03/2024	Cream Shale	T	126	3	J1069	293808
4930. .	25/03/2024	Cream Shale	T	125.48	3	J1069	300735
4930. .	25/03/2024	Cream Shale	T	109.5	2	J1069	301680
4930. .	25/03/2024	Cream Shale	T	112.2	3	J1069	300623
4930. .	25/03/2024	Cream Shale	T	30	1	J1069	301961
4930. .	25/03/2024	Cream Shale	T	76.2	2	J1069	305065
4930. .	25/03/2024	Cream Shale	T	78.8	2	J1069	298768
4930. .	25/03/2024	Cream Shale	T	38.5	1	J1069	302226
4930. .	25/03/2024	Cream Shale	T	29.9	1	J1069	255266
4930. .	25/03/2024	Cream Shale	T	91.7	2	J1069	302009
4930. .	25/03/2024	Cream Shale	T	112.7	3	J1069	301591
4930. .	25/03/2024	Cream Shale	T	150	4	J1069	297841
4930. .	25/03/2024	Cream Shale	T	149.1	4	J1069	297275
4930. .	25/03/2024	Cream Shale	T	39.4	1	J1069	301917
4930. .	25/03/2024	Coombes Apricot Shale	T	72.6	1	J1069	301883
4930. .	25/03/2024	Coombes Apricot Shale	T	83.54	2	J1069	293809
4930. .	25/03/2024	Coombes Apricot Shale	T	83.96	2	J1069	300736
4930. .	25/03/2024	Coombes Apricot Shale	T	73	1	J1069	301681
4930. .	25/03/2024	Coombes Apricot Shale	T	74.9	2	J1069	300633
4930. .	25/03/2024	Coombes Apricot Shale	T	38.3	1	J1069	305064
4930. .	25/03/2024	Coombes Apricot Shale	T	39.5	1	J1069	298767
4930. .	25/03/2024	Coombes Apricot Shale	T	75.4	2	J1069	298265

4930. .	25/03/2024	Coombes Apricot Shale	T	74.5	2	J1069	297276
4930. .	26/03/2024	Cream Shale	T	187	5	J1069	300635
4930. .	26/03/2024	Cream Shale	T	36.4	1	J1069	301885
4930. .	26/03/2024	Cream Shale	T	29.9	1	J1069	255269
4930. .	26/03/2024	Cream Shale	T	30	1	J1069	301964
4930. .	26/03/2024	Cream Shale	T	186.5	5	J1069	297277
4930. .	26/03/2024	Cream Shale	T	224.05	6	J1069	299435
4930. .	26/03/2024	Cream Shale	T	190.5	5	J1069	302227
4930. .	26/03/2024	Cream Shale	T	83.66	2	J1069	293811
4930. .	26/03/2024	Cream Shale	T	83.8	2	J1069	300738
4930. .	26/03/2024	Cream Shale	T	225.4	6	J1069	302279
4930. .	26/03/2024	Cream Shale	T	225.4	6	J1069	297842
4930. .	26/03/2024	Cream Shale	T	196.1	5	J1069	301918
4930. .	26/03/2024	Cream Shale	T	197	5	J1069	298769
4930. .	27/03/2024	Cream Shale	T	30	1	J1069	255272
4930. .	27/03/2024	Cream Shale	T	37.4	1	J1069	302397
4930. .	27/03/2024	Cream Shale	T	37.5	1	J1069	298266
4930. .	27/03/2024	Cream Shale	T	223.8	6	J1069	297278
4930. .	27/03/2024	Cream Shale	T	229	6	J1069	302011
4930. .	27/03/2024	Cream Shale	T	210	5	J1069	293812
4930. .	27/03/2024	Cream Shale	T	208.92	5	J1069	300739
4930. .	27/03/2024	Cream Shale	T	182.46	4	J1069	288338
4930. .	27/03/2024	Cream Shale	T	37.5	1	J1069	298111
4930. .	27/03/2024	Cream Shale	T	76.4	2	J1069	305068
4930. .	28/03/2024	Cream Shale	T	39.4	1	J1069	298772
4930. .	28/03/2024	Cream Shale	T	188.1	5	J1069	302280
4930. .	28/03/2024	Cream Shale	T	186.7	4	J1069	298113
4930. .	28/03/2024	Cream Shale	T	186.1	5	J1069	297279
4930. .	28/03/2024	Cream Shale	T	187.6	4	J1069	297844
4930. .	28/03/2024	Cream Shale	T	187.1	4	J1069	305559
4930. .	28/03/2024	Cream Shale	T	208.82	5	J1069	300740
4930. .	28/03/2024	Cream Shale	T	209.14	5	J1069	293813
4930. .	28/03/2024	Cream Shale	T	149.8	4	J1069	255273
4930. .	28/03/2024	Cream Shale	T	181.5	4	J1069	301686
4930. .	28/03/2024	Cream Shale	T	137.6	3	J1069	302013
4930. .	28/03/2024	Cream Shale	T	137.1	3	J1069	288340
4930. .	28/03/2024	Cream Shale	T	75	2	J1069	300640
4930. .	28/03/2024	Cream Shale	T	37.7	1	J1069	301596
4930. .	3/04/2024	Cream Shale	T	225	6	J1069	300641
4930. .	3/04/2024	Cream Shale	T	78.9	2	J1069	298774
4930. .	3/04/2024	Cream Shale	T	79	2	J1069	305152
4930. .	3/04/2024	Cream Shale	T	225.8	5	J1069	302281
4930. .	3/04/2024	Cream Shale	T	223.6	5	J1069	297280
4930. .	3/04/2024	Cream Shale	T	181.4	4	J1069	301687
4930. .	3/04/2024	Cream Shale	T	181.4	4	J1069	301889
4930. .	3/04/2024	Cream Shale	T	191.4	5	J1069	305070
4930. .	3/04/2024	Cream Shale	T	45.8	1	J1069	302015
4930. .	3/04/2024	Cream Shale	T	187.4	4	J1069	305560
4930. .	3/04/2024	Cream Shale	T	45.5	1	J1069	288342
4930. .	3/04/2024	Cream Shale	T	190.8	5	J1069	302230
4930. .	3/04/2024	Cream Shale	T	188.1	4	J1069	301595
4930. .	3/04/2024	Cream Shale	T	41.68	1	J1069	300742
4930. .	3/04/2024	Cream Shale	T	42	1	J1069	293815
4930. .	4/04/2024	Cream Shale	T	74.4	2	J1069	298115
4930. .	4/04/2024	Cream Shale	T	114	3	J1069	302231
4930. .	4/04/2024	Cream Shale	T	112	3	J1069	297281
4930. .	4/04/2024	Cream Shale	T	126	3	J1069	293816
4930. .	4/04/2024	Cream Shale	T	125.48	3	J1069	300743
4930. .	4/04/2024	Cream Shale	T	39.5	1	J1069	298776
4930. .	4/04/2024	Cream Shale	T	39.4	1	J1069	305154
4930. .	4/04/2024	Cream Shale	T	75	2	J1069	297846
4930. .	4/04/2024	Cream Shale	T	112.7	3	J1069	305561
4930. .	4/04/2024	Cream Shale	T	112.8	3	J1069	301597
4930. .	8/04/2024	Coombes Apricot Shale	T	112.1	3	J1069	299441

4930. .	8/04/2024	Coombes Apricot Shale	T	149.9	4	J1069	298117
4930. .	8/04/2024	Coombes Apricot Shale	T	182.7	4	J1069	302017
4930. .	8/04/2024	Coombes Apricot Shale	T	82.5	2	J1069	300644
4930. .	8/04/2024	Coombes Apricot Shale	T	59.9	1	J1069	255280
4930. .	8/04/2024	Coombes Apricot Shale	T	145.8	3	J1069	301689
4930. .	8/04/2024	Coombes Apricot Shale	T	150.3	4	J1069	297847
4930. .	8/04/2024	Coombes Apricot Shale	T	149.3	4	J1069	297283
4930. .	8/04/2024	Coombes Apricot Shale	T	181.7	4	J1069	288344
4930. .	8/04/2024	Coombes Apricot Shale	T	158	4	J1069	298778
4930. .	8/04/2024	Coombes Apricot Shale	T	157.2	4	J1069	305156
4930. .	8/04/2024	Coombes Apricot Shale	T	149.8	4	J1069	302399
4930. .	8/04/2024	Coombes Apricot Shale	T	75.1	2	J1069	302284
4930. .	8/04/2024	Coombes Apricot Shale	T	59.3	1	J1069	301973
4930. .	9/04/2024	Coombes Apricot Shale	T	75.15	2	J1069	298118
4930. .	9/04/2024	Coombes Apricot Shale	T	74.6	2	J1069	297284
4930. .	9/04/2024	Coombes Apricot Shale	T	181.8	4	J1069	288345
4930. .	9/04/2024	Coombes Apricot Shale	T	182.7	4	J1069	302018
4930. .	9/04/2024	Coombes Apricot Shale	T	168	4	J1069	293820
4930. .	9/04/2024	Coombes Apricot Shale	T	117.8	3	J1069	298779
4930. .	9/04/2024	Coombes Apricot Shale	T	118.2	3	J1069	305157
4930. .	9/04/2024	Coombes Apricot Shale	T	150	4	J1069	297848
4930. .	9/04/2024	Coombes Apricot Shale	T	150.5	4	J1069	301598
4930. .	10/04/2024	Coombes Apricot Shale	T	118.2	3	J1069	298781
4930. .	10/04/2024	Coombes Apricot Shale	T	118.2	3	J1069	305159
4930. .	10/04/2024	Coombes Apricot Shale	T	135.8	3	J1069	288346
4930. .	10/04/2024	Coombes Apricot Shale	T	112.4	3	J1069	301600
4930. .	10/04/2024	Coombes Apricot Shale	T	152.7	4	J1069	302233
4930. .	10/04/2024	Coombes Apricot Shale	T	152.9	4	J1069	305074
4930. .	10/04/2024	Coombes Apricot Shale	T	136.8	3	J1069	302019
4930. .	10/04/2024	Coombes Apricot Shale	T	126	3	J1069	293821
4930. .	10/04/2024	Coombes Apricot Shale	T	125.12	3	J1069	300745
4930. .	10/04/2024	Coombes Apricot Shale	T	108.5	2	J1069	301892
4930. .	11/04/2024	Coombes Apricot Shale	T	197.3	5	J1069	305160
4930. .	11/04/2024	Coombes Apricot Shale	T	185.6	5	J1069	297288
4930. .	11/04/2024	Coombes Apricot Shale	T	150.1	4	J1069	300647
4930. .	11/04/2024	Coombes Apricot Shale	T	210	5	J1069	293822
4930. .	11/04/2024	Coombes Apricot Shale	T	208.86	5	J1069	300746
4930. .	11/04/2024	Coombes Apricot Shale	T	181.6	4	J1069	301692
4930. .	11/04/2024	Coombes Apricot Shale	T	187.6	5	J1069	305565
4930. .	12/04/2024	Coombes Apricot Shale	T	150.4	4	J1069	302153
4930. .	12/04/2024	Coombes Apricot Shale	T	112.6	3	J1069	305567
4930. .	12/04/2024	Coombes Apricot Shale	T	227.1	6	J1069	288348
4930. .	12/04/2024	Coombes Apricot Shale	T	37.5	1	J1069	302101
4930. .	12/04/2024	Coombes Apricot Shale	T	39.5	1	J1069	305163
4930. .	12/04/2024	Coombes Apricot Shale	T	196.8	5	J1069	298784
4930. .	12/04/2024	Coombes Apricot Shale	T	209.28	5	J1069	300747
4930. .	12/04/2024	Coombes Apricot Shale	T	208.1	5	J1069	293823
4930. .	12/04/2024	Coombes Apricot Shale	T	76.2	2	J1069	305077
4930. .	12/04/2024	Coombes Apricot Shale	T	228.6	6	J1069	302021
4930. .	12/04/2024	Coombes Apricot Shale	T	150	4	J1069	302291
4930. .	12/04/2024	Coombes Apricot Shale	T	38	1	J1069	302236
4930. .	15/04/2024	Coombes Apricot Shale	T	229.6	6	J1069	302239
4930. .	15/04/2024	Coombes Apricot Shale	T	181.6	4	J1069	301693
4930. .	15/04/2024	Coombes Apricot Shale	T	187.6	5	J1069	305569
4930. .	15/04/2024	Coombes Apricot Shale	T	197.3	5	J1069	305165
4930. .	15/04/2024	Coombes Apricot Shale	T	196.9	5	J1069	298786
4930. .	15/04/2024	Coombes Apricot Shale	T	152.4	4	J1069	305078
4930. .	16/04/2024	Coombes Apricot Shale	T	197	5	J1069	298787
4930. .	16/04/2024	Coombes Apricot Shale	T	196.4	5	J1069	305166
4930. .	16/04/2024	Coombes Apricot Shale	T	208.9	5	J1069	300750
4930. .	16/04/2024	Coombes Apricot Shale	T	210	5	J1069	293825
4930. .	16/04/2024	Coombes Apricot Shale	T	226.8	6	J1069	306101
4930. .	16/04/2024	Coombes Apricot Shale	T	229	6	J1069	302024
4930. .	16/04/2024	Coombes Apricot Shale	T	181.4	4	J1069	301897

4930. .	17/04/2024	Coombes Apricot Shale	T	112.4	3	J1069	302297
4930. .	17/04/2024	Coombes Apricot Shale	T	157.7	4	J1069	298788
4930. .	17/04/2024	Coombes Apricot Shale	T	150.3	4	J1069	302157
4930. .	17/04/2024	Coombes Apricot Shale	T	137	3	J1069	302025
4930. .	17/04/2024	Coombes Apricot Shale	T	118.4	3	J1069	305167
4930. .	17/04/2024	Coombes Apricot Shale	T	136.2	3	J1069	306102
4930. .	17/04/2024	Coombes Apricot Shale	T	125.6	3	J1069	298369
4930. .	17/04/2024	Coombes Apricot Shale	T	126	3	J1069	293826
4930. .	18/04/2024	Coombes Apricot Shale	T	167.28	4	J1069	298371
4930. .	18/04/2024	Coombes Apricot Shale	T	78.9	2	J1069	298790
4930. .	18/04/2024	Coombes Apricot Shale	T	168	4	J1069	293828
4930. .	18/04/2024	Coombes Apricot Shale	T	112.6	3	J1069	305572
4930. .	18/04/2024	Coombes Apricot Shale	T	118.4	3	J1069	305169
4930. .	18/04/2024	Coombes Apricot Shale	T	181.5	4	J1069	306104
4930. .	18/04/2024	Coombes Apricot Shale	T	150.1	4	J1069	297294
4930. .	18/04/2024	Coombes Apricot Shale	T	182.9	4	J1069	302027
4930. .	18/04/2024	Coombes Apricot Shale	T	74.7	2	J1069	302102
4930. .	19/04/2024	Coombes Apricot Shale	T	229.1	6	J1069	302243
4930. .	19/04/2024	Coombes Apricot Shale	T	197.2	5	J1069	305170
4930. .	19/04/2024	Coombes Apricot Shale	T	187.8	5	J1069	305573
4930. .	19/04/2024	Coombes Apricot Shale	T	224	6	J1069	304758
4930. .	19/04/2024	Coombes Apricot Shale	T	210	5	J1069	293829
4930. .	19/04/2024	Coombes Apricot Shale	T	181.6	4	J1069	305001
4930. .	19/04/2024	Coombes Apricot Shale	T	190.9	5	J1069	305082
4930. .	19/04/2024	Coombes Apricot Shale	T	229.2	6	J1069	302028
4930. .	19/04/2024	Coombes Apricot Shale	T	197.5	5	J1069	304551
4930. .	22/04/2024	Coombes Apricot Shale	T	196.4	5	J1069	298794
4930. .	22/04/2024	Coombes Apricot Shale	T	190.6	5	J1069	302246
4930. .	22/04/2024	Coombes Apricot Shale	T	226.8	6	J1069	305084
4930. .	22/04/2024	Coombes Apricot Shale	T	145.3	3	J1069	305003
4930. .	22/04/2024	Coombes Apricot Shale	T	226.5	6	J1069	306107
4930. .	22/04/2024	Coombes Apricot Shale	T	229	6	J1069	302030
4930. .	22/04/2024	Coombes Apricot Shale	T	117.2	3	J1069	305174
4930. .	22/04/2024	Coombes Apricot Shale	T	181.7	4	J1069	301700
4930. .	22/04/2024	Coombes Apricot Shale	T	111.55	3	J1069	305577
4930. .	22/04/2024	Coombes Apricot Shale	T	190.6	5	J1069	306201
4930. .	23/04/2024	Coombes Apricot Shale	T	112.8	3	J1069	297005
4930. .	23/04/2024	Coombes Apricot Shale	T	227.5	6	J1069	305085
4930. .	23/04/2024	Coombes Apricot Shale	T	197.1	5	J1069	298795
4930. .	23/04/2024	Coombes Apricot Shale	T	191.1	5	J1069	306202
4930. .	23/04/2024	Coombes Apricot Shale	T	209.52	5	J1069	298374
4930. .	23/04/2024	Coombes Apricot Shale	T	226.8	6	J1069	306108
4930. .	23/04/2024	Coombes Apricot Shale	T	181.7	4	J1069	306001
4930. .	23/04/2024	Coombes Apricot Shale	T	228.9	6	J1069	302031
4930. .	24/04/2024	Coombes Apricot Shale	T	187.5	5	J1069	298273
4930. .	24/04/2024	Coombes Apricot Shale	T	210	5	J1069	293834
4930. .	24/04/2024	Coombes Apricot Shale	T	227.3	6	J1069	306109
4930. .	24/04/2024	Coombes Apricot Shale	T	114.6	3	J1069	306203
4930. .	24/04/2024	Coombes Apricot Shale	T	91.5	2	J1069	306204
4930. .	24/04/2024	Coombes Apricot Shale	T	209.2	5	J1069	298375
4930. .	24/04/2024	Coombes Apricot Shale	T	227.9	6	J1069	305086
4930. .	24/04/2024	Coombes Apricot Shale	T	187.4	5	J1069	305601
4930. .	24/04/2024	Coombes Apricot Shale	T	186.6	5	J1069	302104
4930. .	29/04/2024	Coombes Apricot Shale	T	197.1	5	J1069	305178
4930. .	29/04/2024	Coombes Apricot Shale	T	236.7	6	J1069	298797
4930. .	29/04/2024	Coombes Apricot Shale	T	227.5	6	J1069	306110
4930. .	29/04/2024	Coombes Apricot Shale	T	227.5	6	J1069	306205
4930. .	29/04/2024	Coombes Apricot Shale	T	187.4	5	J1069	302105
4930. .	29/04/2024	Coombes Apricot Shale	T	227.2	6	J1069	305087
4930. .	29/04/2024	Coombes Apricot Shale	T	228.7	6	J1069	302032
4930. .	29/04/2024	Coombes Apricot Shale	T	181.5	4	J1069	306002
4930. .	30/04/2024	Coombes Apricot Shale	T	84	2	J1069	293836
4930. .	30/04/2024	Coombes Apricot Shale	T	228.4	6	J1069	302033
4930. .	30/04/2024	Coombes Apricot Shale	T	228	6	J1069	306206

4930. .	30/04/2024	Coombes Apricot Shale	T	75.96	2	J1069	298377
4930. .	30/04/2024	Coombes Apricot Shale	T	228	6	J1069	306111
4930. .	30/04/2024	Coombes Apricot Shale	T	227.3	6	J1069	305088
4930. .	1/05/2024	Coombes Apricot Shale	T	118.7	3	J1069	298800
4930. .	1/05/2024	Coombes Apricot Shale	T	157.9	3	J1069	305182
4930. .	1/05/2024	Coombes Apricot Shale	T	37.5	1	J1069	297011
4930. .	1/05/2024	Coombes Apricot Shale	T	112.6	3	J1069	297012
4930. .	1/05/2024	Coombes Apricot Shale	T	181.7	4	J1069	306113
4930. .	1/05/2024	Coombes Apricot Shale	T	181.6	4	J1069	305090
4930. .	1/05/2024	Coombes Apricot Shale	T	112.3	3	J1069	305604
4930. .	1/05/2024	Coombes Apricot Shale	T	183	4	J1069	302035
4930. .	1/05/2024	Coombes Apricot Shale	T	136.8	3	J1069	306208
4930. .	2/05/2024	Coombes Apricot Shale	T	112.7	2	J1069	305655
4930. .	2/05/2024	Coombes Apricot Shale	T	91.1	2	J1069	305092
4930. .	2/05/2024	Coombes Apricot Shale	T	108.8	2	J1069	305015
4930. .	2/05/2024	Coombes Apricot Shale	T	75.1	2	J1069	297014
4930. .	2/05/2024	Coombes Apricot Shale	T	210	4	J1069	298381
4930. .	2/05/2024	Coombes Apricot Shale	T	157.5	3	J1069	305184
4930. .	2/05/2024	Coombes Apricot Shale	T	30.1	1	J1069	305512
4930. .	2/05/2024	Coombes Apricot Shale	T	30	1	J1069	301998
4930. .	2/05/2024	Coombes Apricot Shale	T	73	1	J1069	306007
4930. .	2/05/2024	Coombes Apricot Shale	T	157.7	3	J1069	302453
4930. .	2/05/2024	Coombes Apricot Shale	T	182	3	J1069	306115
4930. .	2/05/2024	Coombes Apricot Shale	T	183.1	3	J1069	306210
4930. .	2/05/2024	Coombes Apricot Shale	T	75.1	2	J1069	305607
4930. .	2/05/2024	Coombes Apricot Shale	T	75.2	2	J1069	306057
4930. .	2/05/2024	Coombes Apricot Shale	T	168	3	J1069	293840
4930. .	3/05/2024	Coombes Apricot Shale	T	137.5	3	J1069	302039
4930. .	3/05/2024	Coombes Apricot Shale	T	113.1	3	J1069	305657
4930. .	3/05/2024	Coombes Apricot Shale	T	118.2	3	J1069	305186
4930. .	3/05/2024	Coombes Apricot Shale	T	137.1	3	J1069	306212
4930. .	3/05/2024	Coombes Apricot Shale	T	136.8	3	J1069	305095
4930. .	3/05/2024	Coombes Apricot Shale	T	126	3	J1069	293842
4930. .	3/05/2024	Coombes Apricot Shale	T	136.8	3	J1069	306117
4930. .	3/05/2024	Coombes Apricot Shale	T	118.5	3	J1069	302455
4930. .	3/05/2024	Coombes Apricot Shale	T	84	2	J1069	298383
4930. .	14/05/2024	Coombes Apricot Shale	T	197.2	5	J1069	305190
4930. .	14/05/2024	Coombes Apricot Shale	T	228.8	5	J1069	302040
4930. .	14/05/2024	Coombes Apricot Shale	T	187	5	J1069	298279
4930. .	14/05/2024	Coombes Apricot Shale	T	197	5	J1069	302457
4930. .	14/05/2024	Coombes Apricot Shale	T	181.5	4	J1069	305017
4930. .	14/05/2024	Coombes Apricot Shale	T	209.48	5	J1069	298385
4930. .	14/05/2024	Coombes Apricot Shale	T	210	5	J1069	293846
4930. .	14/05/2024	Coombes Apricot Shale	T	76.8	2	J1069	304506
4930. .	14/05/2024	Coombes Apricot Shale	T	72.7	1	J1069	304507
4930. .	14/05/2024	Coombes Apricot Shale	T	187.8	4	J1069	305608
4930. .	14/05/2024	Coombes Apricot Shale	T	149.3	4	J1069	298139
4930. .	14/05/2024	Coombes Apricot Shale	T	191.1	5	J1069	301801
4930. .	15/05/2024	Coombes Apricot Shale	T	188.2	5	J1069	297021
4930. .	15/05/2024	Coombes Apricot Shale	T	145.2	3	J1069	305018
4930. .	15/05/2024	Coombes Apricot Shale	T	153.1	4	J1069	301802
4930. .	15/05/2024	Coombes Apricot Shale	T	228.7	6	J1069	302041
4930. .	15/05/2024	Coombes Apricot Shale	T	168	4	J1069	293847
4930. .	15/05/2024	Coombes Apricot Shale	T	167.7	4	J1069	298386
4930. .	15/05/2024	Coombes Apricot Shale	T	75.65	2	J1069	305660
4930. .	15/05/2024	Coombes Apricot Shale	T	186.7	5	J1069	304774
4930. .	15/05/2024	Coombes Apricot Shale	T	150.4	4	J1069	305609
4930. .	15/05/2024	Coombes Apricot Shale	T	182.2	4	J1069	306118
4930. .	15/05/2024	Coombes Apricot Shale	T	39.5	1	J1069	302460
4930. .	15/05/2024	Coombes Apricot Shale	T	39.5	1	J1069	305193
4930. .	15/05/2024	Coombes Apricot Shale	T	37.6	1	J1069	298142
4930. .	15/05/2024	Coombes Apricot Shale	T	36.5	1	J1069	306012
4930. .	15/05/2024	Coombes Apricot Shale	T	37.6	1	J1069	306059
4930. .	15/05/2024	Coombes Apricot Shale	T	38	1	J1069	304510

4930. .	15/05/2024	Coombes Apricot Shale	T	112.7	3	J1069	305586
4930. .	16/05/2024	Coombes Apricot Shale	T	228.8	5	J1069	302043
4930. .	16/05/2024	Coombes Apricot Shale	T	228.9	5	J1069	306213
4930. .	16/05/2024	Coombes Apricot Shale	T	196.8	4	J1069	302462
4930. .	16/05/2024	Coombes Apricot Shale	T	196.3	4	J1069	305195
4930. .	16/05/2024	Coombes Apricot Shale	T	210	5	J1069	293849
4930. .	16/05/2024	Coombes Apricot Shale	T	228.8	5	J1069	305096
4930. .	16/05/2024	Coombes Apricot Shale	T	114.6	3	J1069	301804
4930. .	16/05/2024	Coombes Apricot Shale	T	83.8	2	J1069	298388
4930. .	16/05/2024	Coombes Apricot Shale	T	37.2	1	J1069	302108
4930. .	16/05/2024	Coombes Apricot Shale	T	75.6	2	J1069	304777
4930. .	16/05/2024	Coombes Apricot Shale	T	37.5	1	J1069	306060
4930. .	16/05/2024	Coombes Apricot Shale	T	229.6	5	J1069	304512
4930. .	16/05/2024	Coombes Apricot Shale	T	228.2	5	J1069	306120
4930. .	16/05/2024	Coombes Apricot Shale	T	37.7	1	J1069	298145
4930. .	16/05/2024	Coombes Apricot Shale	T	29.9	1	J1069	305524
4930. .	17/05/2024	Coombes Apricot Shale	T	167.4	4	J1069	298389
4930. .	17/05/2024	Coombes Apricot Shale	T	118.1	3	J1069	305197
4930. .	17/05/2024	Coombes Apricot Shale	T	168	4	J1069	293850
4930. .	17/05/2024	Coombes Apricot Shale	T	118.1	3	J1069	302465
4930. .	17/05/2024	Coombes Apricot Shale	T	182.5	4	J1069	306122
4930. .	17/05/2024	Coombes Apricot Shale	T	137.3	3	J1069	306215
4930. .	17/05/2024	Coombes Apricot Shale	T	136.9	3	J1069	305098
4930. .	17/05/2024	Coombes Apricot Shale	T	229	6	J1069	302045
4930. .	31/05/2024	Coombes Apricot Shale	T	36.5	1	J1069	306040
4930. .	31/05/2024	Coombes Apricot Shale	T	209.7	4	J1069	297457
4930. .	31/05/2024	Coombes Apricot Shale	T	227.47	5	J1069	306147
4930. .	31/05/2024	Coombes Apricot Shale	T	72.6	1	J1069	305044
4930. .	31/05/2024	Coombes Apricot Shale	T	196.9	4	J1069	302488
4930. .	31/05/2024	Coombes Apricot Shale	T	210	4	J1069	301619
4930. .	31/05/2024	Coombes Apricot Shale	T	149.6	4	J1069	297048
4930. .	31/05/2024	Coombes Apricot Shale	T	227.5	5	J1069	301815
4930. .	31/05/2024	Coombes Apricot Shale	T	46	1	J1069	302072
4930. .	31/05/2024	Coombes Apricot Shale	T	45.8	1	J1069	306241
4930. .	31/05/2024	Coombes Apricot Shale	T	45.6	1	J1069	305422
4930. .	3/06/2024	Coombes Apricot Shale	T	59.8	1	J1069	305225
4930. .	3/06/2024	Coombes Apricot Shale	T	59.9	1	J1069	305301
4930. .	3/06/2024	Coombes Apricot Shale	T	151.6	4	J1069	301816
4930. .	3/06/2024	Coombes Apricot Shale	T	136.66	3	J1069	306148
4930. .	3/06/2024	Coombes Apricot Shale	T	112.4	3	J1069	305714
4930. .	3/06/2024	Coombes Apricot Shale	T	112.9	3	J1069	305680
4930. .	3/06/2024	Coombes Apricot Shale	T	112.4	3	J1069	300554
4930. .	3/06/2024	Coombes Apricot Shale	T	183	4	J1069	306242
4930. .	3/06/2024	Coombes Apricot Shale	T	36.1	1	J1069	305048
4930. .	3/06/2024	Coombes Apricot Shale	T	188.5	5	J1069	297049
4930. .	3/06/2024	Coombes Apricot Shale	T	197.2	5	J1069	302489
4930. .	3/06/2024	Coombes Apricot Shale	T	183.3	4	J1069	302074
4930. .	3/06/2024	Coombes Apricot Shale	T	191	5	J1069	304540
4930. .	3/06/2024	Coombes Apricot Shale	T	210	5	J1069	301620
4930. .	3/06/2024	Coombes Apricot Shale	T	136.8	3	J1069	305423
4930. .	5/06/2024	Coombes Apricot Shale	T	46	1	J1069	306248
4930. .	5/06/2024	Coombes Apricot Shale	T	36.5	1	J1069	306046
4930. .	5/06/2024	Coombes Apricot Shale	T	42	1	J1069	297463
4930. .	5/06/2024	Coombes Apricot Shale	T	42	1	J1069	301625
4930. .	5/06/2024	Coombes Apricot Shale	T	38	1	J1069	301820
4930. .	4/06/2024	Cream Shale	T	41.9	1	J1069	297459
4930. .	4/06/2024	Cream Shale	T	42	1	J1069	301621
4930. .	4/06/2024	Cream Shale	T	36.5	1	J1069	306043
4930. .	4/06/2024	Cream Shale	T	45.8	1	J1069	305428
4930. .	4/06/2024	Cream Shale	T	75.4	2	J1069	302301
4930. .	4/06/2024	Cream Shale	T	37.3	1	J1069	304807
4930. .	4/06/2024	Cream Shale	T	75.1	2	J1069	300556
4930. .	4/06/2024	Cream Shale	T	183.3	4	J1069	302077
4930. .	4/06/2024	Cream Shale	T	181.92	4	J1069	299052

4930. .	4/06/2024	Cream Shale	T	137.1	3	J1069	306244
4930. .	4/06/2024	Cream Shale	T	41.9	1	J1069	297459
4930. .	4/06/2024	Cream Shale	T	42	1	J1069	301621
4930. .	4/06/2024	Cream Shale	T	36.5	1	J1069	306043
4930. .	4/06/2024	Cream Shale	T	45.8	1	J1069	305428
4930. .	4/06/2024	Cream Shale	T	75.4	2	J1069	302301
4930. .	4/06/2024	Cream Shale	T	37.3	1	J1069	304807
4930. .	4/06/2024	Cream Shale	T	75.1	2	J1069	300556
4930. .	4/06/2024	Cream Shale	T	183.3	4	J1069	302077
4930. .	4/06/2024	Cream Shale	T	181.92	4	J1069	299052
4930. .	4/06/2024	Cream Shale	T	137.1	3	J1069	306244
4930. .	4/06/2024	Coombes Apricot Shale	T	45.8	1	J1069	306243
4930. .	12/06/2024	Cream Shale	T	167.62	4	J1069	297465
4930. .	12/06/2024	Cream Shale	T	74.2	2	J1069	298299
4930. .	12/06/2024	Cream Shale	T	137	3	J1069	305351
4930. .	12/06/2024	Cream Shale	T	78.3	2	J1069	302494
4930. .	12/06/2024	Cream Shale	T	91.3	2	J1069	302082
4930. .	12/06/2024	Cream Shale	T	114.6	3	J1069	304544
4930. .	12/06/2024	Cream Shale	T	111.2	3	J1069	300560
4930. .	12/06/2024	Cream Shale	T	91.2	2	J1069	299057
4930. .	12/06/2024	Cream Shale	T	111.8	3	J1069	304814
4930. .	12/06/2024	Cream Shale	T	90.8	2	J1069	305433
4930. .	13/06/2024	Cream Shale	T	118.4	3	J1069	302496
4930. .	13/06/2024	Cream Shale	T	90.4	2	J1069	305434
4930. .	13/06/2024	Cream Shale	T	137.4	3	J1069	302087
4930. .	13/06/2024	Cream Shale	T	118	3	J1069	301933
4930. .	13/06/2024	Cream Shale	T	137	3	J1069	305355
4930. .	13/06/2024	Cream Shale	T	113.8	3	J1069	304546
4930. .	13/06/2024	Cream Shale	T	114.3	3	J1069	301823
4930. .	13/06/2024	Cream Shale	T	181.9	4	J1069	299061
4930. .	14/06/2024	Cream Shale	T	112	3	J1069	302308
4930. .	14/06/2024	Cream Shale	T	75.7	2	J1069	304550
4930. .	14/06/2024	Cream Shale	T	91.2	2	J1069	302090
4930. .	14/06/2024	Cream Shale	T	90.7	2	J1069	305440
4930. .	14/06/2024	Cream Shale	T	74	2	J1069	300564
4930. .	14/06/2024	Cream Shale	T	91	2	J1069	299063
4930. .	14/06/2024	Cream Shale	T	37.2	1	J1069	301827
4930. .	14/06/2024	Cream Shale	T	83.6	2	J1069	297469
4930. .	14/06/2024	Cream Shale	T	84	2	J1069	301631
4930. .	14/06/2024	Cream Shale	T	91.5	2	J1069	305358
4930. .	17/06/2024	Cream Shale	T	182.7	4	J1069	305441
4930. .	17/06/2024	Cream Shale	T	118.3	3	J1069	301936
4930. .	17/06/2024	Cream Shale	T	228.9	6	J1069	305359
4930. .	17/06/2024	Cream Shale	T	157.6	4	J1069	302499
4930. .	17/06/2024	Cream Shale	T	137.4	3	J1069	302091
4930. .	17/06/2024	Cream Shale	T	190.2	5	J1069	301829
4930. .	17/06/2024	Cream Shale	T	183.1	4	J1069	299064
4930. .	18/06/2024	Cream Shale	T	113.45	3	J1069	301831
4930. .	18/06/2024	Cream Shale	T	137.4	3	J1069	305361
4930. .	18/06/2024	Cream Shale	T	136.9	3	J1069	305443
4930. .	18/06/2024	Cream Shale	T	136.96	3	J1069	299066
4930. .	18/06/2024	Cream Shale	T	137	3	J1069	302094
4930. .	18/06/2024	Cream Shale	T	126	3	J1069	301633
4930. .	18/06/2024	Cream Shale	T	125.62	3	J1069	297471
4930. .	19/06/2024	Cream Shale	T	91.7	2	J1069	305363
4930. .	19/06/2024	Cream Shale	T	45.4	1	J1069	305445
4930. .	19/06/2024	Cream Shale	T	137.6	3	J1069	302096
4930. .	19/06/2024	Cream Shale	T	118.2	3	J1069	306802
4930. .	19/06/2024	Cream Shale	T	182.1	4	J1069	299069
4930. .	19/06/2024	Cream Shale	T	74.9	2	J1069	305689
4930. .	19/06/2024	Cream Shale	T	157.3	4	J1069	301940
4930. .	20/06/2024	Cream Shale	T	137.8	3	J1069	305449
4930. .	20/06/2024	Cream Shale	T	137.4	3	J1069	305367
4930. .	20/06/2024	Cream Shale	T	125.7	3	J1069	297476

4930. .	20/06/2024	Cream Shale	T	137.6	3	J1069	302100
4930. .	20/06/2024	Cream Shale	T	182.8	4	J1069	299073
4930. .	20/06/2024	Cream Shale	T	126	3	J1069	301638
4930. .	20/06/2024	Cream Shale	T	75.1	2	J1069	300571
4930. .	21/06/2024	Cream Shale	T	137.2	3	J1069	299075
4930. .	21/06/2024	Cream Shale	T	118.3	3	J1069	306807
4930. .	21/06/2024	Cream Shale	T	137.4	3	J1069	305370
4930. .	21/06/2024	Cream Shale	T	137.5	3	J1069	306752
4930. .	21/06/2024	Cream Shale	T	114.1	3	J1069	301836
4930. .	21/06/2024	Cream Shale	T	36.5	1	J1069	306563
4930. .	21/06/2024	Cream Shale	T	29.9	1	J1069	305324
4930. .	21/06/2024	Cream Shale	T	29.7	1	J1069	305248
4930. .	24/06/2024	Cream Shale	T	137.1	3	J1069	305373
4920. .	27/06/2024	Cream Shale	T	157.5	3	J1069	306816
4920. .	27/06/2024	Cream Shale	T	182.7	4	J1069	306760
4920. .	27/06/2024	Cream Shale	T	183.2	4	J1069	305380
4920. .	27/06/2024	Cream Shale	T	183.3	4	J1069	306262
4920. .	12/07/2024	Cream Shale	T	188.2	5	J1069	302347
4920. .	12/07/2024	Cream Shale	T	186.5	5	J1069	304836
4920. .	12/07/2024	Cream Shale	T	187.2	5	J1069	300587
4920. .	12/07/2024	Cream Shale	T	190.9	5	J1069	304624
4920. .	15/07/2024	Coombes Apricot Shale	T	196.6	4	J1069	305819
4920. .	15/07/2024	Coombes Apricot Shale	T	225.1	5	J1069	300589
4920. .	15/07/2024	Coombes Apricot Shale	T	236.4	5	J1069	306828
4920. .	15/07/2024	Coombes Apricot Shale	T	229.1	5	J1069	307260
4920. .	16/07/2024	Coombes Apricot Shale	T	296.3	7	J1069	305627
4930. .	27/06/2024	Cream Shale	T	118.1	2	J1069	306817
4930. .	27/06/2024	Cream Shale	T	91.5	2	J1069	305381
4930. .	28/06/2024	Cream Shale	T	183.1	4	J1069	306264
4930. .	28/06/2024	Cream Shale	T	183.3	4	J1069	306762
4930. .	10/07/2024	Coombes Apricot Shale	T	36.2	1	J1069	306184
4930. .	10/07/2024	Coombes Apricot Shale	T	137.5	3	J1069	306270
4930. .	10/07/2024	Coombes Apricot Shale	T	75.5	2	J1069	302345
4930. .	10/07/2024	Coombes Apricot Shale	T	75.5	2	J1069	307256
4930. .	10/07/2024	Coombes Apricot Shale	T	183.2	4	J1069	305388
4930. .	10/07/2024	Coombes Apricot Shale	T	182.74	4	J1069	299092
4930. .	10/07/2024	Coombes Apricot Shale	T	182.6	4	J1069	306766
4930. .	10/07/2024	Coombes Apricot Shale	T	39.5	1	J1069	305815
4930. .	10/07/2024	Coombes Apricot Shale	T	89.8	2	J1069	306372
4900. .	30/07/2024	Coombes Brown Shale	T	111.5	3	J1069	302143
4900. .	30/07/2024	Coombes Brown Shale	T	45.8	1	J1069	305860
4900. .	31/07/2024	Coombes Brown Shale	T	305.1	7	J1069	307282
4900. .	31/07/2024	Coombes Brown Shale	T	365.4	8	J1069	306790
4900. .	31/07/2024	Coombes Brown Shale	T	276	6	J1069	305843
4900. .	31/07/2024	Coombes Brown Shale	T	366.7	8	J1069	305861
4900. .	31/07/2024	Coombes Brown Shale	T	292.6	6	J1069	306962
4900. .	31/07/2024	Coombes Brown Shale	T	45.8	1	J1069	306295
4900. .	31/07/2024	Coombes Brown Shale	T	42	1	J1069	307470
4900. .	31/07/2024	Coombes Brown Shale	T	45.6	1	J1069	306414
4900. .	1/08/2024	Coombes Brown Shale	T	149.1	3	J1069	302146
4900. .	1/08/2024	Coombes Brown Shale	T	182.7	4	J1069	306791
4900. .	1/08/2024	Coombes Brown Shale	T	157.5	4	J1069	306842
4900. .	12/08/2024	Coombes Brown Shale	T	37.6	1	J1069	306323
4900. .	12/08/2024	Coombes Brown Shale	T	74.9	2	J1069	307862
4900. .	12/08/2024	Coombes Brown Shale	T	91	2	J1069	306429
4900. .	12/08/2024	Coombes Brown Shale	T	76.4	2	J1069	307601
4900. .	12/08/2024	Coombes Brown Shale	T	91.9	2	J1069	305878
4900. .	12/08/2024	Coombes Brown Shale	T	91.7	2	J1069	305964
4900. .	12/08/2024	Cream Shale	T	150.2	4	J1069	297730
4900. .	12/08/2024	Cream Shale	T	157.7	4	J1069	308261
4900. .	12/08/2024	Cream Shale	T	182.9	4	J1069	308208
4900. .	12/08/2024	Cream Shale	T	168	4	J1069	307487
4900. .	12/08/2024	Cream Shale	T	167.4	4	J1069	306981
4930. .	2/08/2024	Coombes Apricot Shale	T	46	1	J1069	306299

4930. .	2/08/2024	Coombes Apricot Shale	T	46	1	J1069	306794
4930. .	2/08/2024	Coombes Apricot Shale	T	38.88	1	J1069	306966
4930. .	2/08/2024	Coombes Apricot Shale	T	45.8	1	J1069	276572
4930. .	5/08/2024	Coombes Apricot Shale	T	198.8	5	J1069	305848
4930. .	5/08/2024	Coombes Apricot Shale	T	275.1	7	J1069	305952
4930. .	5/08/2024	Coombes Apricot Shale	T	75.4	2	J1069	307580
4930. .	5/08/2024	Coombes Apricot Shale	T	196.9	5	J1069	306848
4930. .	5/08/2024	Coombes Apricot Shale	T	227.16	6	J1069	306421
4930. .	5/08/2024	Coombes Apricot Shale	T	228.8	6	J1069	306795
4930. .	5/08/2024	Coombes Apricot Shale	T	229.4	6	J1069	305865
4930. .	6/08/2024	Coombes Apricot Shale	T	196.5	4	J1069	306849
4930. .	6/08/2024	Coombes Apricot Shale	T	74.4	2	J1069	306316
4930. .	6/08/2024	Coombes Apricot Shale	T	74.8	2	J1069	307854
4930. .	6/08/2024	Coombes Apricot Shale	T	209.2	4	J1069	307478
4930. .	6/08/2024	Coombes Apricot Shale	T	229.1	5	J1069	305953
4930. .	6/08/2024	Coombes Apricot Shale	T	37.6	1	J1069	307582
4930. .	6/08/2024	Coombes Apricot Shale	T	227.5	5	J1069	306422
4930. .	6/08/2024	Coombes Apricot Shale	T	273.3	6	J1069	306796
4930. .	6/08/2024	Coombes Apricot Shale	T	229.2	5	J1069	305866
4930. .	6/08/2024	Coombes Apricot Shale	T	125.5	3	J1069	306968
4930. .	6/08/2024	Coombes Apricot Shale	T	156.7	3	J1069	305849
4900. .	20/08/2024	Cream Shale	T	182.86	4	J1069	306433
4900. .	21/08/2024	Cream Shale	T	150.4	4	J1069	306332
4900. .	21/08/2024	Cream Shale	T	168	4	J1069	307493
4900. .	21/08/2024	Cream Shale	T	167.5	4	J1069	306987
4900. .	21/08/2024	Cream Shale	T	183.3	4	J1069	308215
4900. .	21/08/2024	Cream Shale	T	229.7	6	J1069	305972
4900. .	21/08/2024	Coombes Brown Shale	T	37.7	1	J1069	306331
4900. .	21/08/2024	Coombes Brown Shale	T	45.7	1	J1069	306436
4900. .	21/08/2024	Coombes Brown Shale	T	46	1	J1069	305971
4900. .	21/08/2024	Coombes Brown Shale	T	45.98	1	J1069	304881
4900. .	21/08/2024	Coombes Brown Shale	T	42	1	J1069	307492
4930. .	7/08/2024	Coombes Apricot Shale	T	145.2	3	J1069	307764
4930. .	7/08/2024	Coombes Apricot Shale	T	157.3	3	J1069	305850
4930. .	7/08/2024	Coombes Apricot Shale	T	157.5	3	J1069	306850
4930. .	7/08/2024	Coombes Apricot Shale	T	46	1	J1069	305868
4930. .	7/08/2024	Coombes Apricot Shale	T	153	3	J1069	307292
4930. .	7/08/2024	Coombes Apricot Shale	T	167.72	3	J1069	307479
4930. .	7/08/2024	Coombes Apricot Shale	T	137.1	3	J1069	306797
4930. .	20/08/2024	Cream Shale	T	36.3	1	J1069	306669
4930. .	20/08/2024	Cream Shale	T	36.5	1	J1069	307777
4930. .	23/08/2024	Cream Shale	T	36.3	1	J1069	306679
4930. .	27/08/2024	Cream Shale	T	118.3	3	J1069	308275
4930. .	27/08/2024	Cream Shale	T	137.7	3	J1069	305982
4930. .	27/08/2024	Cream Shale	T	137.7	3	J1069	305887
4920. .	16/07/2024	Coombes Apricot Shale	T	275.3	6	J1069	306830
4920. .	16/07/2024	Coombes Apricot Shale	T	274.45	6	J1069	305821
4920. .	17/07/2024	Coombes Apricot Shale	T	216.9	5	J1069	306586
4920. .	17/07/2024	Coombes Apricot Shale	T	225.7	6	J1069	300593
4920. .	17/07/2024	Coombes Apricot Shale	T	236.3	6	J1069	306832
4920. .	17/07/2024	Coombes Apricot Shale	T	217.8	5	J1069	306653
4920. .	18/07/2024	Coombes Apricot Shale	T	197.1	4	J1069	305824
4920. .	18/07/2024	Coombes Apricot Shale	T	181.9	4	J1069	306588
4920. .	18/07/2024	Coombes Apricot Shale	T	180.9	4	J1069	306655
4920. .	18/07/2024	Coombes Apricot Shale	T	196.9	5	J1069	306834
4920. .	19/07/2024	Coombes Apricot Shale	T	37.5	1	J1069	302132
4920. .	19/07/2024	Coombes Apricot Shale	T	196.9	5	J1069	305828
4920. .	19/07/2024	Coombes Apricot Shale	T	235.9	6	J1069	306838
4920. .	21/08/2024	Coombes Apricot Shale	T	113	3	J1069	306330
4920. .	21/08/2024	Coombes Apricot Shale	T	137.5	3	J1069	304880
4920. .	21/08/2024	Coombes Apricot Shale	T	117	3	J1069	307491
4920. .	21/08/2024	Coombes Apricot Shale	T	78	2	J1069	306985
4920. .	21/08/2024	Coombes Apricot Shale	T	137.3	3	J1069	308213
4920. .	21/08/2024	Coombes Apricot Shale	T	137.36	3	J1069	306435

4920. .	21/08/2024	Coombes Apricot Shale	T	137.9	3	J1069	305970
4920. .	22/08/2024	Coombes Apricot Shale	T	78.1	2	J1069	306989
4920. .	22/08/2024	Coombes Apricot Shale	T	182.9	4	J1069	308216
4920. .	22/08/2024	Coombes Apricot Shale	T	182.86	4	J1069	306438
4920. .	22/08/2024	Coombes Apricot Shale	T	156	4	J1069	307494
4920. .	22/08/2024	Coombes Apricot Shale	T	183.7	4	J1069	304883
4900. .	21/08/2024	Coombes Brown Shale	T	83.6	2	J1069	306986
4900. .	21/08/2024	Coombes Brown Shale	T	45.8	1	J1069	308214
4900. .	22/08/2024	Cream Shale	T	209.5	5	J1069	306990
4900. .	22/08/2024	Cream Shale	T	228.64	6	J1069	306439
4900. .	22/08/2024	Cream Shale	T	210	5	J1069	307495
4900. .	22/08/2024	Cream Shale	T	150.2	4	J1069	306334
4900. .	22/08/2024	Cream Shale	T	183.5	4	J1069	305974
4900. .	22/08/2024	Cream Shale	T	153.1	4	J1069	307609
4900. .	22/08/2024	Cream Shale	T	183.6	4	J1069	304884
4900. .	23/08/2024	Cream Shale	T	236	6	J1069	308270
4900. .	23/08/2024	Cream Shale	T	228.4	6	J1069	308219
4900. .	21/06/2024	Cream Shale	T	45.8	1	J1069	305371
4900. .	21/06/2024	Cream Shale	T	38.5	1	J1069	301837
4900. .	21/06/2024	Cream Shale	T	36.4	1	J1069	306166
4900. .	21/06/2024	Cream Shale	T	36.5	1	J1069	306564
4900. .	25/06/2024	Cream Shale	T	45.8	1	J1069	305376
4900. .	25/06/2024	Cream Shale	T	29.9	1	J1069	305330
4900. .	25/06/2024	Cream Shale	T	29.8	1	J1069	306355
4900. .	26/06/2024	Cream Shale	T	30	1	J1069	305332
4900. .	26/06/2024	Cream Shale	T	30	1	J1069	306357
4900. .	26/06/2024	Cream Shale	T	112.8	3	J1069	300578
4900. .	26/06/2024	Cream Shale	T	45.8	1	J1069	299084
4900. .	26/06/2024	Cream Shale	T	45.9	1	J1069	306261
4900. .	26/06/2024	Cream Shale	T	38.2	1	J1069	301844
4920. .	21/06/2024	Cream Shale	T	137.4	3	J1069	305369
4920. .	21/06/2024	Cream Shale	T	137.5	3	J1069	306751
4920. .	21/06/2024	Cream Shale	T	114.6	3	J1069	301835
4920. .	24/06/2024	Sandstone	T	46	1	J1069	299078
4920. .	24/06/2024	Cream Shale	T	137.4	3	J1069	305372
4920. .	24/06/2024	Cream Shale	T	112.9	3	J1069	300574
4920. .	24/06/2024	Cream Shale	T	91.3	2	J1069	299077
4920. .	24/06/2024	Cream Shale	T	117	3	J1069	301641
4920. .	24/06/2024	Cream Shale	T	39.1	1	J1069	297479
4920. .	24/06/2024	Cream Shale	T	37.6	1	J1069	302318
4920. .	24/06/2024	Cream Shale	T	136.8	3	J1069	306753
4920. .	24/06/2024	Cream Shale	T	137.5	3	J1069	306255
4920. .	25/06/2024	Cream Shale	T	117.9	3	J1069	301948
4930. .	24/06/2024	Cream Shale	T	112.7	3	J1069	300575
4930. .	24/06/2024	Cream Shale	T	136.5	3	J1069	299079
4930. .	24/06/2024	Cream Shale	T	126	3	J1069	301642
4930. .	24/06/2024	Cream Shale	T	125.7	3	J1069	297480
4930. .	24/06/2024	Cream Shale	T	37.4	1	J1069	304825
4930. .	24/06/2024	Cream Shale	T	37.5	1	J1069	302319
4930. .	24/06/2024	Cream Shale	T	137.1	3	J1069	306754
4930. .	24/06/2024	Cream Shale	T	37.7	1	J1069	306452
4930. .	24/06/2024	Cream Shale	T	37.7	1	J1069	305695
4930. .	24/06/2024	Cream Shale	T	183.5	4	J1069	306256
4930. .	25/06/2024	Cream Shale	T	118	3	J1069	301949
4930. .	25/06/2024	Cream Shale	T	137.5	3	J1069	306756
4930. .	25/06/2024	Cream Shale	T	118.4	3	J1069	306812
4920. .	25/06/2024	Cream Shale	T	136.7	3	J1069	306755
4920. .	25/06/2024	Cream Shale	T	118.4	3	J1069	306811
4920. .	25/06/2024	Cream Shale	T	183.5	4	J1069	306257
4920. .	25/06/2024	Cream Shale	T	182.9	4	J1069	305374
4920. .	25/06/2024	Cream Shale	T	152.5	4	J1069	301840
4920. .	25/06/2024	Cream Shale	T	183	4	J1069	299080
4920. .	26/06/2024	Cream Shale	T	188.4	5	J1069	300577
4920. .	26/06/2024	Cream Shale	T	228.8	6	J1069	299082

4920. .	26/06/2024	Cream Shale	T	191.2	5	J1069	301842
4920. .	26/06/2024	Cream Shale	T	156	4	J1069	301644
4920. .	26/06/2024	Cream Shale	T	156.36	4	J1069	297482
4920. .	27/06/2024	Cream Shale	T	157.9	3	J1069	305803
4920. .	26/08/2024	Coombes Apricot Shale	T	117	3	J1069	307499
4920. .	27/08/2024	Coombes Apricot Shale	T	157.7	4	J1069	308274
4920. .	27/08/2024	Coombes Apricot Shale	T	137.7	3	J1069	305981
4920. .	27/08/2024	Coombes Apricot Shale	T	137.8	3	J1069	305886
4920. .	27/08/2024	Coombes Apricot Shale	T	183.4	4	J1069	308222
4920. .	27/08/2024	Coombes Apricot Shale	T	156	4	J1069	306901
4920. .	27/08/2024	Coombes Apricot Shale	T	182.22	4	J1069	306446
4920. .	28/08/2024	Coombes Apricot Shale	T	229.8	6	J1069	305984
4920. .	28/08/2024	Coombes Apricot Shale	T	229.22	6	J1069	306448
4920. .	28/08/2024	Coombes Apricot Shale	T	39.5	1	J1069	308278
4920. .	28/08/2024	Coombes Apricot Shale	T	183.2	4	J1069	308224
4920. .	28/08/2024	Coombes Apricot Shale	T	111.6	3	J1069	307880
4920. .	28/08/2024	Coombes Apricot Shale	T	229.5	6	J1069	305889
4900. .	26/08/2024	Cream Shale	T	72.8	1	J1069	306684
4900. .	26/08/2024	Cream Shale	T	210	5	J1069	307500
4900. .	26/08/2024	Cream Shale	T	209.3	5	J1069	306996
4900. .	27/08/2024	Cream Shale	T	46	1	J1069	305983
4900. .	27/08/2024	Cream Shale	T	46	1	J1069	305888
4900. .	28/08/2024	Cream Shale	T	183.5	4	J1069	305985
4900. .	28/08/2024	Cream Shale	T	183.1	4	J1069	306449
4900. .	28/08/2024	Cream Shale	T	41.8	1	J1069	308501
4900. .	28/08/2024	Cream Shale	T	157.6	4	J1069	308279
4900. .	28/08/2024	Cream Shale	T	36.5	0	J1069	307789
4900. .	28/08/2024	Cream Shale	T	42	1	J1069	306905
4900. .	28/08/2024	Cream Shale	T	183.7	4	J1069	308225
4900. .	28/08/2024	Cream Shale	T	36.1	0	J1069	306688
4930. .	27/08/2024	Cream Shale	T	137.8	3	J1069	308223
4930. .	27/08/2024	Cream Shale	T	126	3	J1069	306902
4930. .	27/08/2024	Cream Shale	T	137.2	3	J1069	306447
4900. .	28/08/2024	Cream Shale	T	74.9	2	J1069	307881
4900. .	28/08/2024	Cream Shale	T	138.1	3	J1069	305890
4900. .	29/08/2024	Cream Shale	T	118.2	3	J1069	307330
4900. .	29/08/2024	Cream Shale	T	229.3	5	J1069	306450
4900. .	29/08/2024	Cream Shale	T	149.45	3	J1069	306344
4900. .	29/08/2024	Cream Shale	T	37.3	1	J1069	307883
4900. .	29/08/2024	Cream Shale	T	39.5	1	J1069	308281
4900. .	29/08/2024	Cream Shale	T	183.6	3	J1069	305986
4900. .	29/08/2024	Cream Shale	T	83.7	2	J1069	308504
4900. .	29/08/2024	Cream Shale	T	84	2	J1069	306908
4900. .	29/08/2024	Cream Shale	T	36.5	1	J1069	306692
4900. .	29/08/2024	Cream Shale	T	183.2	4	J1069	308227
4900. .	29/08/2024	Cream Shale	T	183.7	3	J1069	305892
4900. .	30/08/2024	Cream Shale	T	229.3	5	J1069	305989
4900. .	30/08/2024	Cream Shale	T	229.4	5	J1069	308229
4900. .	30/08/2024	Cream Shale	T	157.7	4	J1069	308284
4900. .	30/08/2024	Cream Shale	T	118.2	3	J1069	307332
4900. .	30/08/2024	Cream Shale	T	126	3	J1069	306911
4900. .	30/08/2024	Cream Shale	T	111.9	3	J1069	307885
4900. .	30/08/2024	Cream Shale	T	125	3	J1069	308507
4900. .	30/08/2024	Cream Shale	T	187.7	4	J1069	306347
4900. .	30/08/2024	Cream Shale	T	188.2	4	J1069	309001
4900. .	9/08/2024	Cream Shale	T	228.7	5	J1069	305906
4900. .	9/08/2024	Coombes Brown Shale	T	45.9	1	J1069	308204
4900. .	9/08/2024	Coombes Brown Shale	T	39.2	1	J1069	308256
4900. .	9/08/2024	Coombes Brown Shale	T	38.3	1	J1069	307297
4900. .	9/08/2024	Coombes Brown Shale	T	39.3	1	J1069	307306
4900. .	9/08/2024	Coombes Brown Shale	T	45.8	1	J1069	305960
4900. .	9/08/2024	Coombes Brown Shale	T	46	1	J1069	305874
4900. .	9/08/2024	Coombes Brown Shale	T	45.5	1	J1069	305905
4920. .	20/08/2024	Coombes Apricot Shale	T	75.4	2	J1069	306328

4920. .	20/08/2024	Coombes Apricot Shale	T	156.3	4	J1069	306984
4920. .	20/08/2024	Coombes Apricot Shale	T	156	4	J1069	307490
4920. .	20/08/2024	Coombes Apricot Shale	T	229.1	5	J1069	308212
4920. .	20/08/2024	Coombes Apricot Shale	T	229.06	5	J1069	306434
4920. .	20/08/2024	Coombes Apricot Shale	T	229.7	6	J1069	305969
4900. .	1/08/2024	Coombes Brown Shale	T	229.3	5	J1069	305862
4900. .	1/08/2024	Coombes Brown Shale	T	145.6	3	J1069	307759
4900. .	1/08/2024	Coombes Brown Shale	T	150.2	3	J1069	306306
4900. .	7/08/2024	Cream Shale	T	73	1	J1069	307765
4900. .	7/08/2024	Cream Shale	T	91.5	2	J1069	306424
4900. .	7/08/2024	Cream Shale	T	137.9	3	J1069	305955
4900. .	7/08/2024	Cream Shale	T	78.4	2	J1069	307301
4900. .	7/08/2024	Cream Shale	T	78.7	2	J1069	308251
4900. .	7/08/2024	Cream Shale	T	91.8	2	J1069	305869
4900. .	7/08/2024	Cream Shale	T	91.7	2	J1069	306798
4900. .	7/08/2024	Cream Shale	T	76.6	2	J1069	307293
4900. .	7/08/2024	Cream Shale	T	84	2	J1069	307480
4900. .	8/08/2024	Coombes Brown Shale	T	183.8	4	J1069	305957
4930. .	18/07/2024	Cream Shale	T	182.3	4	J1069	306401
4930. .	18/07/2024	Cream Shale	T	137.4	3	J1069	306279
4930. .	18/07/2024	Cream Shale	T	72.9	1	J1069	306656
4930. .	18/07/2024	Cream Shale	T	39.5	1	J1069	306835
4930. .	18/07/2024	Cream Shale	T	183.1	4	J1069	306396
4930. .	19/07/2024	Cream Shale	T	183.4	4	J1069	306281
4930. .	19/07/2024	Cream Shale	T	125.5	3	J1069	306952
4930. .	19/07/2024	Cream Shale	T	149.4	4	J1069	304848
4930. .	19/07/2024	Cream Shale	T	126	3	J1069	307460
4930. .	19/07/2024	Cream Shale	T	137.4	3	J1069	306777
4930. .	19/07/2024	Cream Shale	T	182.8	4	J1069	306402
4930. .	19/07/2024	Cream Shale	T	137.5	3	J1069	306399
4930. .	19/07/2024	Cream Shale	T	108.9	2	J1069	306593
4900. .	23/08/2024	Cream Shale	T	229.4	6	J1069	305976
4900. .	23/08/2024	Cream Shale	T	228.56	6	J1069	306441
4900. .	23/08/2024	Cream Shale	T	210	5	J1069	307497
4900. .	23/08/2024	Cream Shale	T	209.3	5	J1069	306992
4900. .	26/08/2024	Cream Shale	T	236.7	6	J1069	307324
4900. .	26/08/2024	Cream Shale	T	228.2	6	J1069	306445
4900. .	26/08/2024	Cream Shale	T	149	4	J1069	307876
4900. .	26/08/2024	Cream Shale	T	229.6	6	J1069	305980
4900. .	26/08/2024	Cream Shale	T	112.2	3	J1069	306338
4900. .	26/08/2024	Cream Shale	T	229.5	6	J1069	305885
4900. .	26/08/2024	Cream Shale	T	197.2	5	J1069	308273
4920. .	23/08/2024	Coombes Apricot Shale	T	91.5	2	J1069	305880
4920. .	23/08/2024	Coombes Apricot Shale	T	137.7	3	J1069	305975
4920. .	23/08/2024	Coombes Apricot Shale	T	137.3	3	J1069	306440
4920. .	23/08/2024	Coombes Apricot Shale	T	78	2	J1069	306991
4920. .	23/08/2024	Coombes Apricot Shale	T	78	2	J1069	307496
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4920. .	29/08/2024	Coombes Apricot Shale	T	229.5	6	J1069	305987
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4920. .	30/08/2024	Coombes Apricot Shale	T	138	3	J1069	305988
4920. .	30/08/2024	Coombes Apricot Shale	T	137.3	3	J1069	308228
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4900. .	8/08/2024	Coombes Brown Shale	T	157.5	4	J1069	308253
4900. .	8/08/2024	Coombes Brown Shale	T	157.6	4	J1069	307303
4900. .	8/08/2024	Coombes Brown Shale	T	183.04	4	J1069	306426
4900. .	8/08/2024	Coombes Brown Shale	T	183.7	4	J1069	305871
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4900. .	9/08/2024	Cream Shale	T	229.4	5	J1069	305875
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4920. .	8/08/2024	Coombes Apricot Shale	T	45.4	1	J1069	306425
4920. .	8/08/2024	Coombes Apricot Shale	T	45.8	1	J1069	305870
4920. .	9/08/2024	Coombes Apricot Shale	T	45.8	1	J1069	308203
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4920. .	30/07/2024	Coombes Apricot Shale	T	274.3	6	J1069	306789
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4900. .	29/07/2024	Coombes Brown Shale	T	90.8	2	J1069	306410
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4900. .	30/07/2024	Coombes Brown Shale	T	275.3	6	J1069	305842
4900. .	30/07/2024	Coombes Brown Shale	T	45.4	1	J1069	306412
4900. .	30/07/2024	Coombes Brown Shale	T	46	1	J1069	306293
4900. .	30/07/2024	Coombes Brown Shale	T	75.4	2	J1069	305637
4900. .	30/07/2024	Coombes Brown Shale	T	114.2	3	J1069	307280
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4900. .	22/07/2024	Cream Shale	T	39.3	1	J1069	305833
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4900. .	19/08/2024	Cream Shale	T	315.3	7	J1069	308263
4900. .	19/08/2024	Cream Shale	T	217.9	4	J1069	307775
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4900. .	20/08/2024	Cream Shale	T	46	1	J1069	304879
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4900. .	28/06/2024	Cream Shale	T	274.3	6	J1069	305383
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4930. .	11/07/2024	Coombes Apricot Shale	T	229	6	J1069	307257
4930. .	11/07/2024	Coombes Apricot Shale	T	209.3	5	J1069	297492
4930. .	11/07/2024	Coombes Apricot Shale	T	37.4	1	J1069	304834
4930. .	11/07/2024	Coombes Apricot Shale	T	72.8	1	J1069	306583
4930. .	11/07/2024	Coombes Apricot Shale	T	228.3	6	J1069	306767
4930. .	11/07/2024	Coombes Apricot Shale	T	38.1	1	J1069	304623
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4930. .	11/07/2024	Coombes Apricot Shale	T	196.9	5	J1069	306826
4900. .	26/06/2024	Cream Shale	T	168	4	J1069	301645
4900. .	26/06/2024	Cream Shale	T	167.5	4	J1069	297483
4900. .	26/06/2024	Cream Shale	T	45.8	1	J1069	305379
4900. .	27/06/2024	Cream Shale	T	196.5	5	J1069	305804
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4900. .	27/06/2024	Cream Shale	T	36.5	1	J1069	306571
4900. .	27/06/2024	Cream Shale	T	183.6	3	J1069	306761
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4900. .	27/06/2024	Cream Shale	T	209.08	5	J1069	297485
4900. .	28/06/2024	Cream Shale	T	290.2	6	J1069	306173
4900. .	17/07/2024	Cream Shale	T	78.9	2	J1069	306833
4900. .	17/07/2024	Cream Shale	T	72.7	1	J1069	306654
4900. .	17/07/2024	Cream Shale	T	188.3	5	J1069	307553
4900. .	17/07/2024	Cream Shale	T	366	9	J1069	305395
4900. .	18/07/2024	Cream Shale	T	36.5	1	J1069	306591

4900. .	18/07/2024	Cream Shale	T	46	1	J1069	306280
4900. .	18/07/2024	Cream Shale	T	39.5	1	J1069	306837
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4920. .	22/07/2024	Coombes Apricot Shale	T	275.9	7	J1069	305832
4920. .	23/07/2024	Coombes Apricot Shale	T	236.6	5	J1069	305834
4920. .	23/07/2024	Coombes Apricot Shale	T	267.4	6	J1069	304642
4920. .	23/07/2024	Coombes Apricot Shale	T	276.1	6	J1069	304853
4920. .	24/07/2024	Coombes Apricot Shale	T	229.6	6	J1069	307275
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4920. .	24/07/2024	Coombes Apricot Shale	T	263.6	7	J1069	302138
4920. .	25/07/2024	Coombes Apricot Shale	T	364.36	9	J1069	306408
4920. .	25/07/2024	Coombes Apricot Shale	T	305.7	8	J1069	307277
4920. .	25/07/2024	Coombes Apricot Shale	T	300.1	8	J1069	305634
4920. .	29/07/2024	Coombes Apricot Shale	T	272.96	7	J1069	306409
4930. .	22/07/2024	Cream Shale	T	114.8	3	J1069	304640
4930. .	22/07/2024	Cream Shale	T	112.9	3	J1069	307565
4930. .	22/07/2024	Cream Shale	T	229.1	6	J1069	305854
4930. .	22/07/2024	Cream Shale	T	182.5	4	J1069	306782
4930. .	23/07/2024	Cream Shale	T	167.5	3	J1069	306957
4930. .	23/07/2024	Cream Shale	T	168	3	J1069	307465
4930. .	23/07/2024	Cream Shale	T	228.2	5	J1069	306406
4930. .	23/07/2024	Cream Shale	T	229.2	5	J1069	306288
4930. .	23/07/2024	Cream Shale	T	39.4	1	J1069	304854
4930. .	24/07/2024	Cream Shale	T	76.4	2	J1069	304645
4930. .	24/07/2024	Cream Shale	T	118.3	3	J1069	304855
4930. .	24/07/2024	Cream Shale	T	38.5	1	J1069	307276
4930. .	24/07/2024	Cream Shale	T	91.2	2	J1069	304856
4920. .	2/08/2024	Coombes Apricot Shale	T	223.05	6	J1069	302148
4920. .	2/08/2024	Coombes Apricot Shale	T	274.9	6	J1069	306298
4920. .	2/08/2024	Coombes Apricot Shale	T	273.8	6	J1069	306793
4920. .	2/08/2024	Coombes Apricot Shale	T	193.6	5	J1069	306965
4920. .	2/08/2024	Coombes Apricot Shale	T	275	6	J1069	305864
4920. .	6/08/2024	Coombes Apricot Shale	T	186.5	5	J1069	307853
4920. .	6/08/2024	Coombes Apricot Shale	T	186.7	5	J1069	306315
4920. .	7/08/2024	Coombes Apricot Shale	T	229.4	5	J1069	305867
4920. .	7/08/2024	Coombes Apricot Shale	T	275.3	6	J1069	305954
4920. .	8/08/2024	Coombes Apricot Shale	T	45.7	1	J1069	305956
4920. .	8/08/2024	Coombes Apricot Shale	T	45.5	1	J1069	306799
4920. .	8/08/2024	Coombes Apricot Shale	T	39.12	1	J1069	306974
4930. .	1/08/2024	Coombes Apricot Shale	T	78.8	2	J1069	306843
4930. .	1/08/2024	Coombes Apricot Shale	T	91	2	J1069	305863
4930. .	1/08/2024	Coombes Apricot Shale	T	72.7	1	J1069	307760
4930. .	1/08/2024	Coombes Apricot Shale	T	91.7	2	J1069	306297
4930. .	1/08/2024	Coombes Apricot Shale	T	91.4	2	J1069	306416
4930. .	1/08/2024	Coombes Apricot Shale	T	74.9	2	J1069	306307
4930. .	1/08/2024	Coombes Apricot Shale	T	40.4	1	J1069	306964
4930. .	2/08/2024	Coombes Apricot Shale	T	39.5	1	J1069	306846
4930. .	2/08/2024	Coombes Apricot Shale	T	38.4	1	J1069	307286
4930. .	2/08/2024	Coombes Apricot Shale	T	45.5	1	J1069	306418
4930. .	2/08/2024	Coombes Apricot Shale	T	36.92	1	J1069	304862
4930. .	2/08/2024	Coombes Apricot Shale	T	39	1	J1069	307474
4930. .	2/08/2024	Coombes Apricot Shale	T	37.5	1	J1069	302149

Appendix C

Development and rehabilitation

EMM
creating opportunities

C.1 Quarry overview (12 August 2023)

Downloaded from Metromap on 6 September 2024.

Images from September 2023 were not available on Metromap. The image shown was the closest to the September period that could be sourced through the service.

C.2 Quarry overview (25 February 2024)

Downloaded from Metromap on 6 September 2024.

C.3 Quarry overview (17 May 2024)

Downloaded from Metromap on 6 September 2024.

Images from September 2023 were not available on Metromap. The image shown is the most recent available.

Appendix D

Surface Water and Groundwater Annual Review

creating opportunities

DA 315-7-2003 (MOD 5) Annual Review

Water technical summary report

Prepared for Luddenham Operations Pty Ltd

September 2024

DA 315-7-2003 (MOD 5) Annual Review

Water technical summary report

Luddenham Operations Pty Ltd

E231131 RP5D

September 2024

Version	Date	Prepared by	Reviewed by	Comments
1	23 September 2024	Patrick Carolan	David Bone	Draft for client review
2	27 September 2024	Patrick Carolan	David Bone	Final

Approved by

David Bone
Associate Director
27 September 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

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1 Introduction

1.1 Overview

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by State significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd is operating the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003 which was granted on 24 May 2021.

1.2 Purpose of this report

This report outlines water quality monitoring and water balance modelling undertaken by EMM Consulting (EMM) to support the Luddenham Quarry Annual Review (AR), for the period of 1 September 2023 to 31 August 2024.

1.3 Report structure

The following sections set out:

- an overview of the background associated with the site and EMM's understanding activities undertaken during the annual review period (Chapter 2)
- a summary of water monitoring results and exceedance investigations undertaken for the annual review period (Chapter 3)
- water balance results for the annual review period (Chapter 4)
- a summary of recommendations for ongoing environmental compliance (Chapter 5).

2 Background

2.1 Overview

This section describes EMM's understanding of the site operations, water management and water quality monitoring program. A figure presenting the site water management storages, proximity to Oaky Creek and the surface and groundwater monitoring network is provided in Attachment A.

2.2 Site operations

2.2.1 General activities

During the AR period, quarrying activities included the ongoing removal of existing stockpiled materials and extraction of new material from the quarry footprint. Outside of quarry campaigns, there were no other activities on site.

2.2.2 Water management

Luddenham Operations has advised the following water management information for the AR period:

- No transfers between the water management dam and the quarry pit were undertaken.
- No discharges were observed to occur from the water management dam to Oaky Creek.
- Dust suppression activities occurred all year round (refer Table 2.1 for details). Water was sourced preferentially from the quarry pit then the water management dam (later in the AR period).
- Active management of the pit lake was undertaken through the installation of an evaporator misting canon by Minetek mid-February 2024 (refer Table 2.2 for details). A single canon was installed within the quarry pit shell to mist pit water over the pit lake and accelerate evaporative losses from the storage. Following implementation of the evaporator, the quarry pit was largely dewatered by July 2024.

i Dust suppression

Luddenham Operations provided EMM with logs of water cart trips for dust suppression for the AR period. Broad details of these are provided in Table 2.1.

Table 2.1 Dust suppression activities

Period	Activities	Water management
September 2023 – December 2023	Quarrying operations (extraction and stockpiling) and export	Dust suppression via 40 kL water cart
January 2024 – May 2024	Primarily export only	Dust suppression via 15 kL water cart
June 2024 – August 2024	Quarrying operations (extraction and stockpiling) and export	Dust suppression via 40 kL water cart

ii Minetek evaporator

Details of the Minetek evaporator and implementation at the site are provided in Table 2.2.

Table 2.2 Minetek evaporator water management details

Attribute	Details
Misting rate/pumping rate	37.5 litres per second
Commencement of operation	16 February 2024
Operating times	7:00 am – 6:00 pm, weekdays unless raining
Evaporation efficiency	Up to 50% of the misting rate[1], depending on climate (temperature/humidity etc)

1. Claims based on supplier specifications, refer to Section 3.1.2iv for the modelled evaporation rates.

2.3 Water monitoring program

2.3.1 Monitoring sites

i Groundwater monitoring network

A groundwater monitoring bore network was installed before quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores were drilled and installed to a depth of approximately 30 metres (m) into the Bringelly Shale with the overlying unconsolidated material cased off. The monitoring bores were sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

Sites BSM1 and BSM2 were replaced with new bores in 2023, with subsequent monitoring producing anomalous results. Redevelopment of the bores was attempted ahead of the quarter 1 (Q1) 2024 monitoring round.

ii Surface water monitoring locations

The surface water monitoring program consists of the following locations (refer Attachment A):

- Oaky Creek upstream of the site
- Oaky Creek downstream of the site
- water stored within the quarry pit
- water stored within the water management dam.

2.3.2 Water quality analytes

The analytical suite for the monitoring program is presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

The following additional monitoring was included in the 2023–2024 monitoring period to investigate trigger exceedances:

- Detailed hydrocarbon analysis was added to the analytical suite as a recommendation from the Q2 groundwater monitoring round, to assist in determining the likely source of oil and grease concentrations above detection.

- In Q4 silica gel cleanup was a step added to the analytical process of testing for hydrocarbons. Silica is a polar material that is used to adsorb (remove) non-hydrocarbon polar organics during the sample extraction process.

Table 2.3 Water quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids, turbidity.	In the field with a calibrated hand-held water quality meter.
	Total suspended solids.	Analysis undertaken at NATA accredited laboratory.
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus.	Analysis undertaken at NATA accredited laboratory.
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc.	Analysis undertaken at NATA accredited laboratory.
Other	Total hardness, oil and grease.	Analysis undertaken at NATA accredited laboratory.
Hydrocarbons[1]	BTEXN (benzene, toluene, ethylbenzene, xylene and naphthalene), TRH/TPH (total petroleum hydrocarbon) and PAH (polycyclic aromatic hydrocarbons). Including analysis/results for Chromatogram. TRH/TPH (total petroleum hydrocarbon) with Silica Gel Cleanup.	Analysis undertaken at NATA accredited laboratory.

Table notes:

1. Hydrocarbon analysis undertaken for exceedance investigations during some rounds of the 2023–2024 monitoring program.

2.3.3 Trigger exceedance criteria

The soil and water management plan (EMM 2021) outlines water quality trigger values for both surface and groundwater quality monitoring.

The surface water quality trigger values are presented in Table 2.4 and groundwater quality trigger values are presented in Table 2.5.

Table 2.4 Surface water assessment criteria and trigger values

Parameter	Units	Trigger value
General[1]		
pH	-	6.5–8.5
Electrical conductivity[3]	µS/cm	125–2,200
Turbidity	NTU	6–50
Oil and grease	mg/L	Above detection
Nutrients[1]		
Ammonia	µg N/L	20
Oxidised nitrogen	µg N/L	40

Parameter	Units	Trigger value
Total nitrogen	µg N/L	500
Reactive phosphorus	µg P/L	20
Total phosphorus	µg P/L	50
Dissolved metals[2]		
Aluminium	µg/L	55
Arsenic[4]	µg/L	13
Boron	µg/L	370
Cadmium	µg/L	0.2
Chromium[5]	µg/L	1.0
Copper	µg/L	1.4
Iron	µg/L	-
Manganese	µg/L	1,900
Nickel	µg/L	11
Lead	µg/L	3.4
Zinc	µg/L	8.0

1. The trigger values for general parameters and nutrients refer to the DGVs for physical and chemical stressors in south-east Australia (lowland river) that are reported in Tables 3.3.2 and 3.3.3 of ANZECC (2000) as DGV is not yet defined by ANZG (2018).
2. Dissolved metal trigger values are for slightly to moderately disturbed ecosystems (ANZG 2018).
3. Table 3.3.3 of ANZECC (2000) specifies NSW coastal rivers typically have salinity values in the range of 200–300 µS/cm. The DGV for salinity in lowland rivers is 125–2,200 µS/cm as a DGV is not yet defined by ANZG (2018).
4. For AS (V).
5. For Cr (VI).

Table 2.5 Groundwater assessment criteria and trigger values

Parameter	Units	Trigger value
General[1]		
pH	-	6.5–8.5
Electrical conductivity[3]	µS/cm	Comparison with upgradient bore[6]
Turbidity	NTU	Comparison with upgradient bore[6]
Oil and grease	mg/L	Above detection
Nutrients[1]		
Ammonia	µg N/L	Comparison with upgradient bore[6]
Oxidised nitrogen	µg N/L	Comparison with upgradient bore[6]
Total nitrogen	µg N/L	Comparison with upgradient bore[6]
Reactive phosphorus	µg P/L	Comparison with upgradient bore[6]

Parameter	Units	Trigger value
Total phosphorus	µg P/L	Comparison with upgradient bore[6]
Dissolved metals[2]		
Aluminium	µg/L	55
Arsenic[4]	µg/L	13
Boron	µg/L	370
Cadmium	µg/L	0.2
Chromium[5]	µg/L	1.0
Copper	µg/L	1.4
Iron	µg/L	-
Manganese	µg/L	1,900
Nickel	µg/L	11
Lead	µg/L	3.4
Zinc	µg/L	8.0

1. The trigger values for general parameters and nutrients refer to the DGVs for physical and chemical stressors in south-east Australia (lowland river) that are reported in Tables 3.3.2 and 3.3.3 of ANZECC (2000) as DGV is not yet defined by ANZG (2018).
2. Dissolved metal trigger values are for slightly to moderately disturbed ecosystems (ANZG 2018).
3. Table 3.3.3 of ANZECC (2000) specifies NSW coastal rivers typically have salinity values in the range of 200–300 µS/cm. The DGV for salinity in lowland rivers is 125–2,200 µS/cm as a DGV is not yet defined by ANZG (2018).
4. For AS (V).
5. For Cr (VI).
6. Parameter known to frequently exceed the DVG. Long term trend comparison to upgradient bore (BSM1) is most appropriate means of assessment.

2.3.4 Water level monitoring

Water levels are monitored via manual measurements at each monitoring bore during sampling. A deviation of 2 m from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two m as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

3 Water balance

3.1 Methodology and data

The site water balance model that was developed for the MOD5 approval (EMM 2020a) was updated to assess the water management system during the annual review period. The following sections outline the model updates.

3.1.1 GoldSim representation

The water balance model was developed in GoldSim version 14. The model was created by representing the water cycle as a series of elements, each containing pre-set rules and data, that were linked together to simulate the interaction of these elements over the annual review period from 1 September 2023 to 31 August 2024.

To undertake the modelling the following simplifications and assumptions were made:

- No pumped water transfers between the water management dam and the quarry pit were applied to the model as advised by Luddenham Operations.
- A simulation reporting timeframe was set as the same as the annual review period with the initial water level in the water management dam and quarry pit assumed to be 6.5 megalitres (ML) and 74.5 ML respectively, at the beginning of the simulation, consistent with site observations/photographs of storages.
- A 'warm-up' period of climate data was applied to the rainfall-runoff model ahead of the simulation reporting timeframe to ensure the hydrological model stores were representative of antecedent conditions.
- A dust suppression timeseries was applied to the model based on information provided by Luddenham Operations (refer to Table 2.1). A total of 23.3 ML/year was applied, sourced preferentially from the quarry pit then the water management dam.
- Operation of the Minetek evaporator was applied to the quarry pit storage on days where rainfall was less than 2 mm/day. Details of the simulated evaporation are outlined in Section 3.1.2iv.

3.1.2 Data

i Climatic data

Daily rainfall and evaporation data from Bureau of Meteorology's Badgerys Creek AWS weather station (station number 67108) was adopted for the water balance model simulation period.

ii Rainfall-runoff model

Surface runoff was estimated using the Australian Water Balance Model (AWBM). The AWBM was developed by Boughton (2004) and is widely used across Australia to estimate runoff. The hydrological model calculates runoff and baseflow components from rainfall after allowing for relevant losses and storage. The AWBM was incorporated into the GoldSim water balance model for the site.

For each surface type present on site, the AWBM was parameterised to achieve long-term average volumetric runoff coefficients (Cv) based on typical values. The assumed catchment breakdown and Cv applied to each surface type are provided in Table 3.1.

Table 3.1 Catchment runoff parameters

Surface type	Management areas	Area (ha)	Cv
Impervious – high runoff potential	Roofs, weighbridge, sealed roads	0.8	0.9
Disturbed – moderate runoff potential	Unsealed roads, stockpiles	9.7	0.6
Pasture – low runoff potential	Grassed catchments, vegetated bunds	2.8	0.4

iii Groundwater inflows

The predicted quantity of groundwater to be intercepted by the quarry pit was assumed to be a constant 5 m^3/day, based on the original groundwater assessment undertaken for the quarry (Douglas Nicolaisen and Associates 2003).

iv Minetek evaporator simulation

To simulate the evaporative loss from the Minetek misting canon, the following equation was applied to the model:

$$Daily\ evaporation\ loss = \frac{\max(0, PET - rain) + loss\ factor}{max\ PET + loss\ factor} \times Misting\ rate$$

For the above equation:

- The percentage of the misting rate evaporated is scaled up or down depending on climate conditions.
- A loss factor of 2 mm/day was found to produce results consistent with anecdotal information, where:
  - The quarry pit was dewatered by July 2024.
  - The evaporator efficiency over the AR period was modelled at a rate of 32.5% (within expected limits based on supplier claims noted in Table 2.2).

3.2 Water balance results

The water management system for Luddenham Quarry was modelled from 1 September 2023 to 31 August 2024. The estimated values for each of the inputs and outputs of the water management system for the annual review period are provided in Figure 3.1. A summary of the estimated annual inputs and outputs of the water management systems is presented in Table 3.2. Total results have been rounded to 0.1 megalitres per year (ML/year).

As shown in Table 3.2, there was a predicted significant net decrease of water stored within the quarry pit and water management dam over the annual review period, which is consistent with anecdotal information and site observations made at the beginning and end of the period. There were no modelled discharges from the water management dam into Oaky Creek during the annual review period.

Table 3.2 Summary of site water balance

Water management element	Volume (ML/year)
Inputs	
Groundwater inflows	1.8
Rainfall	14.3
Catchment runoff	14.5
Total Inputs	**30.6**
Outputs	
Dust suppression	22.3
Evaporation	86.1
Total Outputs	**108.4**
Change in storage	
Quarry pit	-74.5
Water management dam	-3.2
Total change in storage	**-77.7**
Balance	**0**

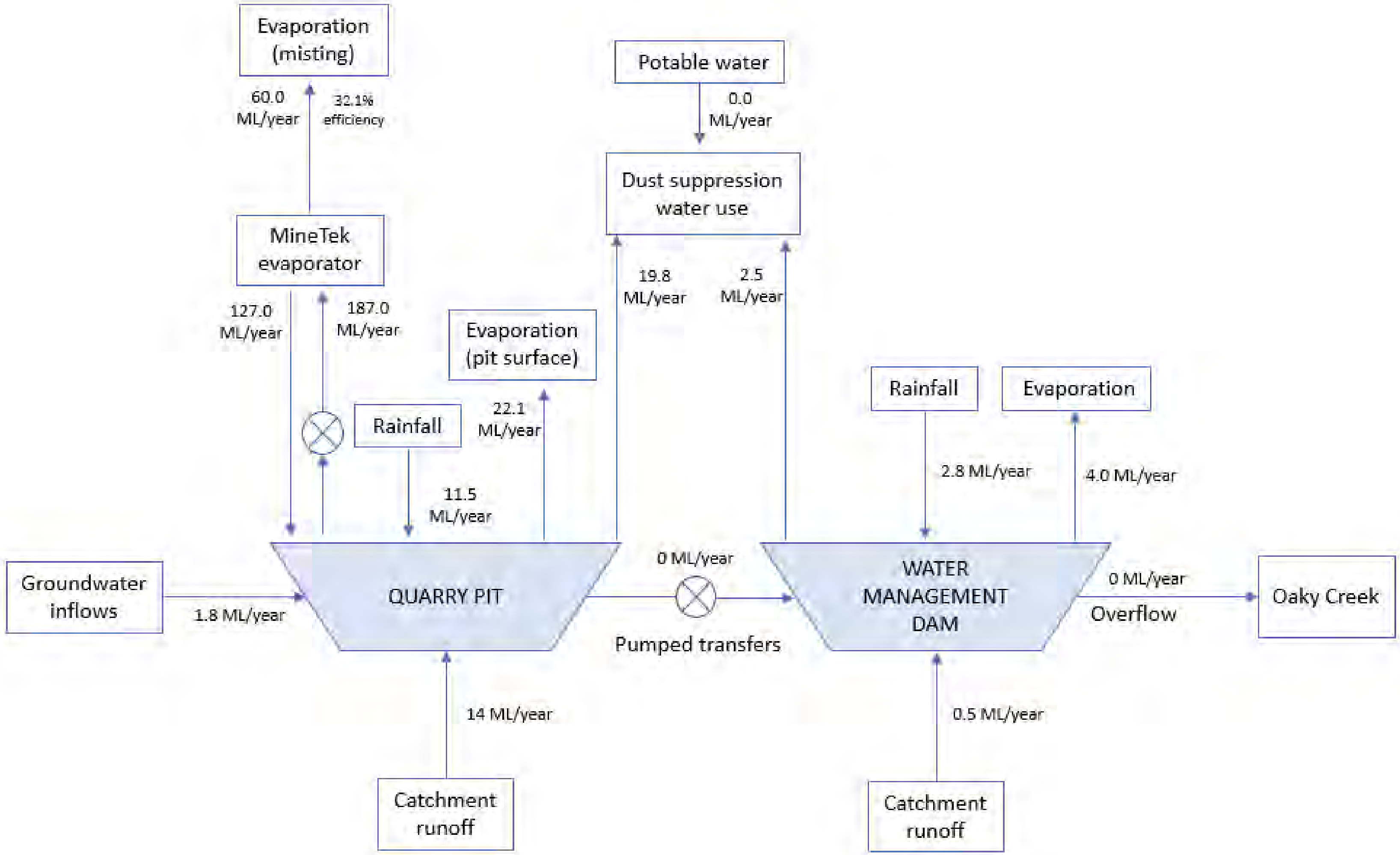

Figure 3.1 Water balance schematic with results

4 Water monitoring results

4.1 Overview

Progressive quarterly reporting was undertaken following each monitoring event, provided as Attachment B.

The following sections outline a summary of completed monitoring, key results and a discussion on anomalous groundwater results and ongoing investigations.

4.2 Completed monitoring

4.2.1 Monitoring events

Three quarterly groundwater monitoring events and one annual surface water and groundwater monitoring event were undertaken for the annual review period. A summary of monitoring events, additional investigation measures and outcomes is provided in Table 4.1.

4.2.2 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Sydney, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

4.2.3 Quality assurance/quality control

Surface and groundwater samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location
- collection of a field duplicate sample.

Quality assurance/control was assessed by calculating relative percentage difference (RPD) of the field duplicate ($S_{duplicate}$) sample to the parent sample (S_{parent}) as per the following equation.

$$Relative\ \%\ difference = \frac{|S_{parent} - S_{Dupilcate}|}{\frac{S_{parent} + S_{Dupilcate}}{2}} \times 100$$

Results were considered to confirm acceptable degree of data quality where RPDs were below 30%.

Table 4.1 Overview of completed monitoring including additional investigation measures undertaken

Monitoring event details	Additional measures undertaken	Summary of outcomes
Groundwater monitoring – 14 December 2023. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Air-compressor driven development works at BSM1 and BSM2 were undertaken prior to sampling based on anomalous results from the previous monitoring round.	Air-compressor driven development noted evidence of sediment and residual drilling material that was cleared from the monitoring wells. However, exceedances of high nutrients and oil and grease were noted in some monitoring wells. Additional surface water monitoring was recommended for future rounds.
Groundwater monitoring – 27 March 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Additional analysis was undertaken of the surface water within the quarry pit and the upgradient location at Oaky Creek, in order to determine potential sources of oil and grease and high nutrients identified in the previous groundwater monitoring rounds.	Oil and grease was noted slightly above detection limits in the quarry pit monitoring. However, nutrient exceedances not noted at the same concentrations. Extended hydrocarbon suite monitoring was recommended for future rounds.
Groundwater monitoring – 23 May 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling as per the SWMP (EMM 2021).	Additional analysis was undertaken of the surface water within the quarry pit and groundwater monitoring locations for an extended hydrocarbon suite, in order to determine potential sources of oil and grease identified in the previous monitoring rounds.	Detection of heavier hydrocarbon fractions were noted, indicating the potential presence of lubricating oils or biogenic material (such as tree sap) in the monitoring wells. A silica gel clean stage was recommended for future monitoring.
	Detailed review of historic exceedances and development of timeseries water quality charts.	Analysis of timeseries data were inconclusive in determining ongoing trends.
Surface water and groundwater monitoring – 7 August 2024. Water levels were monitored using an interface probe at each of the three groundwater monitoring bores, prior to purging and sampling and four surface water sites were sampled as per the SWMP (EMM 2021).	Additional analysis was undertaken of all surface water and groundwater monitoring locations for targeted hydrocarbon suites, in order to determine potential sources of oil and grease identified in the previous monitoring rounds.	All hydrocarbons were noted below detection for post-silica gel cleanup samples, indicating that hydrocarbon sources are related to plant material and not site operations.
	Review of bore construction details (BSM1 and BSM2).	Bore construction details were available; however, no associated lithology from the time of drilling was available for review.

4.3 Water monitoring results and exceedances

4.3.1 Surface water quality exceedances

The following receiving water downstream/impact site exceedances were noted:

- Ammonia exceeded the trigger value at the downstream/impact site. However, poorer water quality was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance.

- Copper exceeded trigger values at the downstream/impact site. An exceedance of equal magnitude was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance. Concentrations of copper recorded within Oaky Creek are the lower end of the recorded baseline range.

There were no downstream/impact site exceedances that are not consistent with the upstream/control site, indicating the quarry is not the source of surface water exceedances. Additionally, no discharge occurred from the site water management system during the AR period.

4.3.2 Groundwater levels

Key observations of groundwater levels during the annual review period include:

- Groundwater levels remain elevated compared to baseline trends.

- Groundwater levels in BSM1 and BSM2 were reduced from the elevated levels reported during the previous review period. Groundwater levels in BSM3 were comparable to levels reported during the previous review periods with the exception August 2024 which recorded its highest standing water levels to date.

4.3.3 Groundwater quality exceedances

i Toxicants

The following exceedances relative to default guideline trigger values and background concentrations reported in BSM1 were noted:

- Concentrations of chromium exceeded the trigger value at BSM2 in May with a concentration of 4 µg/L and at BSM3 in August with a concentration of 3 µg/L. It is noted the upgradient monitoring well, BSM1 reported a concentration of 3 µg/L in May and hence these concentrations are not likely to be attributable to site operations. Attention will be given to any developing trends for chromium concentrations in future groundwater monitoring.

- Concentrations of copper exceeded trigger values at BSM2 for all four monitoring rounds. With the exception of the August result of 5 µg/L, an exceedance of equal magnitude was noted at the upgradient/control site BSM1 during March and May. As both wells were reconstructed during the previous annual review period, these results may be related. Attention will be given to any developing trends for copper concentrations in future groundwater monitoring.

- Concentrations of iron exceeded the trigger value at BSM3 in March and in May with a maximum concentration of 1.89 mg/L. Upgradient location BSM1 recorded a concentration of 1.44 mg/L for iron in August. Iron is known to be present in groundwater near the site with the baseline data set median concentration noted as 8.5 mg/L.

- Concentrations of manganese exceeded trigger values at BSM2 for all four monitoring rounds with a maximum concentration of 2.84 mg/L. An exceedance of 2.01 mg/L was reported at the upgradient/control site BSM1 during March. Attention will be given to any developing trends for manganese concentrations in future groundwater monitoring.

- Concentrations of nickel exceeded the trigger value at BSM3 in March with a concentration of 0.071 mg/L. Upgradient location BSM1 recorded a concentration of 0.016 mg/L for nickel in March. Concentrations of nickel were reported below the trigger value at BSM3 during the two subsequent monitoring rounds.

- Zinc exceeded the trigger values at all three sites. A maximum concentration of 0.048 mg/L was noted at BSM1 and BSM2 which is below the baseline median of 0.06 mg/L.

Trigger value exceedances over default guideline values are consistent with baseline trends and are unlikely to be related to the project.

ii Oil and grease

Concentrations of oil and grease were reported at concentrations below detectable limits for all locations and monitoring wells with the exception of:

- BSM1 in December 2023 and March 2024.

- BSM2 in May 2024.

- BSM3 reported detectable concentrations in March 2024.

Additional analysis was undertaken to assess source of the oil and grease detections including surface water locations and additional analysis of hydrocarbon suites to assess the composition of the detected oil and grease concentrations.

- All surface water samples reported concentrations of oil and grease below detection limits with the exception of a sample taken from the Quarry Pit in March 2024. Subsequent monitoring of the Quarry Pit reported concentrations below detectable limits.

- Concentrations of PAH in all groundwater and surface water samples were below detectable limits.

- Concentrations of total petroleum and recoverable hydrocarbons (TPH and TRH) were reported at concentrations above detectable limits at BSM1 and BSM2 in May and August, with all other locations below detectable limits. Concentrations of TPH and TRH were reported at concentrations below limits at BSM1 and BSM2 following the treatment of samples via silica gel cleanup, indicating the detected concentrations are potentially related to biogenic organic compounds as opposed to petroleum hydrocarbons.

iii Physico-chemical properties

A review of water quality results from the monitoring bore network (BSM1, BSM2 and BSM3) showed water quality for some analytes that are not consistent with baseline data trends, notably:

- Electrical conductivity in BSM1 ranged from 6,714 to 23,375 µS/cm compared to a baseline median of 23,100 µS/cm. Results recorded at the lower range are considered to be anomalous and may contain inflows from a surface water or alluvial groundwater source.
- Total nitrogen in BSM1 ranged from 6 to 73.1 mg/L and in BSM2 ranged from 32.6 to 75 mg/L. Concentrations in BSM3 were elevated, but consistently below BSM1 levels. No baseline data exists for nitrogen; however, nitrogen levels have historically been less than 8.2 mg/L within bores on site during operation.
- Ammonia in BSM1 ranged from 0.2 to 5.46 mg/L and in BSM2/BSM3 ranged from 0.21 to 8.35 mg/L. No baseline data exists for ammonia; however, ammonia levels have been historically ranged from 0.03 to 8.2 mg/L within bores on site during operation.
- Reactive phosphorus in BSM1 ranged from below detection to 23.4 mg/L and in BSM2 ranged from 9.25 to 65.8 mg/L, compared to a baseline median of 0.4 mg/L.

It is suspected that the monitoring well network may be influenced by:

- monitoring well installation processes (for reconstructed bores BSM1 and BSM2)
- surface water ingress or potentially alluvial inflow, or
- offsite activities such as hydro-mulching and use of fertilizers for mass-reestablishment of groundcover at the Western Sydney Airport.

5 Summary and recommendations

5.1 Water balance

The site water balance model that was developed for the MOD5 approval (EMM 2020a) was updated to assess the water management system during the annual review period. The water balance model results were consistent with site observations in that no discharges from the site water management system to Oaky Creek were reported.

A summary of water uses for the annual review period including source and origin of extraction is outlined Table 5.1.

Table 5.1 Summary of water use September 2023 – August 2024

Project Location	Volume	Comments	Water licensing
Water management dam	2.5 ML/year	Dust suppression water sourced from disturbed area runoff.	Exempt[1]
Quarry pit	19.8 ML/year	Dust suppression water sourced from disturbed area runoff.	Exempt[1]
	60 ML/year	Active water management of disturbed area runoff via evaporative misters.	Exempt[1]
	1.8 ML/year	Groundwater inflow to the quarry pit.	10MW119330 WAL34685[2]
Discharge to Oaky Creek	0 ML/year	No discharge events occurred for the annual review period.	N/A

Table notes:

1. Under the Schedule 1, Item 3 of the Water Management (General) Regulation 2018.
2. Trading in the water market is currently underway to satisfy licensing requirements associated with groundwater inflows.

5.2 Water monitoring program recommendations

Considering the baseline data trends, physical and chemical results in the whole well network (both upgradient and downgradient) and results of additional investigative monitoring, it is unlikely that exceedances are related to operations at the quarry. The following recommendations are made for future monitoring rounds:

- Continued additional monitoring of oil and grease/hydrocarbon detections.
- Continued monitoring of trends in metals, nutrients and oil and grease/hydrocarbons to determine if the water quality results return to baseline levels over the next annual review period. Should unrepresentative results continue to be reported, review of the options for replacement of monitoring well network may be required.

References

EMM 2020a, *Luddenham Quarry – Modification 5: Surface Water Assessment*, prepared by EMM Consulting Pty Limited for Coombes Property Group and KLF Holdings Pty Ltd.

EMM 2020b, Luddenham Quarry – Preliminary site investigation, prepared by EMM Consulting Pty Limited for Coombes Property Group and KLF Holdings Pty Ltd.

EMM 2021, *Luddenham Quarry – Soil and Water Management Plan*, prepared by EMM Consulting Pty Limited for Luddenham Operations Pty Ltd.

Attachment A

Water monitoring locations

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

KEY
- Study area
- Cadastral boundary
- Watercourse
- Water quality monitoring location
- Groundwater monitoring bore

0 100 200 m
GDA 1994 MGA Zone 56
N

Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 1

EMM creating opportunities

\\emm.local\xdrive\2023\E231131 - Luddenham Quarry - Environmental Monitoring\GIS\02_Maps\190749\SWM003_WQMonitoringLocations_20240927_03.mxd 27/09/2024

Attachment B

Water monitoring reports

creating opportunities

Ground floor 20 Chandos Street
St Leonards NSW 2065

PO Box 21
St Leonards NSW 1590

02 9493 9500

www.emmconsulting.com.au

Memorandum

14 May 2024

To: Pascal Bobillier
General Manager - Development
Coombes Property Group

From: Patrick Carolan

Subject: Luddenham Quarry SWMP monitoring results (Q1 23-24 review period)

Dear Pascal,

1 Background

This memorandum outlines groundwater water quality and level monitoring undertaken by EMM Consulting Pty Ltd (EMM) for Luddenham Quarry (the site), as required by the water monitoring program that was developed for the Soil and Water Management Plan (SWMP) (EMM 2021).

The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring (refer Appendix A for monitoring locations).

Monitoring outlined in this report was completed for the period of October 2023 to December 2023 (Q1 of the 2023-2024 annual review period).

2 Water monitoring

2.1 Program overview

2.1.1 Groundwater monitoring network

Three monitoring bores exist at the site, installed to a depth of approximately 30 metres (m) into the Bringelly Shale. The monitoring bores are sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

Sites BSM1 and BSM2 were replaced with new bores in 2023, with the first sampling event from these locations being taken on 24 August 2023. Results from the first sampling event suggested that these bores were not properly developed at the time of installation. As such, ahead of the Q1 monitoring round, EMM attempted to develop the bores using an air compressor to remove any silt, debris or remnant drilling products from the bore/screen in order to produce ongoing water samples that are more representative of the aquifer chemistry.

During the attempted bore development, shavings of PVC pipe and contaminated well water were removed from BSM1 and BSM2, refer below site photographs.

Left: Oily sheen on well water removed from BSM2, possibly related to fluid utilised in drilling of new bore.

Right: PVC shavings remnant from well installation.

2.1.2 Analytes

The analytical suite for the monitoring program is presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

Table 2.1 Water quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids	In the field with a calibrated hand-held water quality meter
	Total suspended solids	Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory

2.1.3 Water level monitoring

Water levels are monitored via manual measurements at each monitoring bore during sampling. A deviation of two metres from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two metres as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

2.2 Completed monitoring

The following sections describe the completed monitoring and field observations. Key results are discussed in Section 2.3 and results of groundwater level and groundwater quality are reported in Appendix B and Appendix C, respectively.

2.2.1 Rainfall context

The Bureau of Meteorology operates a rain gauge at Badgerys Creek (approximately 3 kilometres (km) from the site – Station number: 067108). The preceding one, three and five-day rainfall totals to 9:00 am on 14 December 2023 are presented in Table 2.2, to provide context at the time of monitoring.

The five days preceding the monitoring event were dry, however 9 mm of rainfall occurred on the day of monitoring.

Table 2.2 Recorded rainfall in the days before 14 December 2023

Gauge location	One-day prior rainfall total (mm)	Three-day prior rainfall total (mm)	Five-day prior rainfall total (mm)
Badgerys Creek AWS	0.0	0.0	0.0

2.2.2 Groundwater

Field observations for completed groundwater monitoring is presented in Table 2.3.

Table 2.3 Field observations (groundwater monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
14/12/2023 – 11:50 AM	BSM1	Upgradient bore to measure background contamination levels.	Bore hole restored with 0.77 m stick up to top of PVC. Turbid brown colour, no smell.
14/12/2023 – 10:50 AM	BSM2	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore hole restored with 0.54 m stick up to top of PVC. Turbid brown colour, no smell.
14/12/2023 – 09:45 AM	BSM3	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Mostly clear, some suspended solids, slight sulphur smell.

2.2.3 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Smithfield, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

2.2.4 Quality assurance/quality control

Samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location, and
- collection of a field duplicate sample.

Quality assurance/control was assessed by calculating relative percentage difference (RPD) of the field duplicate ($S_{duplicate}$) sample to the parent sample (S_{parent}) as per the following equation.

$$Relative\ \%\ difference = \frac{|S_{parent} - S_{Dupilcate}|}{\frac{S_{parent} + S_{Dupilcate}}{2}} \times 100$$

Results were considered to have a high degree of accuracy where RPDs were below 50%.

All results for the monitoring round were within RPD limits (refer Appendix C), indicating adequate QA/QC.

2.3 Monitoring results - general observations

2.3.1 Groundwater levels

Key observations of groundwater levels for the monitoring period (refer Appendix B) include the following:

- Levels recorded in the newly constructed bores (BSM1 and BSM2) were higher than historical averages but have reduced since the bore development. Higher levels may have been related to elevated well water from blocked well screens and/or contaminant well water (i.e. non-aquifer water in the wells), prior to the bore development. The recent (post-development) lower levels are considered more representative of the aquifer conditions.
- Water levels in BSM3 are relatively consistent with baseline trends.

Based on the above trends, no further action is required with respect to groundwater levels.

2.3.2 Groundwater quality

Key observations of groundwater quality for the monitoring period include the following:

- Salinity, as indicated by electrical conductivity (EC), was reasonably consistent across all bores. EC was also a similar level of magnitude to the median of baseline records for the aquifer. These results suggest that the bore development has contributed to producing more representative samples relative to the previous round of monitoring, which recorded an EC range from 963 – 12,517 µS/cm.

- pH was basic, but within limits of the trigger values. pH was also reasonably consistent across the bores, further suggesting the bore development has improved the aquifer representation in the well compared to the previous monitoring round.

- Nutrients were elevated significantly above baseline ranges in BSM1 (upgradient of the site) and BSM2 (downgradient of the site). The source of elevated nutrients is currently unclear. However, both BSM1 and BSM2 are noted to be replaced bores and contamination remaining from drilling/installation may still occur in the wells. It is also noted that significant development is occurring to the south of the site for the Western Sydney Airport construction, which may have the potential to influence the regional aquifer.

In summary, the bore development appears to have had a positive influence on water chemistry at the site monitoring bores. However, it is unclear if suspicious results relate to ongoing well contamination or a broader changes in chemistry within the regional aquifer.

2.4 Review of exceedances

Water quality results were reviewed for trigger exceedances, via comparison of toxicants to ANZG (2018) guidelines or comparison of other chemical properties to the upgradient bore (BSM1). An assessment of exceedances including actions taken and recommendations is presented in Table 2.4.

Table 2.4 Review of exceedances

Exceedance description	Assessment, actions taken and recommendations
Field measurements	
EC was recorded at 24,704 µS/cm in BSM3, elevated slightly above the upgradient measurement of 23,310 µS/cm.	This exceedance is relatively minor (<6% RPD between samples) given the magnitude of regional groundwater salinity at the time of monitoring. It is recommended to review groundwater salinity for regional trends in the next monitoring round.
Oil and grease	
Oil and grease were above detection limits at the upgradient bore, with a concentration of 9 mg/L recorded. However, oil and grease were not detected at the downgradient bores.	It is unclear whether the oil and grease result indicates a sample contamination issue, presence in the regional aquifer or presence within the well monitoring well itself (related to construction and not cleared by the recent bore development attempt). It is recommended that the presence of oil and grease be evaluated again during the next monitoring round and further action be taken if it is again present.
Nutrients	
Ammonia exceeded the upgradient bore concentration (0.42 mg/L) at both BSM2 and BMS3 with values of 1.07 mg/L and 8.11 mg/L, respectively.	Baseline data results were reviewed, where the following was noted: • No historical records of ammonia were available. • Oxidised nitrogen was noted to be significantly above historical records (with respect to nitrite and nitrate results typically less than 0.01 mg/L). • Reactive phosphorus was noted to have a baseline median concentration of 0.4 mg/L, demonstrating that the reactive phosphorus at the time of monitoring was typically lower than historical records.
Oxidised nitrogen significantly exceeded the upgradient bore concentration (0.09 mg/L) at BSM2 with a concentration of 32.3 mg/L. Oxidised nitrogen was below detection in BSM3.	

Table 2.4 Review of exceedances

<table>
<tr><th>Exceedance description</th><th>Assessment, actions taken and recommendations</th></tr>
<tr><td>Reactive phosphorus exceeded the upgradient bore concentration (0.01 mg/L) at BSM2 and BSM3 with concentrations of 0.08 mg/L at both bores.</td><td>Nutrients appear to be elevated in differing chemical forms in all bores on site, including the upgradient bore. The following recommendations are made:
• Review groundwater nutrients for regional trends in the next monitoring round.
• Undertake additional sampling to try to determine the source of nutrients. It is recommended that the quarry pit and the Oaky Creek upstream site are sampled during the next groundwater monitoring round. This may assist in determining if elevated nutrients are localised or related to impacts associated with the Western Sydney Airport construction.</td></tr>
<tr><td colspan="2">Metals</td></tr>
<tr><td>Copper exceeded the trigger value at BSM2 with a concentration of 0.002 mg/L.</td><td rowspan="3">Baseline data results were reviewed, where the following was noted:
• Copper has historically been below detection.
• No historical records of manganese were available.
• Zinc is historically elevated above the recent monitoring.
It is recommended that exceedances for any metals in the downgradient bores be reviewed during the next monitoring round. Given the possible contamination issues of BSM1, there is a possibility that some exceedances are associated with sample contamination issues. Additional monitoring or the quarry pit (proposed above) will also assist in determining the cause of exceedances.</td></tr>
<tr><td>Manganese exceeded the trigger value at BSM2 with a concentration of 2.67 mg/L.</td></tr>
<tr><td>Zinc exceeded the trigger values at BSM3 with a concentration of 0.044 mg/L. This concentration recorded is below the baseline median of 0.06 mg/L.</td></tr>
</table>

3 Summary of recommendations

The following recommendations are made for future monitoring rounds:

- Review salinity, oil and grease, nutrients and toxicants in the next monitoring round to determine if trends are ongoing.
- Undertake the following additional samples to assist in determining if the groundwater exceedances are related to local or regional effects:
  - 1x sample of the quarry pit water – this may assist in determining if exceedances are related to local land use.
  - 1x sample of Oaky Creek upstream of the site – this may assist in determining if exceedances are related to the Western Sydney Airport activities.

Further recommendations may be made following the above outcomes and the Q2 monitoring results.

Please contact the undersigned with any questions or clarifications.

Yours sincerely

Patrick Carolan
Senior Water Resources Engineer
pcarolan@emmconsulting.com.au

Appendix A

Water quality monitoring locations

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\\emm.local\xdrive\2023\E231131 - Luddenham Quarry - Environmental Monitoring\GIS\02_Maps\190749\SWM003_WQMonitoringLocations_20240927_03.mxd 27/09/2024

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

KEY

- Study area
- Cadastral boundary
- Watercourse
- Water quality monitoring location
- Groundwater monitoring bore

Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 1

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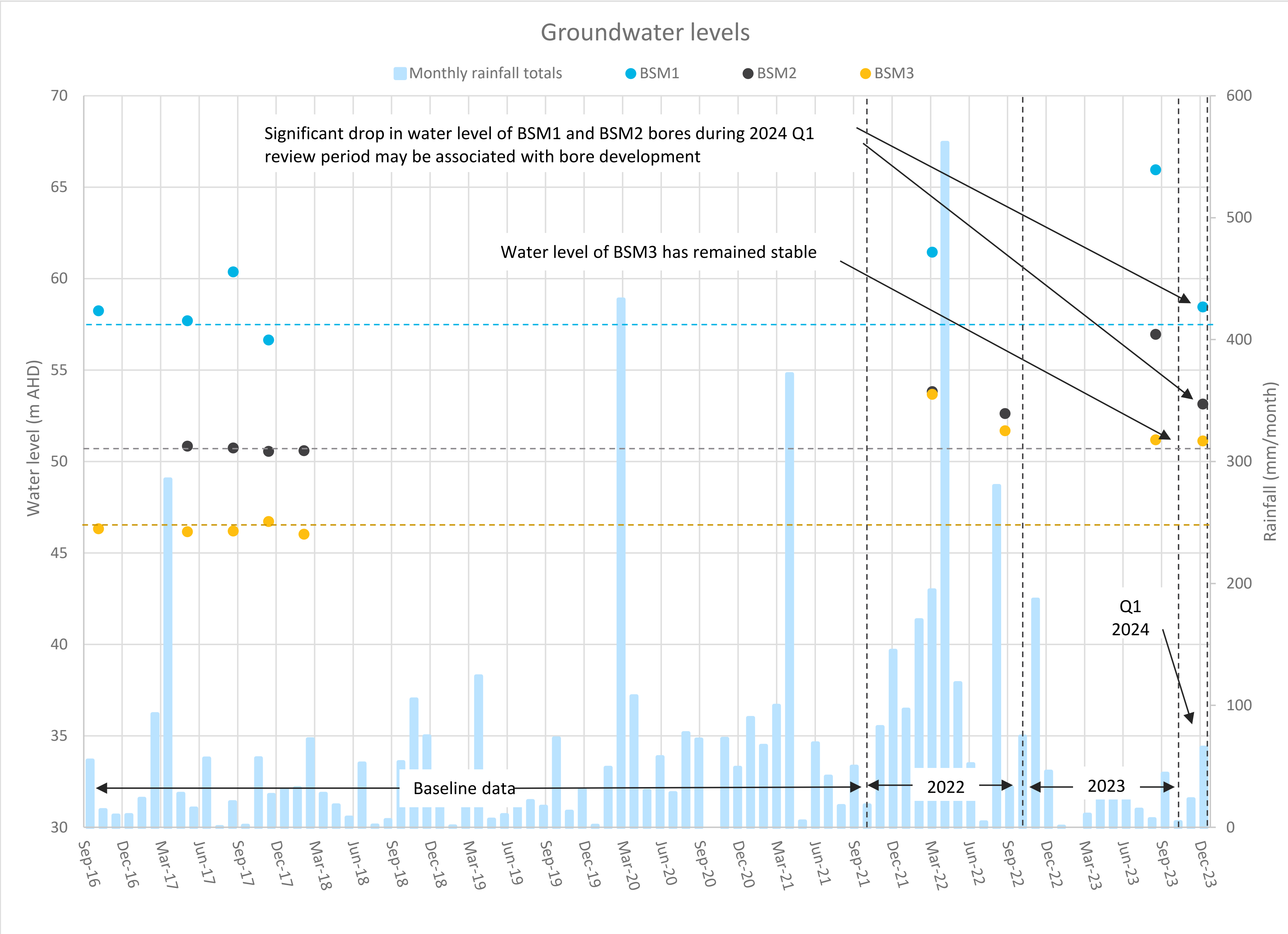
Appendix B
Groundwater levels



Groundwater levels
Monthly rainfall totals
BSM1
BSM2
BSM3
Significant drop in water level of BSM1 and BSM2 bores during 2024 Q1 review period may be associated with bore development
Water level of BSM3 has remained stable
Q1 2024
Baseline data
2022
2023
Water level (m AHD)
Rainfall (mm/month)
70
65
60
55
50
45
40
35
30
600
500
400
300
200
100
0
Sep-16
Dec-16
Mar-17
Jun-17
Sep-17
Dec-17
Mar-18
Jun-18
Sep-18
Dec-18
Mar-19
Jun-19
Sep-19
Dec-19
Mar-20
Jun-20
Sep-20
Dec-20
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Dec-21
Mar-22
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Sep-22
Dec-22
Mar-23
Jun-23
Sep-23
Dec-23

Appendix C
Groundwater quality results

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Table C.1 Groundwater quality results (Q1 groundwater monitoring round)

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Field	Temp	°C	-	–	20.5	26.2	29.8	23.1
	EC	µS/cm	-	Comparison with upgradient bore	23,100	23,310	22,768	24,704
	pH	–	-	6.5 – 8.5	6.7	8.0	8.1	8.1
	DO	% sat	-	–	–	37.3	50.1	13.0
	DO	mg/L	-	–	1.50	2.64	3.37	0.97
	Redox potential	mV	-	–	–	26.8	51.8	44.3
	TDS	mg/L	-	–	–	15,158	14,800	16,061
Nutrients	Ammonia as N	mg/L	0.01	Comparison with upgradient bore	–	0.42	1.07	8.11
	Nitrite + nitrate as N	mg/L	0.01	Comparison with upgradient bore	–	0.09	32.3	<0.01
	Total Kjeldahl nitrogen	mg/L	0.1	–	–	73.0	36.7	9.0
	Nitrite (as N)	mg/L	0.01	–	<0.005	0.02	0.02	<0.01
	Nitrate (as N)	mg/L	0.01	–	0.01	0.07	32.3	<0.01
	Nitrogen (total)	mg/L	0.1	Comparison with upgradient bore	–	73.1	69.0	9.0
	Phosphorus (total)	mg/L	0.01	Comparison with upgradient bore	0.05	39.5	19.1	0.64
	Reactive phosphorus (as P)	mg/1	0.01	Comparison with upgradient bore	0.4	0.01	0.08	0.08
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	–	<0.01	<0.01	<0.01
	Arsenic	mg/L	0.001	0.013	<0.001	0.003	0.002	0.004
	Boron	mg/L	0.05	0.37	–	0.07	0.1	0.09
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	0.002	<0.001	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	<0.001	<0.001	0.002	<0.001
	Iron	mg/L	0.05	0.3	8.5	<0.05	<0.05	<0.05
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	–	0.069	2.670	0.074
	Nickel	mg/L	0.001	0.011	0.006	0.006	0.004	0.006
	Zinc	mg/L	0.005	0.008	0.06	<0.005	<0.005	0.044

Table C.1 Groundwater quality results (Q1 groundwater monitoring round)

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Other	Oil and grease	mg/L	5	Above detection	<5	9	<5	<5
	TSS	mg/L	5	Comparison with upgradient bore	–	46,200	24,400	281

Table C.2 QA/QC assessment (Q1 groundwater monitoring round)

Group	Parameter	Units	LOR	BSM1	QA	Relative % difference
Nutrients	Ammonia as N	mg/L	0.01	0.42	0.50	17.4
	Nitrite + nitrate as N	mg/L	0.01	0.09	0.09	0.0
	Total Kjeldahl nitrogen	mg/L	0.1	73	72.4	0.8
	Nitrite (as N)	mg/L	0.01	0.02	0.02	0.0
	Nitrate (as N)	mg/L	0.01	0.07	0.07	0.0
	Nitrogen (total)	mg/L	0.1	73.1	72.5	0.8
	Phosphorus (total)	mg/L	0.01	39.5	39.9	1.0
	Reactive phosphorus (as P)	mg/1	0.01	0.01	0.01	0.0
Metals (dissolved)	Aluminium	mg/L	0.01	<0.01	<0.01	0.0
	Arsenic	mg/L	0.001	0.003	0.003	0.0
	Boron	mg/L	0.05	0.07	0.08	13.3
	Cadmium	mg/L	0.0001	<0.0001	<0.0001	0.0
	Chromium	mg/L	0.001	<0.001	<0.001	0.0
	Copper	mg/L	0.001	<0.001	<0.001	0.0
	Iron	mg/L	0.05	<0.05	<0.05	0.0
	Lead	mg/L	0.001	<0.001	<0.001	0.0
	Manganese	mg/L	0.001	0.069	0.067	2.9
	Nickel	mg/L	0.001	0.006	0.005	18.2
	Zinc	mg/L	0.005	<0.005	<0.01	0.0
Other	Oil and grease	mg/L	5	9	9	0.0
	TSS	mg/L	0.005	46,200	34,400	29.3

Ground floor 20 Chandos Street
St Leonards NSW 2065

PO Box 21
St Leonards NSW 1590

02 9493 9500

www.emmconsulting.com.au

Memorandum

22 May 2024

To: Pascal Bobillier
General Manager - Development
Coombes Property Group

From: Patrick Carolan

Subject: Luddenham Quarry SWMP monitoring results (Q2 - 2023/2024)

Dear Pascal,

1 Background

This memorandum outlines groundwater water quality and level monitoring undertaken by EMM Consulting Pty Ltd (EMM) for Luddenham Quarry (the site), as required by the water monitoring program that was developed for the Soil and Water Management Plan (SWMP) (EMM 2021).

The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring (refer Appendix A for monitoring locations).

Monitoring outlined in this report was completed for the period of December 2023 to March 2024 (Q2 of the 2023-2024 annual review period).

2 Water monitoring

2.1 Program overview

2.1.1 Groundwater monitoring network

Three monitoring bores exist at the site, installed to a depth of approximately 30 metres (m) into the Bringelly Shale. The monitoring bores are sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

Sites BSM1 and BSM2 were replaced with new bores in 2023, with subsequent monitoring producing suspicious results. Development of the bores was attempted ahead of the Q1 monitoring round (refer Q1 23-24 monitoring report, EMM 2024).

2.1.2 Analytes

The analytical suite for the monitoring program is presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

Table 2.1 Water quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids	In the field with a calibrated hand-held water quality meter
	Total suspended solids	Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory

2.1.3 Water level monitoring

Water levels are monitored via manual measurements at each monitoring bore during sampling. A deviation of two metres from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two metres as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

2.2 Completed monitoring

The following sections describe the completed monitoring and field observations. Key results are discussed in Section 2.3 and results of groundwater level and groundwater quality are reported in Appendix B and Appendix C, respectively.

2.2.1 Rainfall context

The Bureau of Meteorology operates a rain gauge at Badgerys Creek (approximately 3 kilometres (km) from the site – Station number: 067108). The preceding one, three and five-day rainfall totals to 9:00 am on 24 March 2024 are presented in Table 2.2, to provide context at the time of monitoring.

The five days preceding the monitoring event were almost dry with 0.4 mm falling on the 24 March 2024.

Table 2.2 Recorded rainfall in the days before 24 March 2024

Gauge location	One-day prior rainfall total (mm)	Three-day prior rainfall total (mm)	Five-day prior rainfall total (mm)
Badgerys Creek AWS	0.0	0.4	0.4

2.2.2 Groundwater

Field observations for completed groundwater monitoring is presented in Table 2.3.

Table 2.3 Field observations (groundwater monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
27/03/2024 – 11:35 AM	BSM3	Upgradient bore to measure background contamination levels.	Mostly clear, some suspended solids, no smell.
27/03/2024 – 12:15 PM	BSM2	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Turbid light brown colour, no smell.
27/03/2024 – 1:10 PM	BSM1	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Turbid brown colour, no smell.

2.2.3 Surface water additional monitoring

the following additional samples were taken as recommended in last quarters report to assist in determining groundwater exceedances are related to local or regional effects:

- 1x sample of the quarry pit water
- 1x sample of Oaky Creek upstream of the site.

Field observations for the two surface water sites are displayed in Table 2.4

Table 2.4 Field observations (Surface water monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
27/03/2024 – 2:00 PM	Pit	Sample of the pit quarry water in the NE corner of the pit.	Pit water had typical blue colour.
27/03/2024 – 2:30 PM	Creek	Sample of Oakley creek to the east of the site.	Stagnant water in creek, brown colour.

2.2.4 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Smithfield, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

2.2.5 Quality assurance/quality control

Samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location, and
- collection of a field duplicate sample.

Quality assurance/control was assessed by calculating relative percentage difference (RPD) of the field duplicate ($S_{duplicate}$) sample to the parent sample (S_{parent}) as per the following equation.

$$Relative\ \%\ difference = \frac{|S_{parent} - S_{Dupilcate}|}{\frac{S_{parent} + S_{Dupilcate}}{2}} \times 100$$

Results were considered to have a high degree of accuracy where RPDs were below 50%.

All results for the monitoring round were within RPD limits (refer Appendix C), indicating adequate QA/QC.

2.3 Monitoring results - general observations

2.3.1 Groundwater levels

Water levels in all bores for the monitoring period (refer Appendix B) are relatively consistent with baseline trends and no further action is required with respect to groundwater levels.

2.3.2 Groundwater quality

Key observations of groundwater quality for the monitoring period include the following:

- Salinity, as indicated by electrical conductivity (EC), was reasonably consistent across all bores and was also a similar level of magnitude to the median of baseline records for the aquifer.
- pH has shifted from basic to acidic from the last reporting period, but within limits of the trigger values and reasonably consistent across the bores.
- Nutrients remain significantly elevated above baseline ranges in all bores, particularly nitrates in BSM2. However, these results are not consistent with the additional surface water samples taken indicating that the source of nutrients may be local to the monitoring wells.

- Numerous metals exceeded the trigger values across all bores (discussed in Section 2.5).

2.4 Surface water quality

Key observations of surface water quality for the monitoring period are summarised below:

- Water in the quarry pit was basic. Salinity as indicated by EC was typical of baseline trends.
- Nutrients within the quarry pit were typical of baseline values and much lower than concentrations noted in the groundwater monitoring wells.
- Oil and grease were present above detection limits within the pit, indicating potential contamination from equipment on the site or contaminated inflow from the regional aquifer. Arsenic and Nickel concentrations were also above trigger values in the quarry pit, potentially linked to the oil and grease exceedance.
- The Oaky Creek sample had a neutral pH and salinity within trigger limits. Nickel was slightly elevated above trigger limits.

2.5 Review of exceedances

Water quality results were reviewed for trigger exceedances, via comparison of toxicants to ANZG (2018) guidelines or comparison of other chemical properties to the upgradient bore (BSM1). An assessment of exceedances including actions taken and recommendations is presented in Table 2.5.

Table 2.5 Review of exceedances

Exceedance description	Assessment, actions taken and recommendations
Oil and grease	
Oil and grease were above detection limits at the upgradient bore (BSM1), at one downgradient bore (BSM3) and the quarry pit. Oil and grease were not detected at BSM2.	The source of oil and grease remains unclear. Further investigation should aim to verify if the presence within the quarry pit and bores is linked to the same or independent sources. It is recommended that BTEXN/TRH/TPH/PAH hydrocarbon samples be taken to assist in determining the likely source of hydrocarbons (i.e. drilling fluid, diesel etc) and assess potential migration.
Nutrients	
Ammonia exceeded the upgradient bore concentration (4.94 mg/L) at BMS3 with concentration of 8.35 mg/L.	Baseline data results were reviewed, where the following was noted: • No historical records of ammonia were available. • Oxidised nitrogen was noted to be significantly above historical records (with respect to nitrite and nitrate results typically less than 0.01 mg/L). • Reactive phosphorus was noted to have a baseline median concentration of 0.4 mg/L, demonstrating that the reactive phosphorus at the time of monitoring was typically lower than historical records. • No historical records of total nitrogen were available. Additional monitoring was undertaken in the quarry pit and Oaky Creek (upstream of the site) to determine if nutrient issues were present outside of
Oxidised nitrogen significantly exceeded the upgradient bore concentration (0.3 mg/L) at BSM2 with a concentration of 28.1 mg/L.	
Total nitrogen exceeded the upgradient bore concentration (6 mg/L) at BSM3 and BSM3 with concentrations of 32.6 mg/L and 8 mg/L, respectively.	

Table 2.5 Review of exceedances

Exceedance description	Assessment, actions taken and recommendations
Reactive phosphorus was above detection at BSM3 with a concentration of 0.03 mg/L, whereas the upgradient bore was below detection limits.	the bores. No evidence of broader a nutrient issue was found, indicating that the presence may be localised in the monitoring wells. Nutrients continue to be elevated in differing chemical forms in all bores on site, including the upgradient bore. It is recommended that a review of timeseries charts of all nutrients in the groundwater monitoring program be undertaken following the next monitoring round to assist in understanding the temporal flux of exceedances within the bores.
Metals	
Cadmium matched the trigger value at BSM2 with a concentration of 0.0002 mg/L.	Baseline data results were reviewed, where the following was noted: • Cadmium has historically been below detection. • Copper has historically been below detection but was elevated in the last monitoring round. • No historical records of manganese are available. Manganese was also elevated in the previous monitoring round. • Nickel has historically been below trigger values. • The baseline data indicates that Zinc is known to be elevated historically. Additional monitoring of the quarry pit and Oaky Creek showed some exceedances in metals however, these were not consistent with the magnitude of concentrations recorded in the groundwater results. Ongoing trends of elevated metals require further investigation to determined sources. It is recommended that a review of timeseries charts of all toxicants in the groundwater monitoring program be undertaken following the next monitoring round to assist in understanding the temporal flux of exceedances within the bores.
Copper exceeded the trigger value at BSM1 and BSM2 with a concentration of 0.002 mg/L.	
Iron exceeded the trigger value at BSM3 with a concentration of 0.46 mg/L.	
Manganese exceeded the trigger value at BSM2 with a concentration of 2.01 mg/L.	
Nickel exceeded the trigger value at BSM1, BSM2 and BSM3 with concentrations of 0.013 mg/L, 0.016 mg/L and 0.071 mg/L, respectively.	
Zinc exceeded the trigger values at BSM1, BSM2 and BSM3 with concentrations of 0.03 mg/L, 0.048 mg/L and 0.034 mg/L.	

3 Summary of recommendations

The following recommendations are made for future monitoring rounds:

- A review of timeseries charts of all nutrients, metals and oil and grease/hydrocarbons be undertaken following the next monitoring round to assist in understanding the temporal flux of exceedances within the bores.
- Undertake samples of BTEXN/TRH/TPH/PAH hydrocarbons for the next round, at all three groundwater wells and the quarry pit, to assist in determining the likely source of hydrocarbons (i.e. drilling fluid, diesel etc) and assess potential migration.

Further recommendations may be made following the above outcomes and the Q3 monitoring results.

Please contact the undersigned with any questions or clarifications.

Yours sincerely

Patrick Carolan
Senior Water Resources Engineer
pcarolan@emmconsulting.com.au

Appendix A

Water quality monitoring locations

creating opportunities

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

KEY

- Study area
- Cadastral boundary
- Watercourse
- Water quality monitoring location
- Groundwater monitoring bore

Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 1

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Appendix B
Groundwater levels

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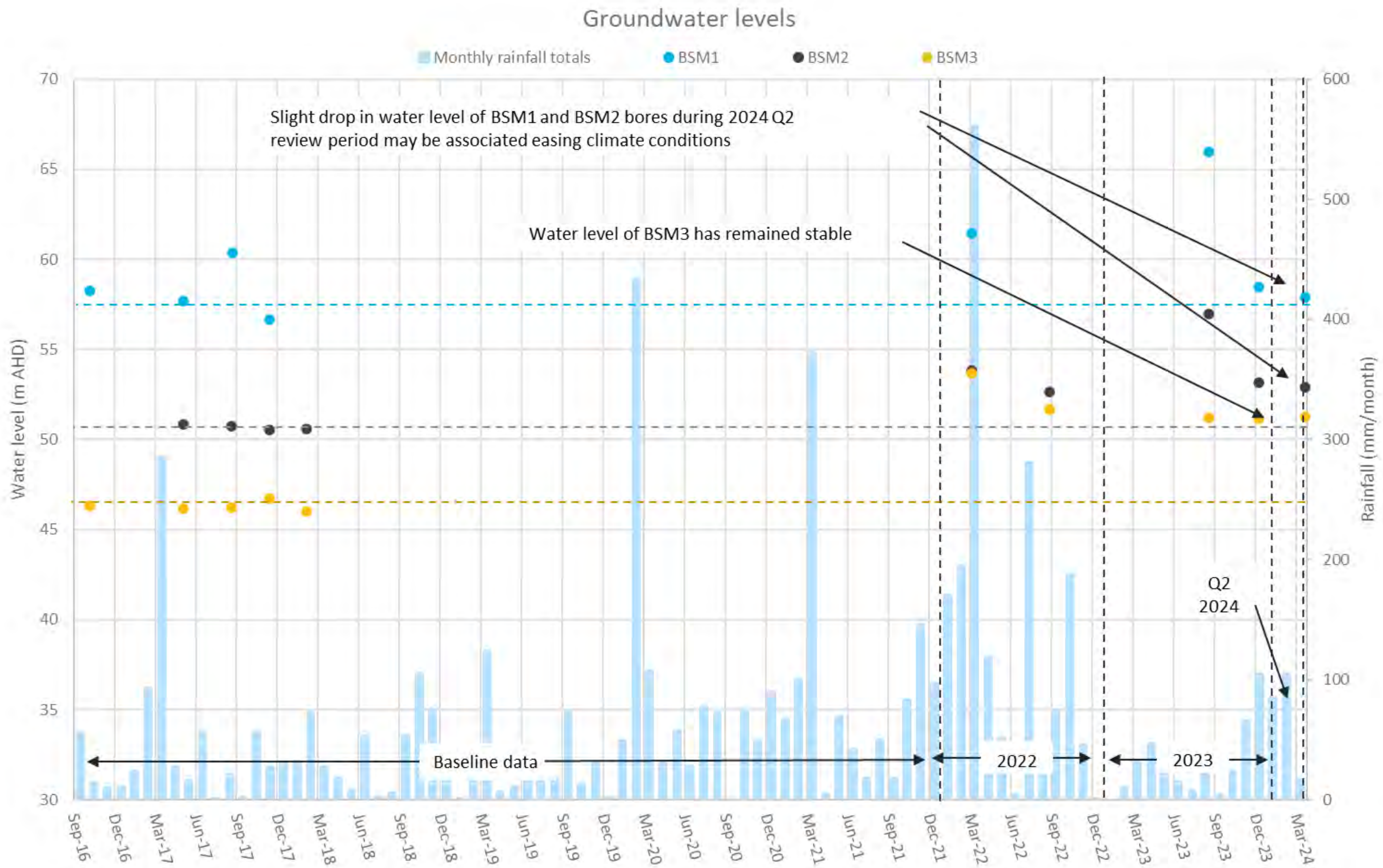
Groundwater levels
Monthly rainfall totals
BSM1
BSM2
BSM3
Water level (m AHD)
Rainfall (mm/month)
Slight drop in water level of BSM1 and BSM2 bores during 2024 Q2
review period may be associated easing climate conditions
Water level of BSM3 has remained stable
Q2
2024
Baseline data
2022
2023
70
65
60
55
50
45
40
35
30
600
500
400
300
200
100
0
Sep-16
Dec-16
Mar-17
Jun-17
Sep-17
Dec-17
Mar-18
Jun-18
Sep-18
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Jun-19
Sep-19
Dec-19
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Jun-21
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Dec-21
Mar-22
Jun-22
Sep-22
Dec-22
Mar-23
Jun-23
Sep-23
Dec-23
Mar-24

Appendix C

Groundwater quality results

creating opportunities

Table C.1 Groundwater quality results (Q2 groundwater monitoring round)

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Field	Temp	°C	-	–	20.5	22.5	24	22.1
	EC	µS/cm	-	Comparison with upgradient bore	23,100	26,493	21,356	24,923
	pH	–	-	6.5 – 8.5	6.7	6.83	6.74	6.86
	DO	% sat	-	–	–	N/A	N/A	N/A
	DO	mg/L	-	–	1.50	N/A	N/A	N/A
	Redox potential	mV	-	–	–	-138.6	15.2	101.7
	TDS	mg/L	-	–	–	N/A	N/A	N/A
Nutrients	Ammonia as N	mg/L	0.01	Comparison with upgradient bore	–	4.94	2.88	8.35
	Nitrite + nitrate as N	mg/L	0.01	Comparison with upgradient bore	–	0.3	28.1	0.02
	Total Kjeldahl nitrogen	mg/L	0.1	–	–	5.7	4.5	8
	Nitrite (as N)	mg/L	0.01	–	<0.005	<0.01	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01	–	0.01	0.3	28.1	0.02
	Nitrogen (total)	mg/L	0.1	Comparison with upgradient bore	–	6	32.6	8
	Phosphorus (total)	mg/L	0.01	Comparison with upgradient bore	0.05	0.17	0.11	0.03
	Reactive phosphorus (as P)	mg/1	0.01	Comparison with upgradient bore	0.4	<0.01	<0.01	0.03
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	–	<0.01	<0.01	<0.01
	Arsenic	mg/L	0.001	0.013	<0.001	<0.001	<0.001	0.001
	Boron	mg/L	0.05	0.37	–	0.07	<0.05	<0.05
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	0.0002	<0.0001
	Chromium	mg/L	0.001	0.001	0.002	<0.001	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	<0.001	0.002	0.002	<0.001
	Iron	mg/L	0.05	0.3	8.5	<0.05	<0.05	0.46
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	–	0.153	2.01	0.089
	Nickel	mg/L	0.001	0.011	0.006	0.013	0.016	0.071
	Zinc	mg/L	0.005	0.008	0.060	0.030	0.048	0.034
Other	Oil and grease	mg/L	5	Above detection	<5	6	<5	5

Table C.1 Groundwater quality results (Q2 groundwater monitoring round)

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
	TSS	mg/L	5	Comparison with upgradient bore	–	148	112	<5

Table C.2 QA/QC assessment (Q2 groundwater monitoring round)

Group	Parameter	Units	LOR	BSM1	QA	Relative % difference
Nutrients	Ammonia as N	mg/L	0.01	2.88	2.9	0.7
	Nitrite + nitrate as N	mg/L	0.01	28.1	23.4	18.3
	Total Kjeldahl nitrogen	mg/L	0.1	4.5	4.4	2.2
	Nitrite (as N)	mg/L	0.01	0.01	0.01	0.0
	Nitrate (as N)	mg/L	0.01	28.1	23.4	18.3
	Nitrogen (total)	mg/L	0.1	32.6	27.8	15.9
	Phosphorus (total)	mg/L	0.01	0.11	0.15	30.8
	Reactive phosphorus (as P)	mg/1	0.01	0.01	0.01	0.0
Metals (dissolved)	Aluminium	mg/L	0.01	0.010	0.010	0.0
	Arsenic	mg/L	0.001	0.001	0.001	0.0
	Boron	mg/L	0.05	0.050	0.050	0.0
	Cadmium	mg/L	0.0001	0.0002	0.0001	66.7
	Chromium	mg/L	0.001	0.001	0.001	0.0
	Copper	mg/L	0.001	0.002	0.003	40.0
	Iron	mg/L	0.05	0.050	0.050	0.0
	Lead	mg/L	0.001	0.001	0.001	0.0
	Manganese	mg/L	0.001	2.010	2.010	0.0
	Nickel	mg/L	0.001	0.016	0.016	0.0
	Zinc	mg/L	0.005	0.048	0.048	0.0
Other	Oil and grease	mg/L	5	5	5	0.0
	TSS	mg/L	0.005	112	96	15.4

Appendix D

Surface water quality results

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Table D.1 Surface water quality results (Q2 monitoring round – additional monitoring)

Group	Parameter	Units	LOR	Trigger value	Baseline data range	Pit	Creek
Field	Temp	°C	-	–	–	26.6	22.1
	EC	µS/cm	-	125–2,200	773 – 5,990	5,952	1,684
	pH	–	-	6.5–8.5	7.8 – 8.6	8.67	7.58
	DO	% sat	-	85%–110%	–	N/A	N/A
	DO	mg/L	-	–	8 – 10.5	N/A	N/A
	Redox potential	mV	-	–	–	69	84
	TDS	mg/L	-	–	398 – 3,720	N/A	N/A
Nutrients	Ammonia as N	mg/L	0.01	0.02	<0.01 – 0.1	0.03	<0.01
	Nitrite + nitrate as N	mg/L	0.01	0.04	<0.01 – 6.51	0.12	0.02
	Total Kjeldahl nitrogen	mg/L	0.1	–	0.2 – 1.4	0.7	0.8
	Nitrite (as N)	mg/L	0.01	–	<0.01 – 0.13	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01	–	<0.01 – 6.38	0.12	0.02
	Nitrogen (total)	mg/L	0.1	0.5	0.2 – 7.9	0.8	0.8
	Phosphorus (total)	mg/L	0.01	0.05	<0.01 – 0.13	0.04	0.04
	Reactive phosphorus (as P)	mg/L	0.01	0.02	<0.01 – <0.01	<0.01	<0.01
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	<0.01 – 0.04	<0.01	<0.01
	Arsenic	mg/L	0.001	0.013	<0.001 – 0.001	0.002	<0.001
	Boron	mg/L	0.05	0.37	<0.05 – <0.05	<0.05	<0.05
	Cadmium	mg/L	0.0001	0.0002	<0.0001 – <0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	<0.001 – 0.0005	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	<0.001 - 0.019	0.002	0.003
	Iron	mg/L	0.05	0.3	<0.05 – <0.05	<0.05	<0.05
	Lead	mg/L	0.001	0.0034	<0.001 – <0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	<0.001 – 0.059	0.020	0.087
	Nickel	mg/L	0.001	0.011	<0.001 – 0.004	0.002	0.002
	Zinc	mg/L	0.005	0.008	<0.005 – 0.026	0.005	0.005
Other	Oil and grease	mg/L	5	<5	<5	7	<5
	TSS	mg/L	5	–	–	7	7

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

02 9493 9500

www.emmconsulting.com.au

Memorandum

29 August 2024

To: Pascal Bobillier
General Manager - Development
Coombes Property Group

From: Patrick Carolan

Subject: Luddenham Quarry SWMP monitoring results (Q3 - 2023/2024)

Dear Pascal,

1 Background

This memorandum outlines groundwater water quality and level monitoring undertaken by EMM Consulting Pty Ltd (EMM) for Luddenham Quarry (the site), as required by the water monitoring program that was developed for the Soil and Water Management Plan (SWMP) (EMM 2021).

The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring (refer Appendix A for monitoring locations).

Monitoring outlined in this report was completed for the period of March 2024 to June 2024 (Q3 of the 2023-2024 annual review period).

2 Water monitoring

2.1 Program overview

2.1.1 Groundwater monitoring network

Three monitoring bores exist at the site, installed to a depth of approximately 30 metres (m) into the Bringelly Shale. The monitoring bores are sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

Sites BSM1 and BSM2 were replaced with new bores in 2023, with subsequent monitoring producing anomalous results. Redevelopment of the bores was attempted ahead of the Q1 monitoring round (refer Q1 23-24 monitoring report, EMM 2024).

2.1.2 Analytes

The analytical suite for the monitoring program is presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

Detailed hydrocarbon analysis was added to the analytical suite as recommended in the Q2 groundwater monitoring report, to assist in determining the likely source of oil and grease found in previous monitoring (i.e. lubricants used as part of the drilling process, oils or greases used as part of quarry operations, diesel etc).

Table 2.1 Water quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids	In the field with a calibrated hand-held water quality meter
	Total suspended solids	Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory
Hydrocarbons[1]	BTEXN (benzene, toluene, ethylbenzene, xylene and naphthalene), TRH/TPH (total petroleum hydrocarbon) and PAH (polycyclic aromatic hydrocarbons). Including analysis/results for Chromatogram.	Analysis undertaken at NATA accredited laboratory

Table notes:

1. Additional analytes to the water monitoring program monitored for exceedance investigations.

2.1.3 Water level monitoring

Water levels are monitored using an interface probe at each monitoring bore during sampling. A deviation of two meters from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two meters as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

2.2 Completed monitoring

The following sections describe the completed monitoring and field observations. Key results are discussed in Section 2.3 and detailed results are provided in:

- Appendix B for groundwater level and Appendix C for groundwater quality;
- Appendix D: Additional monitoring undertaken for investigation (including surface water results and detailed hydrocarbon analysis); and
- Appendix E: Water quality timeseries charts.

2.2.1 Rainfall context

The Bureau of Meteorology operates a rain gauge at Badgerys Creek (approximately 3 kilometres (km) from the site – Station number: 067108). The preceding one, three and five-day rainfall totals to 9:00 am on 23 May 2024 are presented in Table 2.2, to provide context at the time of monitoring.

The five days preceding the monitoring event were almost dry with 0.4 mm falling on the 24 March 2024.

Table 2.2 Recorded rainfall in the days before 23 May 2024

Gauge location	One-day prior rainfall total (mm)	Three-day prior rainfall total (mm)	Five-day prior rainfall total (mm)
Badgerys Creek AWS	0.0	0.0	0.0

2.2.2 Groundwater

Field observations for completed groundwater monitoring is presented in Table 2.3.

Table 2.3 Field observations (groundwater monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
23/05/2024 – 11:25 AM	BSM1	Upgradient bore to measure background contamination levels.	Bore water initially appeared clear but transitioned to brown and highly turbid during purging and when the sample was taken.
23/05/2024 – 12:15 PM	BSM2	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore water initially appeared clear but transitioned to brown and highly turbid during purging and when the sample was taken.
23/05/2024 – 1:10 PM	BSM3	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore water maintained a consistent clear turbidity with a slight sulphuric smell. Fizzy foam present during purging period. A field duplicate was taken as a quality assurance (QA) sample at this bore.

2.2.3 Additional monitoring for investigation purposes

A sample was taken from the quarry pit to assist with understanding the source of oil and grease exceedances in previous monitoring rounds. Field observations for the surface water site is displayed in Table 2.4

Table 2.4 Field observations (Surface water monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
23/04/2024 – 12:15 PM	Pit	Sample of the pit quarry water in the NE corner of the pit.	Clear colour, low turbidity.

2.2.4 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Smithfield, NSW for analysis. All laboratory analytes that were not additionally measured *in situ* (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

2.2.5 Quality assurance/quality control (QA/QC)

Samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location, and
- collection of a field duplicate sample.

Quality assurance/control was assessed by calculating relative percentage difference (RPD) of the field duplicate ($S_{duplicate}$) sample to the parent sample (S_{parent}) as per the following equation.

$$Relative\ \%\ difference = \frac{|S_{parent} - S_{Dupilcate}|}{\frac{S_{parent} + S_{Dupilcate}}{2}} \times 100$$

Results were considered to confirm acceptable degree of data quality where RPDs were below 30%.

All results for the monitoring round were within RPD limits (refer Appendix C), indicating adequate QA/QC.

2.3 Monitoring results - general observations

2.3.1 Groundwater levels

Water levels in all bores for the monitoring period (refer Appendix B) are relatively consistent with baseline trends and no further action is required with respect to groundwater levels.

2.3.2 Groundwater quality

Key observations of groundwater quality for the monitoring period include the following:

- Salinity, as indicated by electrical conductivity (EC), was significantly lower in BSM1 than noted in BSM2 and BSM3. Results at these downgradient bores are more typical of baseline trends, suggesting that the upgradient/BSM1 results may include surface water ingress.

- Nutrients remain significantly elevated above baseline ranges in all bores, particularly in BSM2. However, these results are not reflected in the additional surface water sample taken at the pit, indicating that the elevated nutrients are contained to the groundwater system, attributable to an external source or localised within the wells.

- Elevated metals and hydrocarbons were noted in some bores (discussed in Section 2.5).

2.4 Additional monitoring water quality

Key observations of the pit water quality are summarised below:

- pH was basic and slightly elevated above both the surface water trigger value and historical range. This differed from the groundwater bores which were all acidic.

- EC was typical of baseline trends.

- Ammonia and oxidised nitrogen concentrations were above the surface water trigger values but were typical of baseline values and much lower than concentrations noted in the groundwater monitoring wells.

- Oil and grease/hydrocarbons were not detected within the pit.

2.5 Review of exceedances

Water quality results were reviewed for trigger exceedances, via comparison of toxicants to ANZG (2018) guidelines or comparison of other chemical properties to the upgradient bore (BSM1). An assessment of exceedances including actions taken and recommendations is presented in Table 2.5.

Table 2.5 Review of exceedances

Exceedance description	Assessment, actions taken and recommendations
Oil and grease	
Oil and grease was above detection limits at BSM2. TPH and TRH concentrations were above detection at BSM2 but also at the upgradient bore BSM1. Concentrations at BSM2 were significantly higher than the upgradient bore.	Hydrocarbon chain fraction results were reviewed. It was noted that concentrations of TRH/TPH were below detection for light fraction chains (i.e. C6-C9 for TRH) and that BTEXN analytes were all below detection. Detection of heavier fraction carbon chains may indicate the presence of lubricating oils utilised in machinery (possibly related to well installation) or biogenic hydrocarbons, such as from the breakdown of plant matter or waxes/saps from trees. It is recommended that a silica gel cleanup be undertaken on the next round of hydrocarbon monitoring, to remove any potential biogenic material from the samples and aid in understanding if TRH/TPH results relate to site operations.
Nutrients	
Oxidised nitrogen significantly exceeded the upgradient bore concentration (0.07 mg/L) at BSM2 with a concentration of 9.25 mg/L.	Baseline data results were reviewed, where the following was noted:

Table 2.5 Review of exceedances

Exceedance description	Assessment, actions taken and recommendations
Total nitrogen exceeded the upgradient bore concentration (12.3 mg/L) at BSM2 with concentrations of 65.7 mg/L	• Oxidised nitrogen was noted to be significantly above historical records (with respect to nitrite and nitrate results typically less than 0.01 mg/L). • No historical records of total nitrogen were available.
Total phosphorus significantly exceeded the upgradient bore concentration (2.69 mg/L) at BSM2 with concentrations of 46.3 mg/L.	• Total phosphorus was noted to be significantly above historical records. • Reactive phosphorus was noted to have a baseline median concentration of 0.4 mg/L, demonstrating that the reactive phosphorus at the time of monitoring was typically lower than historical records.
Reactive phosphorus was above detection at BSM2 with a concentration of 0.03 mg/L, whereas the upgradient bore was below detection limits.	Timeseries charts of nutrients exceedances were prepared (refer Appendix E). The following observations are made from charts in Section E.1: • Groundwater exceedances for nutrients generally appear to occur following the bore installation in July 2023. • Most nutrient exceedances appear to be reducing in magnitude over time, except for total nitrogen/total kjeldahl nitrogen and reactive and total phosphorus in the May 2024 monitoring round.
Metals	
Chromium exceeded the trigger value at BSM1 and BSM2 with values of 0.003 and 0.004 mg/L respectively.	Baseline data results were reviewed, where the following was noted: • Chromium, Copper, Iron and Zinc have been noted in the bores historically at similar concentrations. • No historical records of manganese are available. Manganese was also elevated in the previous monitoring round. Additional monitoring of the quarry pit showed some exceedances in metals however, these were not consistent with the magnitude of concentrations recorded in the groundwater results. Timeseries charts of metals exceedances were prepared (refer Appendix E). The following observations are made from charts in Section E.2: • No obvious trends are discernible from the timeseries charts and exceedances of similar magnitude are generally known to occur for some metals in the historical baseline dataset.
Copper exceeded the trigger value at BSM1 and BSM2 with values of 0.002 and 0.003 mg/L respectively.	
Iron exceeded the trigger value at BSM3 with a concentration of 1.89 mg/L.	
Manganese exceeded the trigger value at BSM2 with a concentration of 2.84 mg/L.	
Zinc exceeded the trigger values at BSM2 with a concentration of 0.009 mg/L.	

3 Summary of recommendations

The following recommendations are made for future monitoring rounds:

- Ensuring that three well volumes are purged and from each monitoring well prior to sampling will assist in ensuring samples are representative of the aquifer. EC can be verified with an interface probe prior to sampling to check that sufficient purging has been undertaken.

- It is recommended that hydrocarbon analytes that were detected during this monitoring round be repeated during the next monitoring event (Q4). It is also recommended a silica gel cleanup be undertaken on the next round of hydrocarbon monitoring, to remove any potential biogenic material from the samples and aid in understanding if TRH/TPH results relate to hydrocarbon contamination. To review potential sources and impacted locations, it is recommended that all surface water and groundwater locations be assessed for these analytical suites.

- Timeseries charts for some nutrients (refer Appendix E) present a trend of exceedances an order of magnitude higher than historical trends, with diminishing concentrations over time. The construction methods and design of monitoring wells BSM1 and BSM2 should be confirmed to verify if installation methods are contributing to exceedances.

Please contact the undersigned with any questions or clarifications.

Yours sincerely

Patrick Carolan
Senior Water Resources Engineer
pcarolan@emmconsulting.com.au

Appendix A

Water quality monitoring locations

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Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 1

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Appendix B
Groundwater levels

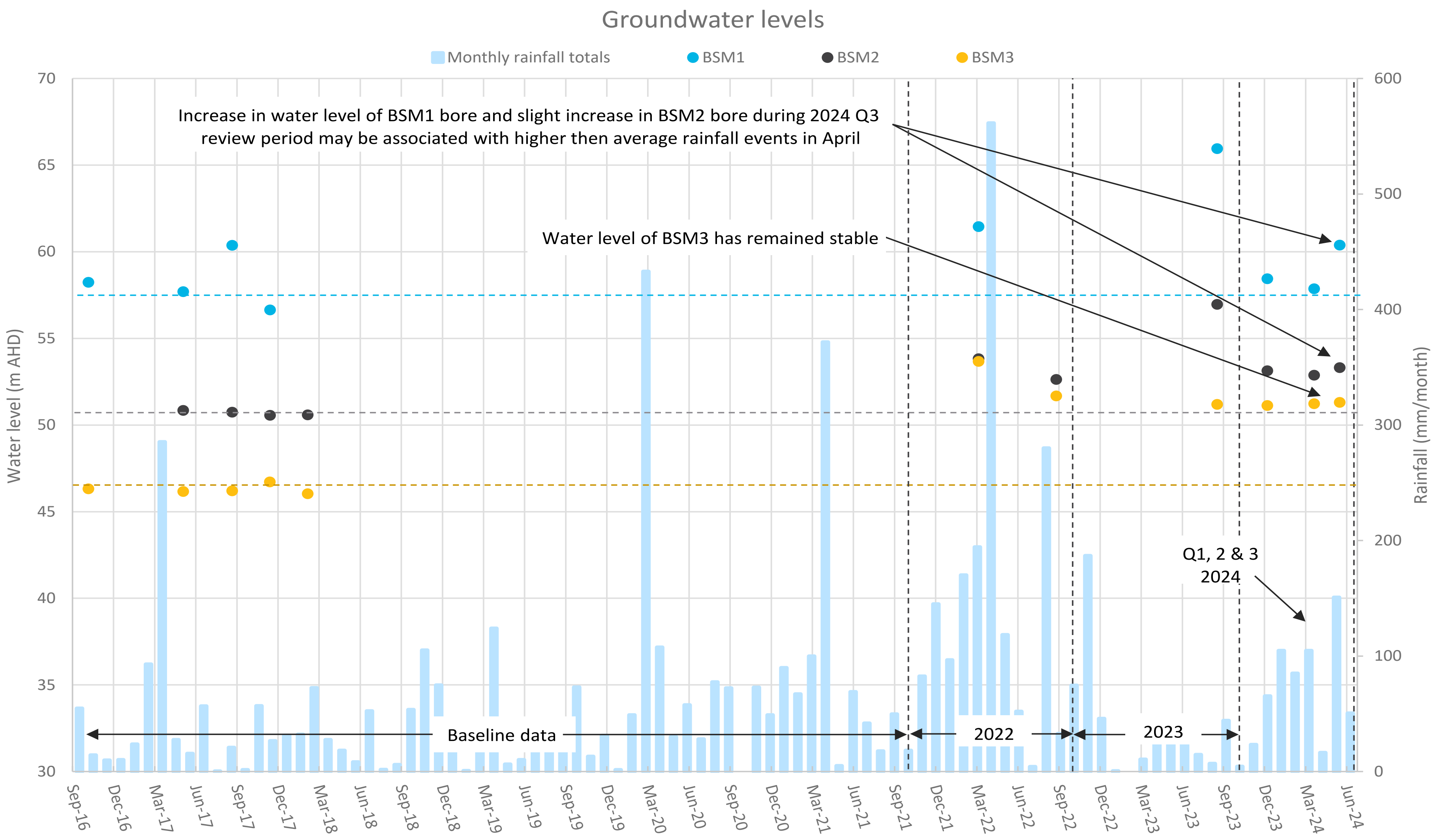

Figure B.1 Ground water levels

Appendix C

Groundwater quality results

Table C.1 Groundwater quality results (Q3 groundwater monitoring round)

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Field	Temperature	°C	-	–	20.5	19.2	20.8	18.8
	Electrical conductivity	µS/cm	-	Comparison with upgradient bore	23,100	9,334	24,922	23,696
	pH	–	-	6.5 – 8.5	6.7	6.63	6.86	6.83
	Dissolved oxygen	% sat	-	–	–	16	27	23
	Dissolved oxygen	mg/L	-	–	1.50	1	2	2
	Redox potential	mV	-	–	–	174	205	-21
	Total dissolved solids	mg/L	-	–	–	8,300	22,940	20,863
Nutrients	Ammonia	mg/L	0.01	Comparison with upgradient bore	–	5.5	0.2	4.7
	Oxidised nitrogen	mg/L	0.01	Comparison with upgradient bore	–	0.07	9.25	0.01
	Total kjeldahl nitrogen	mg/L	0.1	–	–	12.2	65.7	4.6
	Nitrite	mg/L	0.01	–	<0.005	0.08	0.03	<0.01
	Nitrate	mg/L	0.01	–	0.01	<0.01	9.2	0.01
	Total nitrogen	mg/L	0.1	Comparison with upgradient bore	–	12.3	75.0	4.6
	Total phosphorus	mg/L	0.01	Comparison with upgradient bore	0.05	2.69	46.3	0.06
	Reactive phosphorus	mg/L	0.01	Comparison with upgradient bore	0.4	<0.01	0.03	<0.01
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	–	0.030	0.020	0.010
	Arsenic	mg/L	0.001	0.013	<0.001	<0.001	<0.001	0.006
	Boron	mg/L	0.05	0.37	–	0.08	<0.05	<0.05
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	0.002	0.003	0.004	<0.001
	Copper	mg/L	0.001	0.0014	<0.001	0.002	0.002	<0.001
	Iron	mg/L	0.05	0.3	8.5	0.42	<0.05	1.89
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	–	0.78	2.84	0.27
	Nickel	mg/L	0.001	0.011	0.006	0.004	0.009	<0.001
	Zinc	mg/L	0.005	0.008	0.060	0.030	0.032	<0.005

Other	Oil and grease	mg/L	5	Above detection	<5	<5	6	<5
	Total suspended solids	mg/L	5	Comparison with upgradient bore	–	3,320	14,800	35

Table C.2 QA/QC assessment (Q3 groundwater monitoring round)

Group	Parameter	Units	LOR	BSM3	QA	Relative % difference
Nutrients	Ammonia	mg/L	0.01	4.68	4.66	0.4
	Oxidised nitrogen	mg/L	0.01	0.01	<0.01	0.0
	Total kjeldahl nitrogen	mg/L	0.1	4.6	4.6	0.0
	Nitrite	mg/L	0.01	<0.01	<0.01	0.0
	Nitrate	mg/L	0.01	0.01	<0.01	0.0
	Total nitrogen	mg/L	0.1	4.6	4.6	0.0
	Total phosphorus	mg/L	0.01	<0.01	<0.01	0.0
	Reactive phosphorus	mg/1	0.01	0.01	0.01	0.0
Metals (dissolved)	Aluminium	mg/L	0.01	0.01	<0.01	0.0
	Arsenic	mg/L	0.001	0.006	0.006	0.0
	Boron	mg/L	0.05	<0.05	<0.05	0.0
	Cadmium	mg/L	0.0001	<0.0001	<0.0001	0.0
	Chromium	mg/L	0.001	<0.001	<0.001	0.0
	Copper	mg/L	0.001	<0.001	<0.001	0.0
	Iron	mg/L	0.05	1.89	1.77	6.6
	Lead	mg/L	0.001	<0.001	<0.001	0.0
	Manganese	mg/L	0.001	2.270	2.261	0.4
	Nickel	mg/L	0.001	<0.001	<0.001	0.0
	Zinc	mg/L	0.005	<0.005	<0.005	0.0
Other	Oil and grease	mg/L	5	<5	<5	0.0
	Total suspended solids	mg/L	0.005	35	40	13.3

Appendix D

Additional monitoring for investigation

creating opportunities

Table D.1 Additional monitoring results (Q3 monitoring round – surface water)

Group	Parameter	Units	LOR	Trigger value	Baseline data range	Pit
Field	Temperature	°C	-	–	–	18.7
	Electrical conductivity	µS/cm	-	125–2,200	773 – 5,990	4,824
	pH	–	-	6.5–8.5	7.8 – 8.6	8.75
	Dissolved oxygen	% sat	-	85%–110%	–	84.7
	Dissolved oxygen	mg/L	-	–	8 – 10.5	7.66
	Redox potential	mV	-	–	–	8.74
	Total dissolved solids	mg/L	-	–	398 – 3,720	4,263
Nutrients	Ammonia	mg/L	0.01	0.02	<0.01 – 0.1	0.08
	Oxidised nitrogen	mg/L	0.01	0.04	<0.01 – 6.51	0.14
	Total kjeldahl nitrogen	mg/L	0.1	–	0.2 – 1.4	0.3
	Nitrite	mg/L	0.01	–	<0.01 – 0.13	<0.01
	Nitrate	mg/L	0.01	–	<0.01 – 6.38	0.14
	Total nitrogen	mg/L	0.1	0.5	0.2 – 7.9	0.4
	Total phosphorus	mg/L	0.01	0.05	<0.01 – 0.13	0.01
	Reactive phosphorus	mg/L	0.01	0.02	<0.01 – <0.01	0.01
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	<0.01 – 0.04	0.020
	Arsenic	mg/L	0.001	0.013	<0.001 – 0.001	0.002
	Boron	mg/L	0.05	0.37	<0.05 – <0.05	<0.05
	Cadmium	mg/L	0.0001	0.0002	<0.0001 – <0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	<0.001 – 0.0005	<0.001
	Copper	mg/L	0.001	0.0014	<0.001 - 0.019	0.001
	Iron	mg/L	0.05	0.3	<0.05 – <0.05	<0.05
	Lead	mg/L	0.001	0.0034	<0.001 – <0.001	<0.001
	Manganese	mg/L	0.001	1.9	<0.001 – 0.059	0.004
	Nickel	mg/L	0.001	0.011	<0.001 – 0.004	0.002
	Zinc	mg/L	0.005	0.008	<0.005 – 0.026	0.005
Other	Oil and grease	mg/L	5	<5	<5	<5
	Total suspended solids	mg/L	5	–	–	16

Table D.2 Additional monitoring results (Q3 monitoring round – hydrocarbons)

Group	Parameter	Units	LOR	Recovery limits (%)	BSM1	BSM2	BSM3	Pit
Polynuclear Aromatic Hydrocarbons	Naphthalene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Acenaphthylene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Acenaphthene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Fluorene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Phenanthrene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Anthracene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Fluoranthene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Pyrene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Benz(a)anthracene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Chrysene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Benzo(b+j)fluoranthene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Benzo(k)fluoranthene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Benzo(a)pyrene	µg/L	0.5	-	<0.5	<0.6	<0.5	<0.5
	Indeno(1.2.3.cd)pyrene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Dibenz(a.h)anthracene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Benzo(g.h.i)perylene	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0
	Sum of polycyclic aromatic hydrocarbons	µg/L	0.5	-	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (zero)	µg/L	0.5	-	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons	C6 - C9 Fraction	µg/L	20	-	<20	<20	<20	<20
	C10 - C14 Fraction	µg/L	20	-	<50	50	<50	<50
	C15 - C28 Fraction	µg/L	100	-	280	370	<100	<100
	C29 - C36 Fraction	µg/L	50	-	<50	180	<50	<50
	C10 - C36 Fraction (sum)	µg/L	50	-	280	600	<50	<50
Total Recoverable Hydrocarbons - NEPM 2013 Fractions	C6 - C10 Fraction	µg/L	20	-	<20	<20	<20	<20
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	-	<20	<20	<20	<20
	>C10 - C16 Fraction	µg/L	100	-	230	<100	<100	<100
	>C16 - C34 Fraction	µg/L	100	-	<100	440	<100	<100
	>C34 - C40 Fraction	µg/L	100	-	<100	110	<100	<100
	>C10 - C40 Fraction (sum)	µg/L	100	-	230	550	<100	<100

Table D.2 Additional monitoring results (Q3 monitoring round – hydrocarbons)

Group	Parameter	Units	LOR	Recovery limits (%)	BSM1	BSM2	BSM3	Pit
	>C10 - C16 Fraction minus Naphthalene (F2)	µg/L	100	-	230	<100	<100	<100
BTEXN	Benzene	µg/L	1	-	<1	<1	<1	<1
	Toluene	µg/L	2	-	<2	<2	<2	<2
	Ethylbenzene	µg/L	2	-	<2	<2	<2	<2
	meta- & para-Xylene	µg/L	2	-	<2	<2	<2	<2
	ortho-Xylene	µg/L	2	-	<2	<2	<2	<2
	Total Xylenes	µg/L	2	-	<2	<2	<2	<2
	Sum of BTEX	µg/L	1	-	<1	<1	<1	<1
	Naphthalene	µg/L	5	-	<5	<5	<5	<5

Appendix E

Water quality timeseries charts

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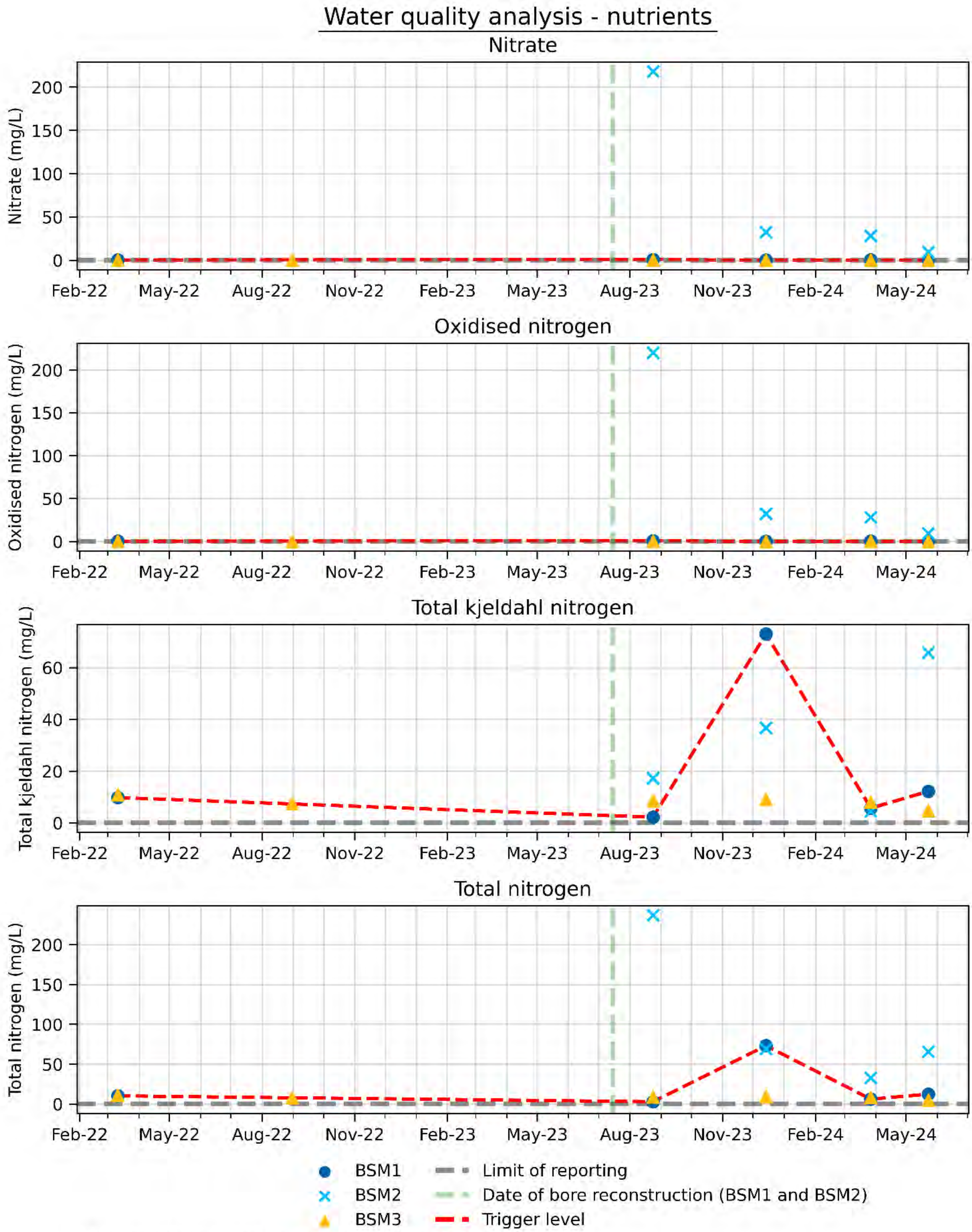
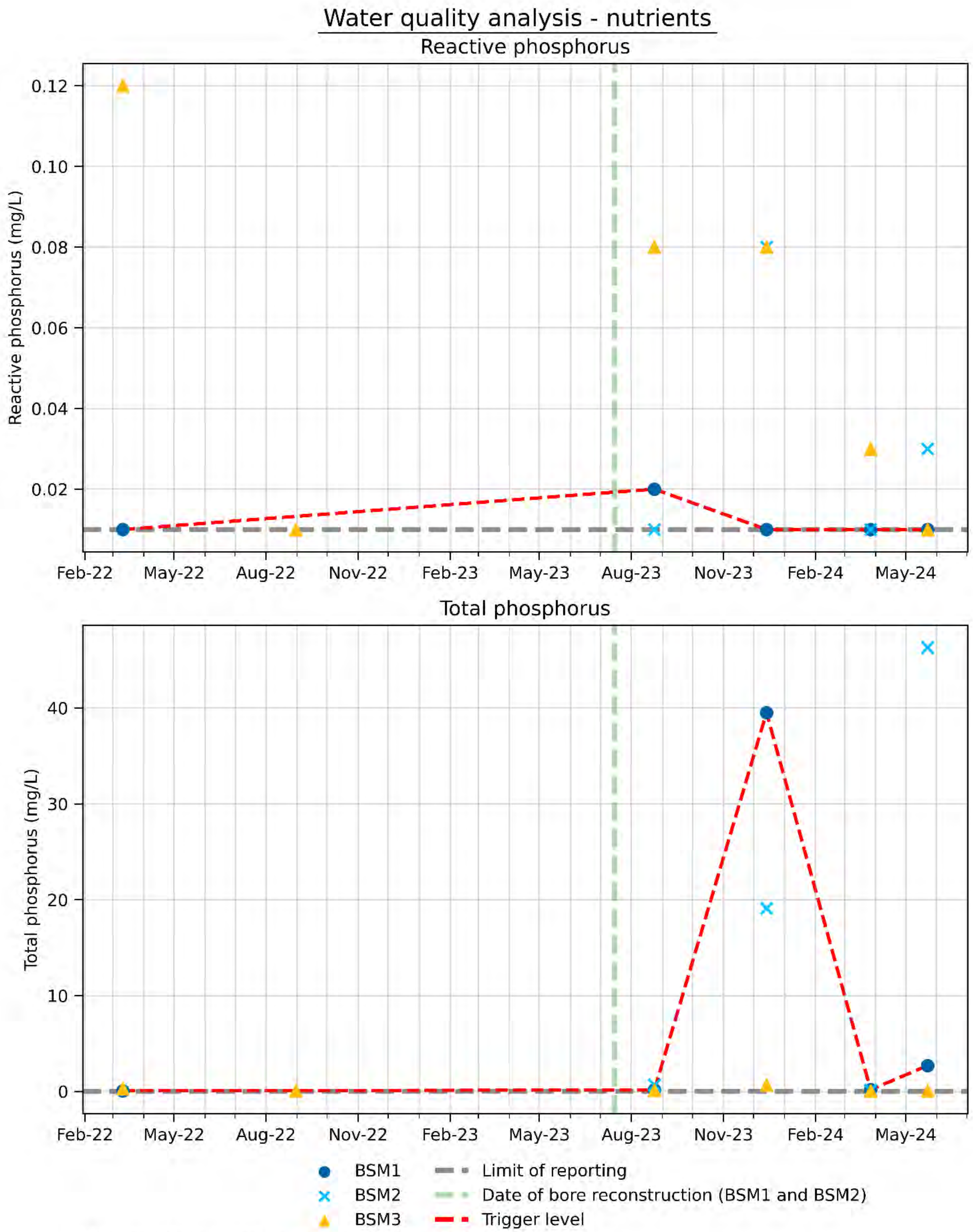
E.1 Timeseries water quality charts – nutrients

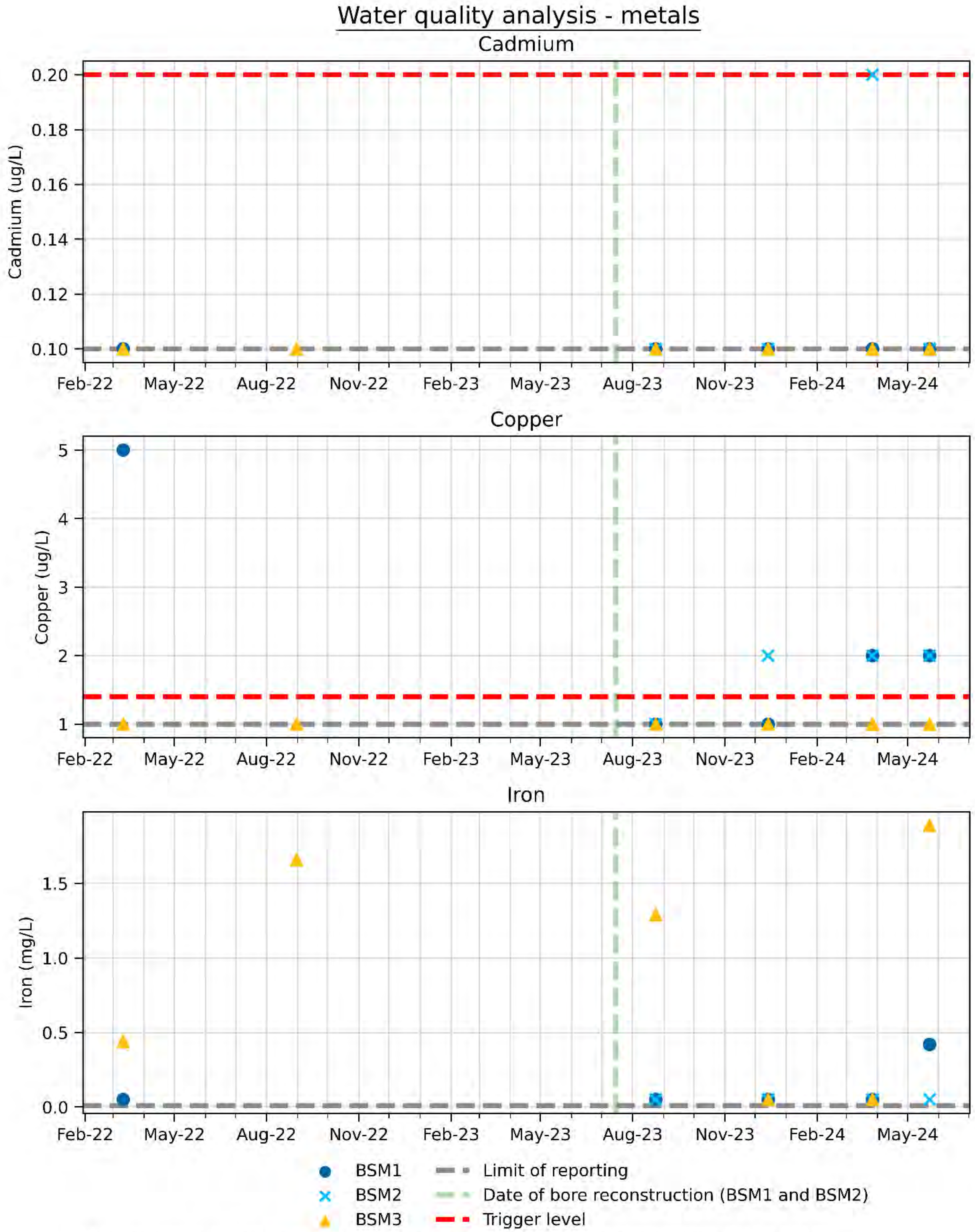


*Trigger values based on upgradient bore (BSM1).

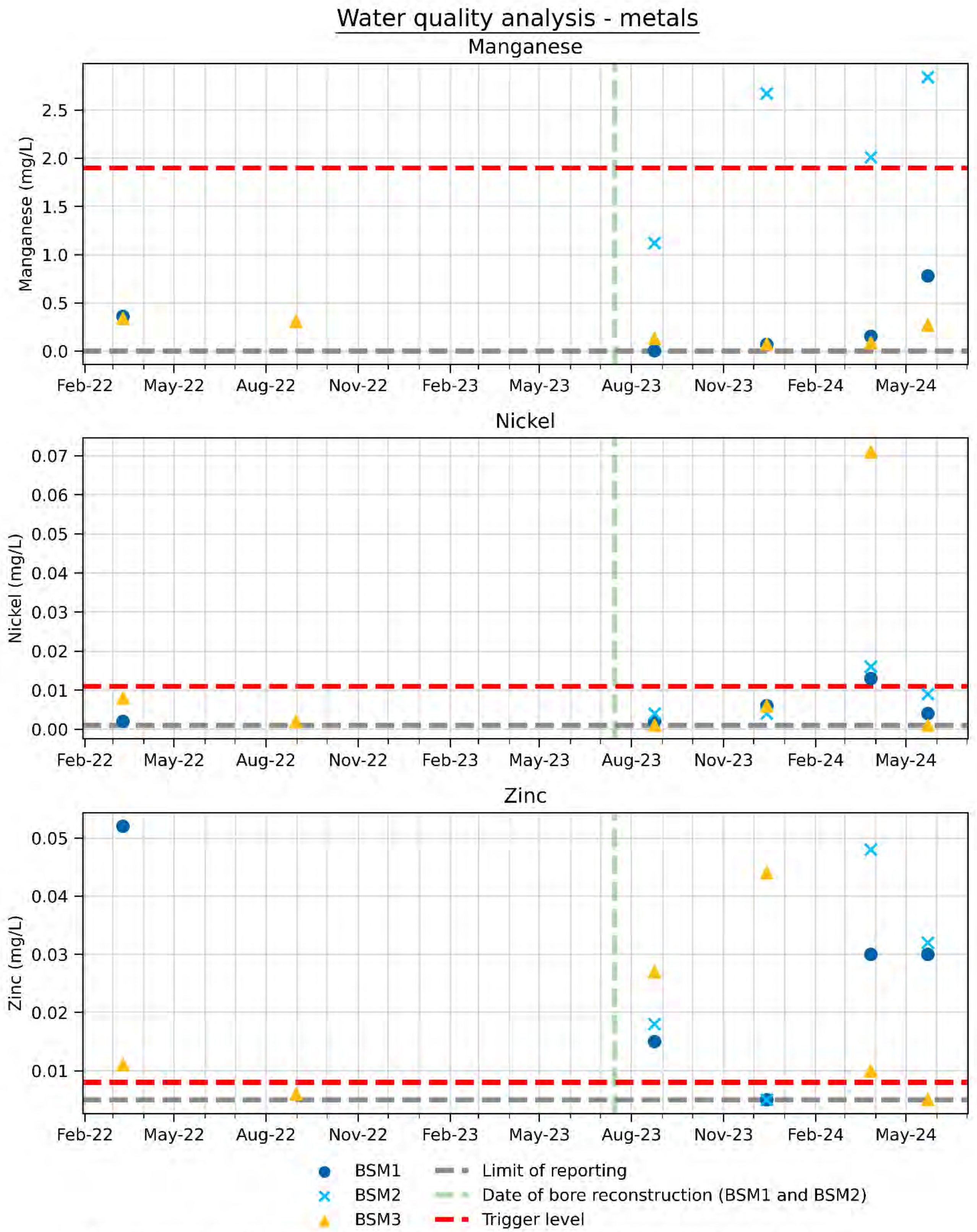


*Trigger values based on upgradient bore (BSM1).

E.2 Timeseries water quality charts – metals

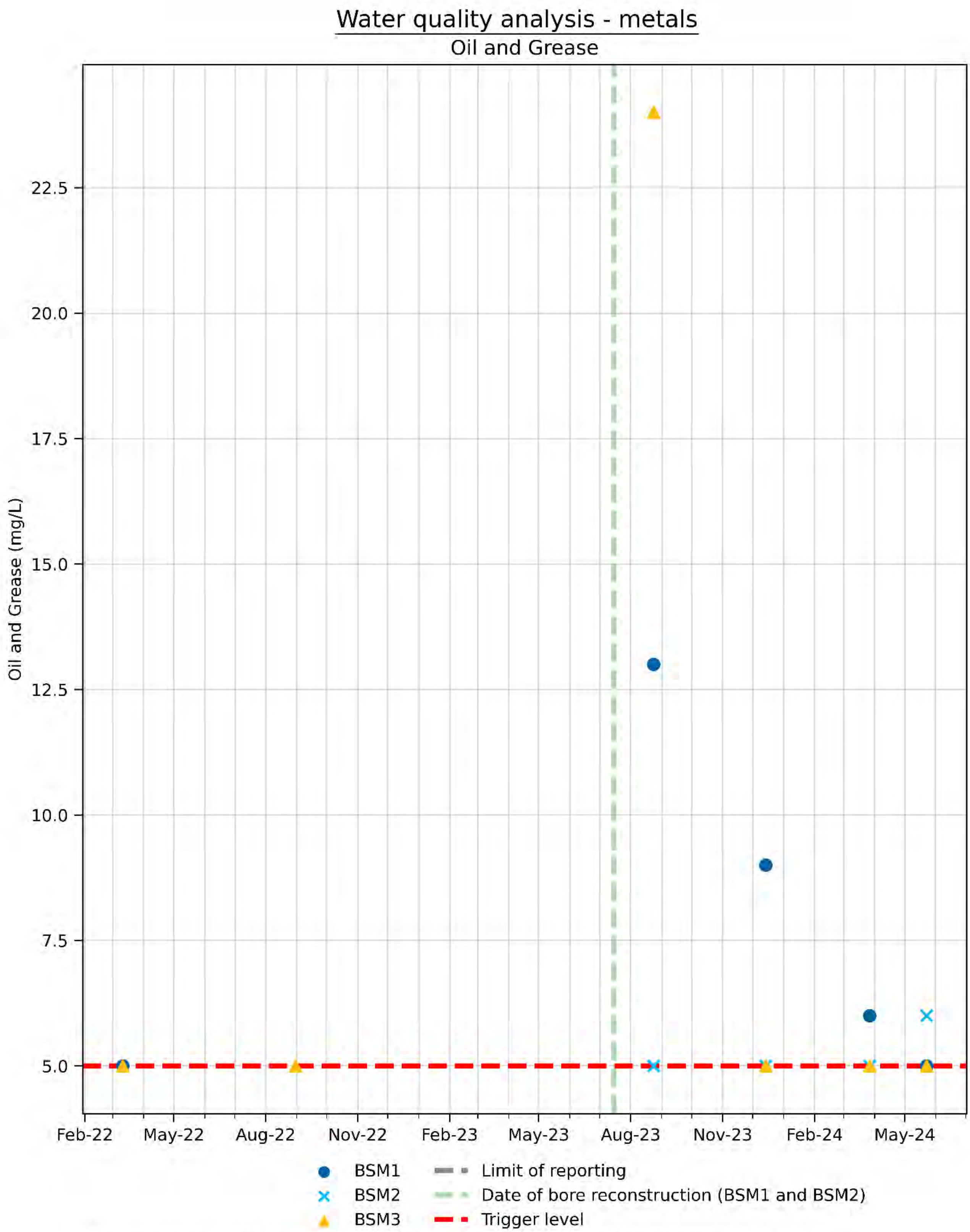


*Trigger values based on slightly-moderately disturbed riverine ecosystems (ANZG 2018).



*Trigger values based on slightly-moderately disturbed riverine ecosystems (ANZG 2018).

E.3 Timeseries water quality charts – oil and grease



*Trigger values based on slightly-moderately disturbed riverine ecosystems (ANZG 2018).

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558
02 9493 9500
www.emmconsulting.com.au

Memorandum

17 September 2029

To: Pascal Bobillier
General Manager - Development
Coombes Property Group

From: Patrick Carolan

Subject: Luddenham Quarry SWMP monitoring results (Q4 - 2023/2024)

Dear Pascal,

1 Background

This memorandum outlines groundwater water quality and level monitoring undertaken by EMM Consulting Pty Ltd (EMM) for Luddenham Quarry (the site), as required by the water monitoring program that was developed for the Soil and Water Management Plan (SWMP) (EMM 2021).

The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring (refer Appendix A for monitoring locations).

Monitoring outlined in this report was completed on 7 August 2024 for the period of June 2024 to August 2024 (Q4 of the 2023-2024 annual review period).

2 Water monitoring

2.1 Program overview

2.1.1 Monitoring locations

i Groundwater monitoring network

Three monitoring bores exist at the site, installed to a depth of approximately 30 metres (m) into the Bringelly Shale. The monitoring bores are sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

Sites BSM1 and BSM2 were replaced with new bores in 2023, with subsequent monitoring producing anomalous results. Redevelopment of the bores was attempted ahead of the Q1 monitoring round (refer Q1 23-24 monitoring report, EMM 2024).

ii Surface water monitoring locations

The surface water monitoring program consists of the following locations (refer Appendix A):

- Oaky Creek upstream of the site
- Oaky Creek downstream of the site
- water stored within the quarry pit
- water stored within the water management dam.

2.1.2 Water quality analytes

The analytical suite for the monitoring program is presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

Detailed hydrocarbon analysis was added to the analytical suite as recommended in the Q2 groundwater monitoring report, to assist in determining the likely source of oil and grease found in previous monitoring (i.e. lubricants used as part of the drilling process, oils or greases used as part of quarry operations, diesel etc).

In Q4 silica gel cleanup was a step added to the analytical process of testing for hydrocarbons. Silica is a polar material that is used to adsorb (remove) non-hydrocarbon polar organics during the sample extraction process.

Table 2.1 Water quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids, turbidity	In the field with a calibrated hand-held water quality meter
	Total suspended solids	Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory
Hydrocarbons[1]	BTEXN (benzene, toluene, ethylbenzene, xylene and naphthalene), TRH/TPH (total petroleum hydrocarbon) and PAH (polycyclic aromatic hydrocarbons). Including analysis/results for Chromatogram. TRH/TPH (total petroleum hydrocarbon) with Silica Gel Cleanup.	Analysis undertaken at NATA accredited laboratory

Table notes:

1. Hydrocarbon analysis undertaken for exceedance investigations from previous monitoring rounds.

2.1.3 Water level monitoring

Water levels are monitored using an interface probe at each monitoring bore during sampling. A deviation of two meters from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two meters as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

2.2 Completed monitoring

The following sections describe the completed monitoring and field observations. Key results are discussed in Section 2.3 and detailed results are provided in the following appendices:

- Appendix B: Groundwater levels
- Appendix C: Water quality monitoring results
- Appendix D: Water quality timeseries charts.

2.2.1 Rainfall context

The Bureau of Meteorology operates a rain gauge at Badgerys Creek (approximately 3 kilometres (km) from the site – Station number: 067108). No rainfall was recorded at the station in the five days preceding the monitoring event.

2.2.2 Groundwater

Field observations for completed groundwater monitoring is presented in Table 2.2.

Table 2.2 Field observations (groundwater monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
07/08/2024 – 11:07 AM	BSM1	Upgradient bore to measure background contamination levels.	Bore water initially appeared clear but transitioned to brown and highly turbid during purging and when the sample was taken. No odour noted.
07/08/2024 – 08:29 AM	BSM2	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore water initially appeared clear but transitioned to slightly brown and turbid during purging and when the sample was taken. A field duplicate was taken as a quality assurance (QA) sample at this bore.
07/08/2024 – 08:51 AM	BSM3	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore water maintained consistent clear colour with a sulphurous odour. Fizzy foam noted during purging.

2.2.3 Surface water

Field observations for completed surface water monitoring is presented in Table 2.3

Table 2.3 Field observations (surface water monitoring)

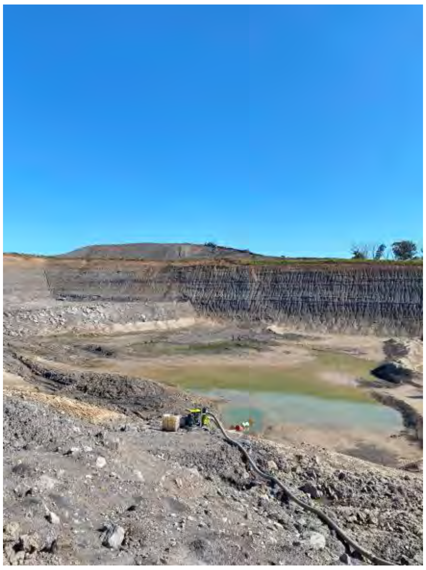
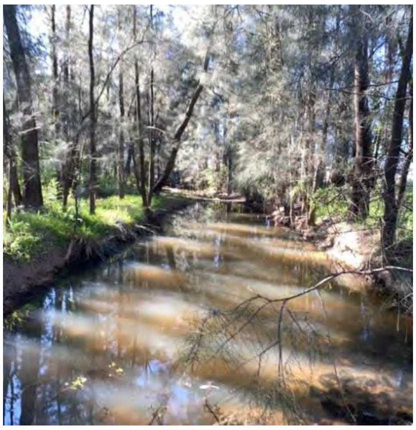
Time of sample	Monitoring point	Site description	Field comments/context	Site photos
Surface water sampling locations				
07/08/2024 – 12:48 AM	QUARRY PIT	Sample of the pit quarry water in the NE corner of the pit.	Murky green. Quarry pit water level was low compared to previous inspection on monitoring rounds.	
07/08/2024 – 01:25 PM	UPSTREAM	Upstream sample point of Oaky Creek	Creek flow stagnant with scum on top of water.	
07/08/2024 – 01:45 PM	DOWNSTREAM	Downstream sample point of Oaky Creek	Creek flow stagnant with scum on top of water.	Not available

Table 2.3 Field observations (surface water monitoring)

Time of sample	Monitoring point	Site description	Field comments/context	Site photos
Surface water sampling locations				
07/08/2024 - 12:45	WATER MANAGEMENT DAM	Water management dam	Clear water. Dam is full, water level above bank level	

2.2.4 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Smithfield, NSW for analysis. All laboratory analytes that were not additionally measured *in situ* (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

2.2.5 Quality assurance/quality control (QA/QC)

Samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location, and
- collection of a field duplicate sample.

Quality assurance/control was assessed by calculating relative percentage difference (RPD) of the field duplicate ($S_{duplicate}$) sample to the parent sample (S_{parent}) as per the following equation.

$$Relative\ \%\ difference = \frac{|S_{parent} - S_{Dupilcate}|}{\frac{S_{parent} + S_{Dupilcate}}{2}} \times 100$$

Results were considered to confirm acceptable degree of data quality where RPDs were below 30%.

Most results for the monitoring round were within RPD limits (refer Appendix C), indicating adequate QA/QC. Copper concentrations at BSM2 exceeded RPD limits, however the elevated RPD is attributed to low detected concentrations.

2.3 Monitoring results - general observations

2.3.1 Groundwater levels

Water levels in all bores for the monitoring period (refer Appendix B) are relatively consistent with baseline trends and no further action is required with respect to groundwater levels.

2.3.2 Groundwater quality

Key observations of groundwater quality for the monitoring period include the following:

- pH was neutral to acidic in all bores.
- Salinity, as indicated by electrical conductivity (EC), was significantly lower in BSM1 than noted in BSM2 and BSM3. Results at these downgradient bores are more typical of baseline trends, suggesting that the upgradient/BSM1 results may include surface water ingress.
- Nutrients remain significantly elevated above baseline in all bores, particularly nitrate in BSM2. However, these results are not reflected in the sample taken at the pit, indicating that the elevated nutrients are contained to the groundwater system, attributable to an external source or localised within the wells.
- Elevated metals were noted in some bores (discussed in Section 2.4).

2.3.3 Surface water quality

Key observations of the surface water quality are summarised below:

- pH was neutral in the receiving environment and basic in the water management storages.
- EC was elevated above historical monitoring. However, this was noted in the Oaky Creek upstream sampling site. EC in the quarry pit was elevated above historical levels, likely due to the use of evaporative misters on site.

2.4 Review of exceedances

Water quality results were reviewed for trigger exceedances, via comparison of default guideline values or comparison of other chemical properties to the upgradient bore (BSM1).

An assessment of exceedances including actions taken and recommendations for the groundwater monitoring is presented in Table 2.4.

Table 2.4 Review of exceedances (groundwater)

Exceedance description	Assessment, actions taken and recommendations
Field parameters	
Electrical conductivity at the upgradient bore was significantly lower than the 2x downgradient bores.	Baseline data results were reviewed, where the following was noted: • Results of the two downgradient bores (BSM2 and BSM3) are relatively consistent with historical data. • Concentrations at BSM1 are significantly lower than the historical data, suggesting that surface water ingress or inflows from a separate water source may be present. Bore construction information was sourced from the original well installation and reviewed. The following observations are noted from the bore construction information for each of the new wells: • Wells were drilled to approximately 30 metres. • A six-metre screen was installed at the base of the wells, with a 25 m gravel pack backfilled (from 5 m to 30 metres below ground level (mbgl)). • A five-metre bentonite seal was installed at the top portion of the bore. • No lithology information from the drilling was available for review. It is understood that a layer of clay/alluvium is situated close to the surface level atop the Bringelly Shale hydrogeological unit. Based on the above bore construction information, it is possible that the shallow alluvial aquifer and the Bringelly Shale aquifer are both contributing to the monitoring bores and producing inconsistencies in the monitoring results.
Hydrocarbons	
Oil and grease was below detection limits in all bores; however, TRH and TPH were above detection in BSM1 and BSM2.	A silica gel cleanup was undertaken for all samples and hydrocarbon analysis was repeated. TRH/TPH concentrations were below detection for all hydrocarbon fractions following the silica gel cleanup procedure, indicating that hydrocarbons noted on site are related to biogenic organic compounds and not the site operations.
Nutrients	
Ammonia exceeded the upgradient bore concentration (0.2 mg/L) at both downgradient bores with concentrations of 1.2 mg/L and 4.7 mg/L at BSM2 and BSM3 respectively. Oxidised nitrogen significantly exceeded the upgradient bore concentration (below detection) at BSM2 with a concentration of 64.3 mg/L. Total nitrogen exceeded the upgradient bore concentration (36 mg/L) at BSM2 with concentrations of 69.9 mg/L	Baseline data results were reviewed, where the following was noted: • No historical records of ammonia or total nitrogen were available. • Oxidised nitrogen was noted to be significantly above historical records (with respect to nitrite and nitrate results typically less than 0.01 mg/L). Timeseries charts of nutrients exceedances were prepared (refer Appendix E). The following observations are made from charts in Section E.1: • Groundwater exceedances for nutrients generally appear to occur following the bore installation in July 2023. • Recent trends of a reduction in nutrient concentrations over time, no longer appear to be consistent. The results of silica gel cleanup from hydrocarbon analysis indicated the presence of biogenic organic compounds in the groundwater samples from a source unrelated to site operations. The source of the biogenic organic compounds may also relate to the high nutrient levels recorded by the monitoring program.

Table 2.4 Review of exceedances (groundwater)

Exceedance description	Assessment, actions taken and recommendations
Metals	
Chromium exceeded the trigger value at BSM3 with a concentration of 0.003 mg/L.	Baseline data results were reviewed, where the following was noted: • Chromium, Copper, Iron and Zinc have been noted in the bores historically at similar concentrations. • No historical records of aluminium or manganese are available. Manganese was also elevated in the previous monitoring round. Surface water results were also reviewed. Monitoring of the quarry pit showed some exceedances in metals however, these were not consistent with the analytes or magnitude of concentrations recorded in the groundwater results. Timeseries charts of metals exceedances were prepared (refer Appendix E). The following observations are made from charts in Section E.2: • No obvious trends are discernible from the timeseries charts and exceedances of similar magnitude are generally known to occur for some metals in the historical baseline dataset.
Copper exceeded the trigger value at BSM2 with a concentration of 0.005 mg/L.	
Aluminium exceeded the trigger value at BSM2 with a concentration of 0.11 mg/L.	
Manganese exceeded the trigger value at BSM2 with a concentration of 2.56 mg/L.	
Zinc exceeded the trigger values at BSM1 and BSM2 with concentrations of 0.016 and 0.026 mg/L respectively.	

An assessment of exceedances including actions taken and recommendations for the surface water monitoring program is presented Table 2.5.

Table 2.5 Review of exceedances (surface water)

Exceedance description	Assessment, actions taken and recommendations
Nutrients	
Ammonia exceeded the trigger value (0.02 mg/L) at the Oaky Creek downstream site with a concentration of 0.05 mg/L.	Results of other surface water monitoring were reviewed, including: • The upstream Oaky Creek site, which had a much higher concentration of 0.46 mg/L. This indicates ammonia is naturally occurring or present from activities upstream of the site. • Both water management storages exceeded the trigger value for ammonia; however, concentrations were an order of magnitude below the upstream Oaky Creek value.
Metals	
Copper exceeded the trigger value at the Oaky Creek downstream site with a concentration of 0.002 mg/L.	Results of the upstream Oaky Creek monitoring was reviewed, which had a similar concentration, indicating copper is naturally occurring or present from activities upstream of the site.

3 Summary and recommendations

The following provides a summary of additional investigations:

- The silica gel cleanup process was successful in showing that hydrocarbons found on site are related to biogenic material and not the site operations.
- The construction details of monitoring wells BSM1 and BSM2 were reviewed, which noted that the wells have an extended gravel pack from 5 – 30 mbgl. It is possible that this construction method is capturing multiple sources of groundwater inflow, if the gravel pack extends across both a shallow alluvial aquifer and the Bringelly Shale. No lithology information was provided with the bore construction details, and it is

therefore not possible to confirm the source of groundwater inflows to the wells. If detailed bore logs with lithology cannot be provided for the new wells, additional drilling and installation of monitoring wells with screens and gravel packs separately targeting observed aquifers may be beneficial to confirm the impacted aquifer(s) and inform source investigations or eliminate if the wells were contaminated as a result of the installation process.

The following recommendations are made for future monitoring:

- It is recommended that the total recoverable hydrocarbon analysis and silica gel cleanup process is continued on future samples to assist with determining the source of any future oil and grease concentrations.

- Continue to monitor groundwater quality results over the next AR period and investigate regional sources of anomalous results. Consider additional investigative drilling to confirm lithology and/or consider replacement of monitoring wells with appropriate design to enable control impact monitoring, if water quality results do not normalise by the end of the next AR period.

Please contact the undersigned with any questions or clarifications.

Yours sincerely

Patrick Carolan
Senior Water Resources Engineer
pcarolan@emmconsulting.com.au

Appendix A

Water quality monitoring locations

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\\emm.local\xdrive\2023\E231131 - Luddenham Quarry - Environmental Monitoring\GIS\02_Maps\190749\SWM003_WQMonitoringLocations_20240927_03.mxd 27/09/2024

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

KEY
- Study area
- Cadastral boundary
- Watercourse
- Water quality monitoring location
- Groundwater monitoring bore

Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 1

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Appendix B
Groundwater levels

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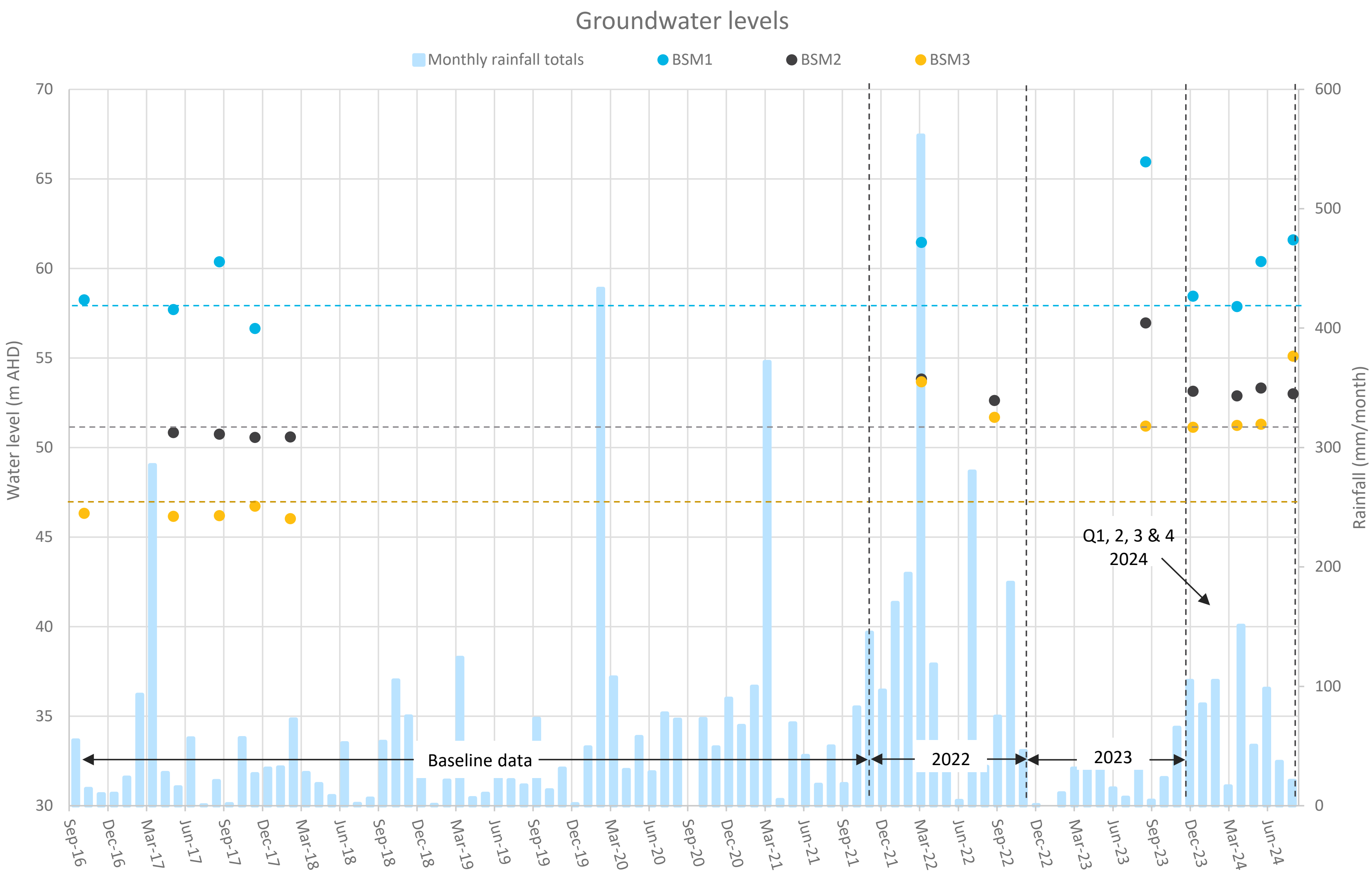

Figure B.1 Ground water levels

Appendix C
Water quality monitoring results

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Table C.1 Water quality monitoring results (Q4 monitoring round - groundwater)

Group	Unit	LOR	ANZECC (2000)	Trigger value (groundwater)	Groundwater BSM1	BSM2	BSM3
Field parameters							
Temperature	°C	-	-	-	19.3	18	17.7
Electrical conductivity	µS/cm	-	-	BSM1	6,714	25,666	21,995
pH	-	-	6.5-8.5	6.5-8.5	7.2	6.9	6.7
Dissolved oxygen	% sat	-	-	-	90.8	35.2	22.1
Dissolved oxygen	mg/L	-	-	-	8.13	3.04	1.85
Redox potential	mg/L	-	-	-	42.2	-21.7	-190
Total dissolved solids	mg/L	-	-	BSM1	4,369	22,236	14,253
Nutrients							
Ammonia as N	mg/L	0.01	0.02	BSM1	0.2	1.2	4.7
Kjeldahl Nitrogen Total	mg/L	0.1	-	BSM1	36	5.6	7.2
Nitrite (as N)	mg/L	0.01	-	BSM1	<0.01	0.02	<0.01
Nitrate (as N)	mg/L	0.01	-	BSM1	<0.01	64.3	<0.01
Nitrite + Nitrate as N	mg/L	0.01	0.04	BSM1	<0.01	64.3	<0.01
Nitrogen (Total)	mg/L	0.1	0.5	BSM1	36	69.9	7.2
Reactive Phosphorus as P	mg/L	0.01	-	BSM1	0.01	0.01	<0.01
Total Phosphorus	mg/L	0.01	0.05	BSM1	17.8	0.29	0.04
Hardness as $CaCO_3$ (filtered)	mg/L	1	-	-	3,460	3,910	3,560
Analytical results – general							
Total suspended solids	mg/L	5	-	BSM1	2,070	218	42
Hardness as $CaCO_3$ (filtered)	mg/L	1	-	-	3,460	3,910	3,560
Metals (dissolved)							
Arsenic	mg/L	0.001	0.013	0.013	0.002	0.001	0.001
Cadmium	mg/L	0.0001	0.0002	0.0002	<0.0001	0.0001	<0.0001
Chromium (III+VI)	mg/L	0.001	0.001	0.001	<0.001	<0.001	0.003
Mercury	mg/L	0.0001	0.0006	0.0006	<0.0001	<0.0001	<0.0001
Copper	mg/L	0.001	0.0014	0.0014	0.001	0.005	<0.001
Iron	mg/L	0.05	-	-	1.44	0.73	0.6
Aluminium	mg/L	0.01	0.055	0.055	0.01	0.11	<0.01
Lead	mg/L	0.001	0.0034	0.0034	<0.001	<0.001	<0.001
Boron	mg/L	0.05	0.37	0.37	0.05	<0.05	<0.05
Manganese	mg/L	0.001	1.9	1.9	0.544	2.56	0.245
Selenium	mg/L	0.01	0.011	0.011	<0.01	<0.01	<0.01
Nickel	mg/L	0.001	0.011	0.011	0.002	0.008	0.007
Zinc	mg/L	0.005	0.008	0.008	0.016	0.026	<0.005
BTEX							
Benzene	µg/L	1	950	LOR	<1	<1	<1
Toluene	µg/L	2	180	LOR	<2	<2	<2
Ethylbenzene	µg/L	2	80	LOR	<2	<2	<2
Xylene (m & p)	µg/L	2	-	LOR	<2	<2	<2
Xylene (o)	µg/L	2	350	LOR	<2	<2	<2
Xylene Total	µg/L	2	-	LOR	<2	<2	<2
Total BTEX	µg/L	1	-	LOR	<1	<1	<1
Naphthalene (VOC)	mg/L	0.005	-	LOR	<0.005	<0.005	<0.005
TRH							
C6-C10	µg/L	20	-	LOR	<20	<20	<20
C6 - C10 less BTEX	µg/L	20	-	LOR	<20	<20	<20
>C10-C16	µg/L	100	-	LOR	220	320	<100
>C10 - C16 less Naphthalene	µg/L	100	-	LOR	220	320	<100
>C16-C34	µg/L	100	-	LOR	490	350	<100
>C34-C40	µg/L	100	-	LOR	<100	<100	<100
>C10-C40 (Sum of total)	µg/L	100	-	LOR	710	670	<100
TRH - (Post Silica Gel Cleanup)							
TRH >C10 - C16 less Naphthalene	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TRH >C10-C16	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TRH >C16-C34	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TRH >C34-C40	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TRH >C10 - C40 (total)	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TPH							
Oil and Grease	mg/L	5	-	LOR	<5	<5	<5
C6-C9	µg/L	20	-	LOR	<20	<20	<20
C10-C14	µg/L	50	-	LOR	120	80	<50
C15-C28	µg/L	100	-	LOR	500	600	<100
C29-C36	µg/L	50	-	LOR	120	100	<50
C10-C36 (total)	µg/L	50	600	LOR	740	780	<50
TPH - (Post Silica Gel Cleanup)							
TPH C10-C14	mg/L	0.05	-	LOR	<0.05	<0.05	<0.05
TPH C15-C28	mg/L	0.1	-	LOR	<0.1	<0.1	<0.1
TPH C29-C36	mg/L	0.05	-	LOR	<0.05	<0.05	<0.05
TPH C10-C36 (total)	mg/L	0.05	600	LOR	<0.05	<0.05	<0.05

Table C.2 Water quality monitoring results (Q4 monitoring round – surface water)

Group	Unit	LOR	ANZECC (2000)	Trigger value (surface water)	Surface water: Oaky Creek US	Surface water: Oaky Creek DS	Surface water: Pit	Surface water: Water management dam
Field parameters								
Temperature	**°C**	-	-	-	11.5	11.3	17.9	14.4
Electrical conductivity	**µS/cm**	-	125-2,200	125-2,200	2,267	2,148	15,116	5,905
pH	**-**	-	6.5 - 8.5	6.5 - 8.5	7.9	7.7	8.6	8.4
Dissolved oxygen	**% sat**	-	-	-	70.2	88.9	140.8	89
Dissolved oxygen	**mg/L**	-	-	-	7.6	9.7	12.7	8.9
Redox potential	**mg/L**	-	-	-	48	49.1	49.6	56
Total dissolved solids	**mg/L**	-	-	-	1,472	1,396	9,826	3,839
Turbidity	**NTU**	-	50	50	13.0	6.9	25.2	5.7
Nutrients								
Ammonia as N	**mg/L**	0.01	0.02	0.02	0.46	0.05	0.08	0.09
Kjeldahl Nitrogen Total	**mg/L**	0.1	-	-	1.2	0.5	0.4	0.5
Nitrite (as N)	**mg/L**	0.01	-	-	<0.01	<0.01	<0.01	<0.01
Nitrate (as N)	**mg/L**	0.01	-	-	<0.01	0.03	<0.01	<0.01
Nitrite + Nitrate as N	**mg/L**	0.01	0.04	0.04	<0.01	0.03	<0.01	<0.01
Nitrogen (Total)	**mg/L**	0.1	0.5	0.5	1.2	0.5	0.4	0.5
Reactive Phosphorus as P	**mg/L**	0.01	-	0.02	<0.01	<0.01	<0.01	<0.01
Total Phosphorus	**mg/L**	0.01	0.05	0.05	0.03	0.03	0.02	0.04
Analytical results – general								
Total suspended solids	**mg/L**	5	-	-	5	<5	32	9
Hardness as $CaCO_3$ (filtered)	**mg/L**	1	-	-	383	453	2,070	762
Metals (dissolved)								
Arsenic	**mg/L**	0.001	0.013	0.013	<0.001	<0.001	0.001	<0.001
Cadmium	**mg/L**	0.0001	0.0002	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (III+VI)	**mg/L**	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
Mercury	**mg/L**	0.0001	0.0006	0.0006	<0.0001	<0.0001	<0.0001	<0.0001
Copper	**mg/L**	0.001	0.0014	0.0014	0.002	0.002	0.002	<0.001
Iron	**mg/L**	0.05	-	-	<0.05	<0.05	<0.05	<0.05
Aluminium	**mg/L**	0.01	0.055	0.055	<0.01	<0.01	<0.01	<0.01
Lead	**mg/L**	0.001	0.0034	0.0034	<0.001	<0.001	<0.001	<0.001
Boron	**mg/L**	0.05	0.37	0.37	<0.05	<0.05	<0.05	<0.05
Manganese	**mg/L**	0.001	1.9	1.9	0.138	0.5	0.043	0.075
Selenium	**mg/L**	0.01	0.011	0.011	<0.01	<0.01	<0.01	<0.01
Nickel	**mg/L**	0.001	0.011	0.011	<0.001	<0.001	0.015	0.001
Zinc	**mg/L**	0.005	0.008	0.008	<0.005	<0.005	<0.005	<0.005
BTEX								
Benzene	**µg/L**	1	950	LOR	<1	<1	<1	<1
Toluene	**µg/L**	2	180	LOR	<2	<2	<2	<2
Ethylbenzene	**µg/L**	2	80	LOR	<2	<2	<2	<2
Xylene (m & p)	**µg/L**	2	-	LOR	<2	<2	<2	<2
Xylene (o)	**µg/L**	2	350	LOR	<2	<2	<2	<2
Xylene Total	**µg/L**	2	-	LOR	<2	<2	<2	<2
Total BTEX	**µg/L**	1	-	LOR	<1	<1	<1	<1
Naphthalene (VOC)	**mg/L**	0.005	-	LOR	<0.005	<0.005	<0.005	<0.005
TRH								
C6-C10	**µg/L**	20	-	LOR	<20	<20	<20	<20
C6 - C10 less BTEX	**µg/L**	20	-	LOR	<20	<20	<20	<20
>C10-C16	**µg/L**	100	-	LOR	<100	<100	<100	<100
>C10 - C16 less Naphthalene	**µg/L**	100	-	LOR	<100	<100	<100	<100
>C16-C34	**µg/L**	100	-	LOR	<100	<100	<100	<100
>C34-C40	**µg/L**	100	-	LOR	<100	<100	<100	<100
>C10-C40 (Sum of total)	**µg/L**	100	-	LOR	<100	<100	<100	<100
TRH - (Post Silica Gel Cleanup)								
TRH >C10 - C16 less Naphthalene	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TRH >C10-C16	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TRH >C16-C34	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TRH >C34-C40	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TRH >C10 - C40 (total)	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TPH								
Oil and Grease	**mg/L**	5	-	LOR	<5	<5	<5	<5
C6-C9	**µg/L**	20	-	LOR	<20	<20	<20	<20
C10-C14	**µg/L**	50	-	LOR	<50	<50	<50	<50
C15-C28	**µg/L**	100	-	LOR	<100	<100	<100	<100
C29-C36	**µg/L**	50	-	LOR	<50	<50	<50	<50
C10-C36 (total)	**µg/L**	50	600	LOR	<50	<50	<50	<50
TPH - (Post Silica Gel Cleanup)								
TPH C10-C14	**mg/L**	0.05	-	LOR	<0.05	<0.05	<0.05	<0.05
TPH C15-C28	**mg/L**	0.1	-	LOR	<0.1	<0.1	<0.1	<0.1
TPH C29-C36	**mg/L**	0.05	-	LOR	<0.05	<0.05	<0.05	<0.05
TPH C10-C36 (total)	**mg/L**	0.05	600	LOR	<0.05	<0.05	<0.05	<0.05

Table C.3 QA/QC assessment (Q4 monitoring round)

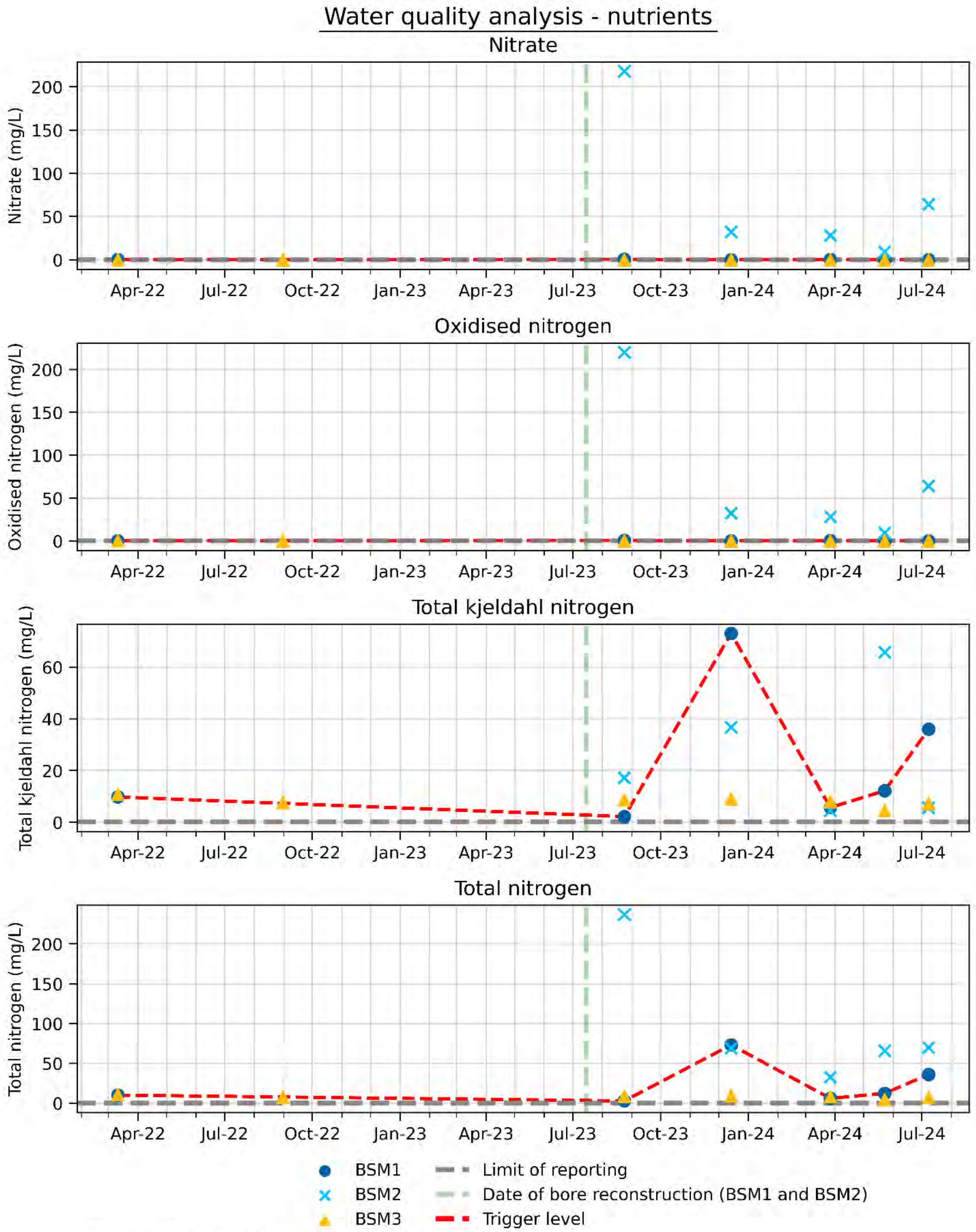
Groups	Unit	LOR	BSM2	QA	RPD
Physicochemical (lab analysis)					
Total suspended solids	mg/L	5	218	211	3
Ammonia as N	mg/L	0.01	1.2	1.25	4
Kjeldahl Nitrogen Total	mg/L	0.1	5.6	6.4	13
Nitrite + Nitrate as N	mg/L	0.01	64.3	65.8	2
Nitrogen (Total)	mg/L	0.1	69.9	72.2	3
Reactive Phosphorus as P	mg/L	0.01	0.01	<0.01	-
Phosphate total (as P)	mg/L	0.01	0.29	0.23	23
Analytical results – general					
Hardness as $CaCO_3$ (filtered)	mg/L	1	3,910	3,830	2
Metals (dissolved)					
Cadmium	mg/L	0.0001	0.0001	<0.0001	-
Aluminium	mg/L	0.01	0.11	0.13	17
Arsenic	mg/L	0.001	0.001	0.002	-
Boron	mg/L	0.05	<0.05	<0.05	0
Chromium (III+VI)	mg/L	0.001	<0.001	<0.001	0
Copper	mg/L	0.001	0.005	0.002	86
Iron	mg/L	0.05	0.73	0.94	25
Lead	mg/L	0.001	<0.001	<0.001	-
Manganese	mg/L	0.001	2.56	2.58	1
Mercury	mg/L	0.0001	<0.0001	<0.0001	-
Nickel	mg/L	0.001	0.008	0.009	12
Selenium	mg/L	0.01	<0.01	<0.01	-
Zinc	mg/L	0.005	0.026	0.03	14
NA					
Phosphate total (as P)	mg/L	0.01	0.29	0.23	23
TRH - (Silica Gel Cleanup)					
>C10 - C16 minus Naphthalene	mg/L	0.1	<0.1	<0.1	-
>C10 - C40 (total)	mg/L	0.1	<0.1	<0.1	-
BTEX					
Benzene	µg/L	1	<1	<1	-
Ethylbenzene	µg/L	2	<2	<2	-
Toluene	µg/L	2	<2	<2	-
Total BTEX	µg/L	1	<1	<1	-
Xylene (m & p)	µg/L	2	<2	<2	-
Xylene (o)	µg/L	2	<2	<2	-
Xylene Total	µg/L	2	<2	<2	-
Naphthalene (VOC)	mg/L	0.005	<0.005	<0.005	-
TRH					
C10-C16	µg/L	100	320	<100	-
C10-C16 (F2 minus Naphthalene)	µg/L	100	320	<100	-
C10-C40 (Sum of total)	µg/L	100	670	<100	-
C16-C34	µg/L	100	350	<100	-
C34-C40	µg/L	100	<100	<100	-
C6-C10	µg/L	20	<20	<20	-
C6-C10 (F1 minus BTEX)	µg/L	20	<20	<20	-
TPH					
Oil and Grease	mg/L	5	<5	<5	-
TPH C10-C14 Fraction after Silica Cleanup	mg/L	0.05	<0.05	<0.05	-
TPH C15-C28 Fraction after Silica Cleanup	mg/L	0.1	<0.1	<0.1	-
TPH C29-C36 Fraction after Silica Cleanup	mg/L	0.05	<0.05	<0.05	-
TRH >C10-C16 (after silica gel clean-up)	mg/L	0.1	<0.1	<0.1	-
TRH >C16-C34 (after silica gel clean-up)	mg/L	0.1	<0.1	<0.1	-
TRH >C34-C40 (after silica gel clean-up)	mg/L	0.1	<0.1	<0.1	-
TRH C10-C36 (Total) (after silica gel clean-up)	mg/L	0.05	<0.05	<0.05	-
+C10-C36 (Sum of total)	µg/L	50	780	<50	-
C15-C28	µg/L	100	600	<100	-
C10-C14	µg/L	50	80	<50	-
C29-C36	µg/L	50	100	<50	-
C6-C9	µg/L	20	<20	<20	-

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories.
Any methods in the row header relate to those used in the primary laboratory

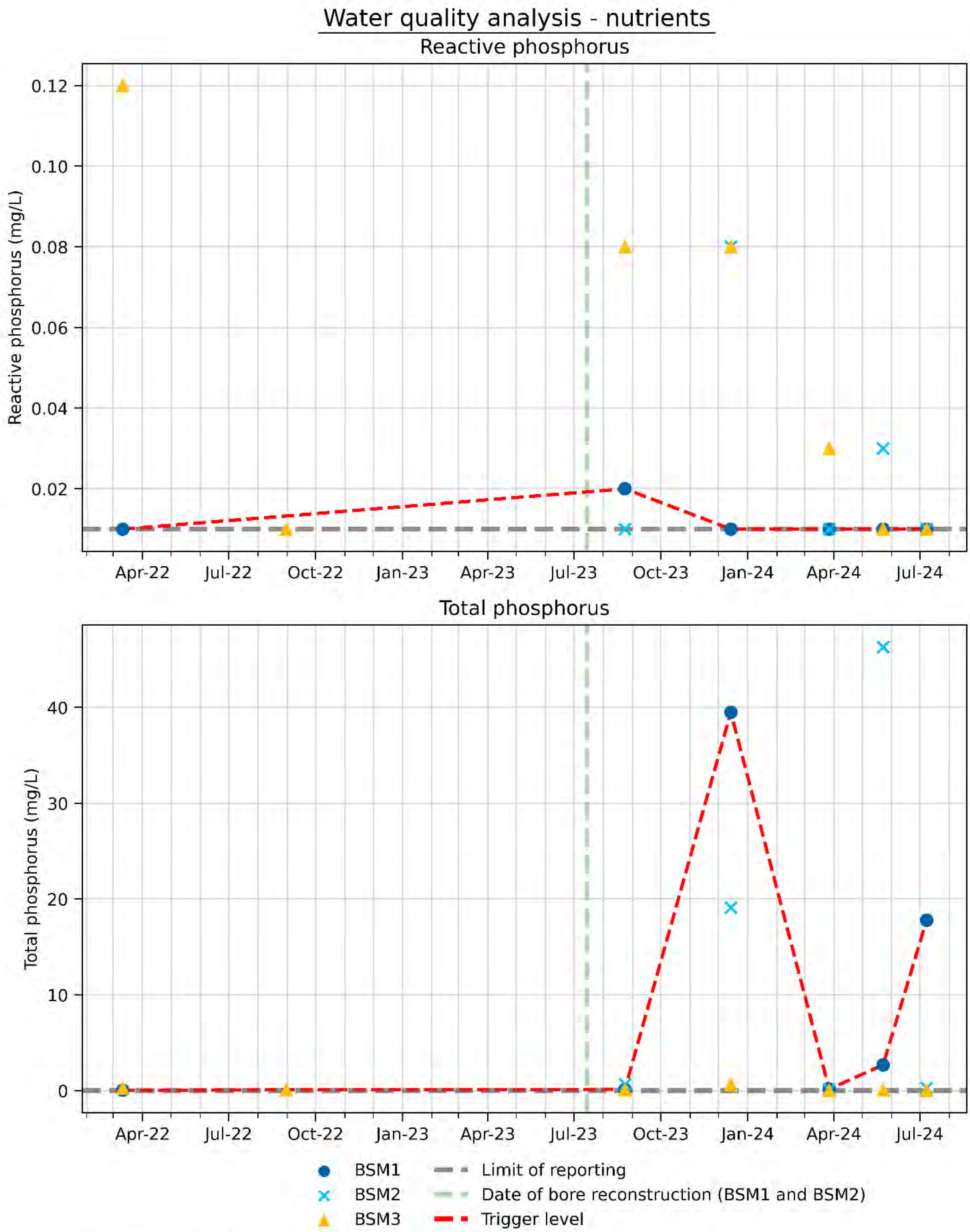
Appendix D

Water quality timeseries charts

D.1 Timeseries water quality charts – nutrients

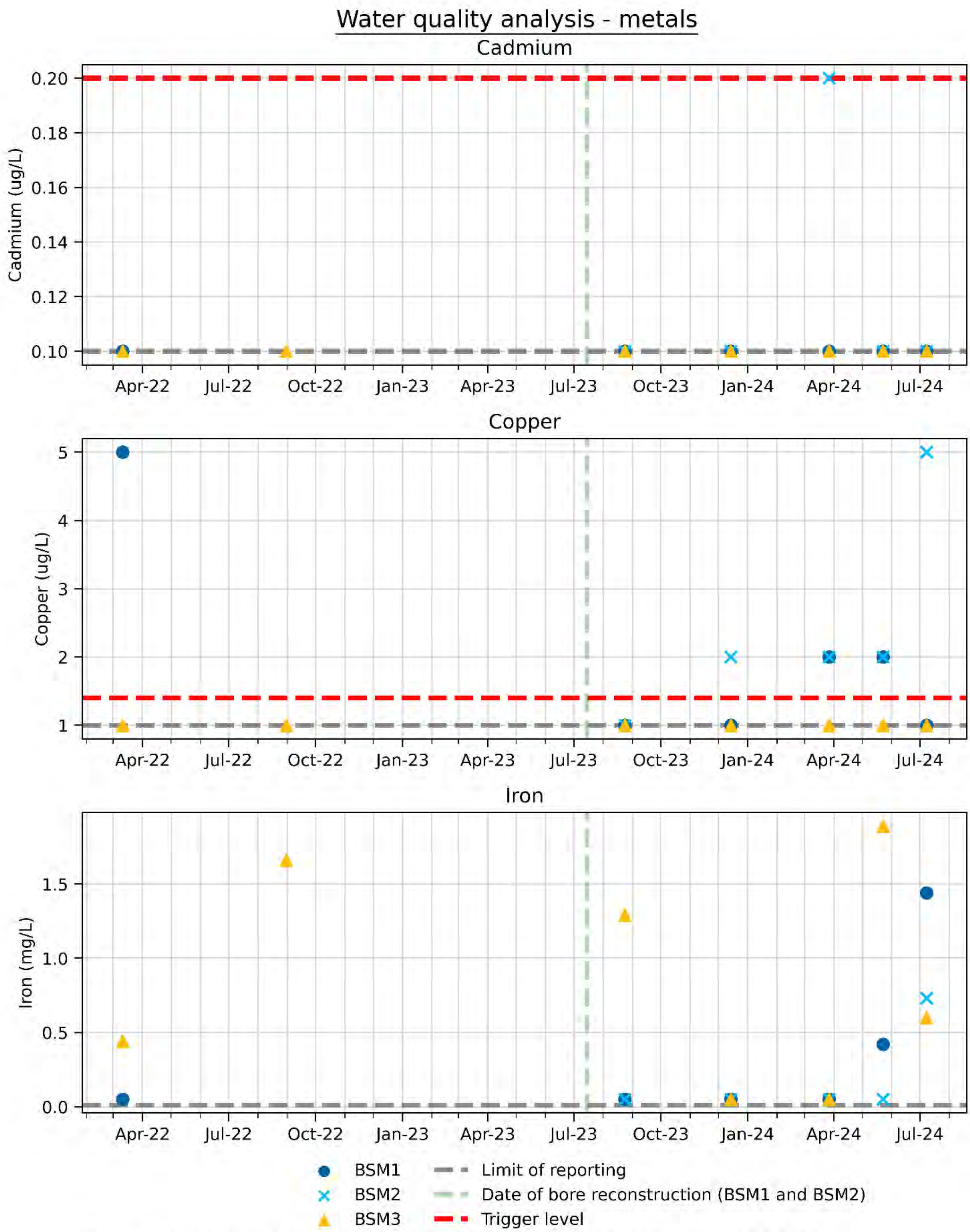


*Trigger values based on upgradient bore (BSM1).



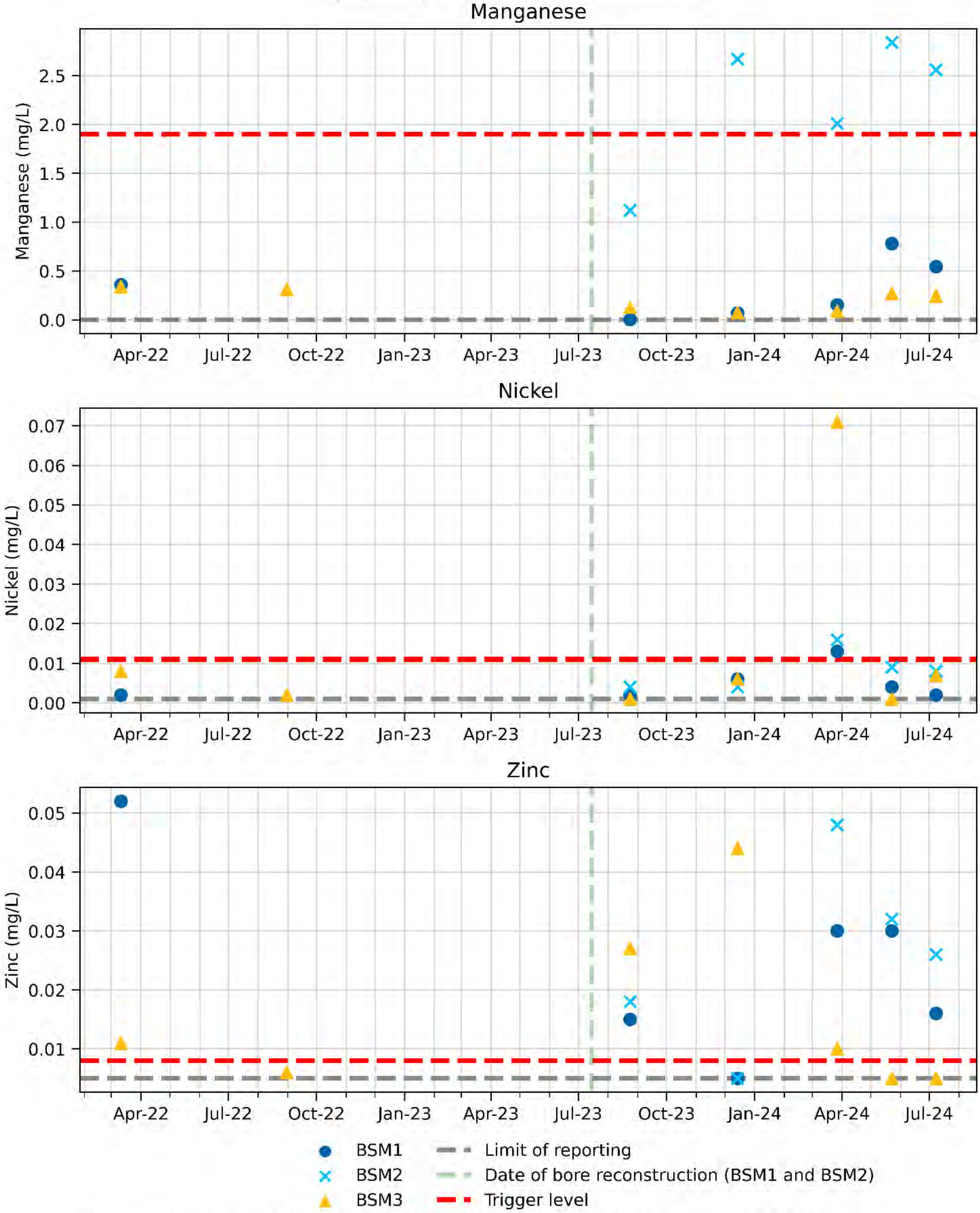
*Trigger values based on upgradient bore (BSM1).

D.2 Timeseries water quality charts – metals



*Trigger values based on slightly-moderately disturbed riverine ecosystems (ANZG 2018).

Water quality analysis - metals



*Trigger values based on slightly-moderately disturbed riverine ecosystems (ANZG 2018).

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.02 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

CALGARY
606 4th Street SW 11 Floor
Calgary Alberta T2P 1T1

linkedin.com/company/emm-consulting-pty-limited
emmconsulting.com.au

Appendix E
Air Quality monitoring

creating opportunities

E.1 Deposited Dust Annual Review

Luddenham Annual Review

Dust Deposition Monitoring

Prepared for Luddenham Operations

September 2024

Luddenham Annual Review

Dust Deposition Monitoring

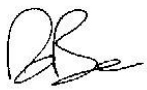
Luddenham Operations

E231131 12

September 2024

Version	Date	Prepared by	Approved by	Comments
1	23 September 2024	Tasman Coupe	David Bone	Final

Approved by



David Bone
Associate Director
23 September 2024

Level 3 175 Scott Street
Newcastle NSW 2300
ABN: 28 141 736 558

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1 Introduction

EMM Consulting has been contracted by Luddenham Operations to undertake environmental air quality monitoring activities for operation of the Luddenham Quarry Project off Adams Road, Luddenham.

The air quality monitoring network consists of 3 dust deposition gauges installed, operated and analysed in accordance with AS 3580. 10. 1 2003. Static dust monitoring sites were chosen at locations adjacent to sensitive receivers in close proximity to the works in accordance with the approved Air Quality Management Plan (AQMP). This report has been prepared to support the September 2023 – August 2024 Annual Review (AR).

2 Methodology

Depositional Dust Gauges (DDG) have been installed in accordance with the requirements *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) and AS 3580. 10. 1 2016.

In accordance with DEC (2007) '*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*', the project specific criterion for dust deposition is:

> Annual average dust deposition of no greater than 4g/m2/month (assessed as total insoluble solids), and no more than a 2g/m^2/month increase on background (assessed as insoluble solids).

Samples are analysed in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC 2006) guidelines by a NATA Accredited laboratory. Certificate of Analysis reports are included in Appendix A.

3 Results

Results for the period September 2023 – August 2024 are compiled in Table 3.1.

Table 3.1 AR DDG results

Date on	Date off	No. days active	Insoluble solids (g/m^2/month)*			Comments
			DG01	DG02	DG03	
26/10/2023	24/11/2023	29	Nil	0.7	0.1	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days. The sample container for DG01 was broken during transportation to the laboratory (by the courier) and the sample could not be recovered.
24/11/2023	21/12/2023	27	4.4	1.6	1.4	Sample exposure is less than AS 3580.10.1 - 2016 due to Christmas break.
21/12/2023	18/01/2024	28	3	1.8	0.4	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
18/01/2024	19/02/2024	32	0.8	1.2	0.6	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
19/02/2024	20/03/2024	30	0.5	0.8	0.1	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
20/03/2024	23/04/2024	34	1.1	1.5	0.8	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
23/04/2024	21/05/2024	28	0.8	1.5	0.7	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
20/05/2024	18/06/2024	28	2.1	1.5	0.8	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
18/06/2024	16/07/2024	28	1.2	3.6	0.4	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.
16/07/2024	13/08/2024	28	5.7	2.3	0.9	Sample exposure complies with AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days.

Notes:

1. No monitoring was completed during the period between 30 September 2023 and 26 October 2023 due to technical difficulties.
2. The following periods did not comply with the sample exposure for *Australian Standard (AS) 3580.10.1 – 2016 Methods for sampling and analysis of ambient air, Method 10.1: Determination of particulate matter - Deposited matter - Gravimetric method* allowances for 30 days + / - 2 days:
   a. 24 November 2023 to 21 December 2023 due to Christmas break.
   b. 20 March 2024 to 23 April 2024 due to logistical and resourcing complications.
3. An update to the AQMP was approved on 12 July 2024. Monitoring was not completed beyond the 13 August 2024 as monitoring requirements for the 2023-2024 period had been met.

A copy of the laboratory Certificate of Analysis' are attached in Appendix A.

Figure 3.1 below show the annual dust deposition results.

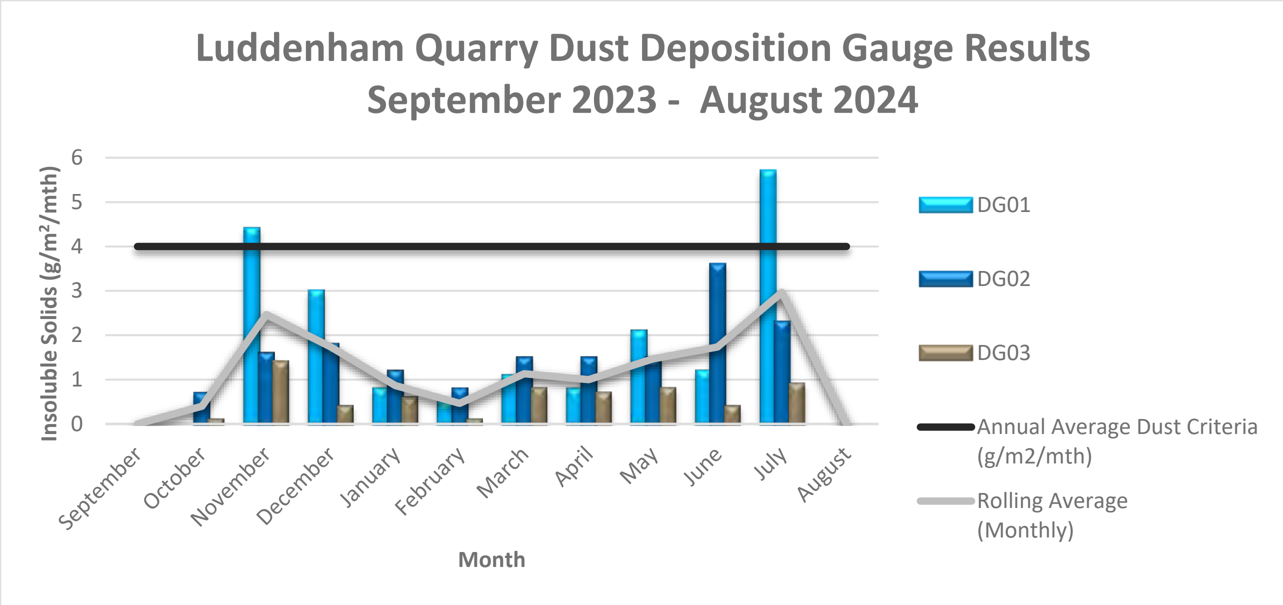

Figure 3.1 DDG Results (September 2023 – August 2024)

4 Conclusion

Insoluble solids is the criterion which dust deposition is measured by the NSW EPA and is considered to be the most representative measure of dust components such as soil and weathered rock disturbed during earthworks and construction activities. Other matter collected may include bird droppings, insects, organic matter such as pollen and seeds, coal and vegetative matter.

From the results reviewed over the AR period, the following comments and recommendations are made:

- All gauges analysed during the AR period recorded dust deposition results under 4.0 g/m^2/month with the exception of:
  - DG01 between 24 November 2023 and 21 December 2023at a reported concentration of 4.4 g/m^2/month.
  - DG01 between 16 July 2024 and 13 August 2024 at a reported concentration of 5.7 g/m^2/month.
- All gauges are compliant with the 4.0 g/m^2/month rolling annual average dust deposition criteria.
- All DDG results have generally shown consistent and ongoing compliance, below the monthly and annual criteria.
- To maintain ongoing compliance, it is recommended that site personnel exercise caution when working and operating machinery, ensure exposed surfaces are sealed or revegetated in accordance with approved measures and continued regular use of dust control measures such as the use of water carts and street sweepers when the site is active.

Appendix A
Certificates of Analysis

EMM
creating opportunities

A.1 Monitoring Period (26 October 2023 - 24 November 2023)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2312654**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: ES231131 Luddenham Dust Deposition Monitoring	Date Samples Received	: 18-Dec-2023 16:41
Order number	: ----	Date Analysis Commenced	: 21-Dec-2023
C-O-C number	: ----	Issue Date	: 31-Dec-2023 16:58
Sampler	: Sheri Thomson		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 2		
No. of samples analysed	: 2		

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*
Zoran Grozdanovski	Team Leader - Chemistry	Newcastle - Inorganics, Mayfield West, 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.

- Dust analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in deposition units e.g., g/m².mth where the sampling procedure is not NATA accredited. ALS Mudgee laboratory is NATA accredited for dust sampling, therefore ALS Mudgee reported deposition units are accredited.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Sample ID	DG02 26/10/23 - 24/11/23	DG03 26/10/23 - 24/11/23	----	----	----
			Sampling date / time	24-Nov-2023 00:00	24-Nov-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EN2312654-001	EN2312654-002	--------	--------	--------
				Result	Result	----	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.7**	<0.1	----	----	----
Total Insoluble Matter (mg)	----	2	mg	**12**	<2	----	----	----

A.2 Monitoring Period (24 November 2023 - 21 December 2023)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2400180**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 09-Jan-2024 08:45
Order number	: ES231131	Date Analysis Commenced	: 12-Jan-2024
C-O-C number	: ----	Issue Date	: 18-Jan-2024 10:15
Sampler	: D Nugent		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, 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.

- Dust analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in deposition units e.g., g/m².mth where the sampling procedure is not NATA accredited. ALS Mudgee laboratory is NATA accredited for dust sampling, therefore ALS Mudgee reported deposition units are accredited.
- Sample exposure period is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1/AS3580.10.2
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Sample ID	DG01 24/11/23 - 21/12/23	DG02 24/11/23 - 21/12/23	DG03 24/11/23 - 21/12/23	----	----
			Sampling date / time	21-Dec-2023 00:00	21-Dec-2023 00:00	21-Dec-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	EN2400180-001	EN2400180-002	EN2400180-003	--------	--------
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**4.4**	**1.6**	**1.4**	----	----
Total Insoluble Matter (mg)	----	2	mg	**70**	**25**	**23**	----	----

A.3 Monitoring Period (21 December 2023 - 18 January 2024)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2400579**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 22-Jan-2024 10:00
Order number	: ES231131	Date Analysis Commenced	: 24-Jan-2024
C-O-C number	: ----	Issue Date	: 02-Feb-2024 15:57
Sampler	: D Nugent		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Zoran Grozdanovski	Team Leader - Chemistry	Newcastle - Inorganics, Mayfield West, 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.

- Dust analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in deposition units e.g., g/m².mth where the sampling procedure is not NATA accredited. ALS Mudgee laboratory is NATA accredited for dust sampling, therefore ALS Mudgee reported deposition units are accredited.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Sample ID	DG01 21/12/23 - 18/01/24	DG02 21/12/23 - 18/01/24	DG03 21/12/23 - 18/01/24	----	----
			Sampling date / time	18-Jan-2024 00:00	18-Jan-2024 00:00	18-Jan-2024 00:00	----	----
Compound	CAS Number	LOR	Unit	EN2400579-001	EN2400579-002	EN2400579-003	--------	--------
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**3.0**	**1.8**	**0.4**	----	----
Total Insoluble Matter (mg)	----	2	mg	**50**	**29**	**6**	----	----

A.4 Monitoring Period (18 January 2024 - 19 February 2024)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2401562**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: Cale Kennedy	Contact	:
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 21-Feb-2024 17:00
Order number	: E231131	Date Analysis Commenced	: 26-Feb-2024
C-O-C number	: ----	Issue Date	: 04-Mar-2024 16:00
Sampler	: Sheri Thomson		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, 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.

- Dust analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in deposition units e.g., g/m².mth where the sampling procedure is not NATA accredited. ALS Mudgee laboratory is NATA accredited for dust sampling, therefore ALS Mudgee reported deposition units are accredited.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Sample ID	DG01 18/01/24 - 19/02/24	DG02 18/01/24 - 19/02/24	DG03 18/01/24 - 19/02/24	----	----
			Sampling date / time	19-Feb-2024 00:00	19-Feb-2024 00:00	19-Feb-2024 00:00	----	----
Compound	CAS Number	LOR	Unit	EN2401562-001	EN2401562-002	EN2401562-003	--------	--------
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.8**	**1.2**	**0.6**	----	----
Total Insoluble Matter (mg)	----	2	mg	**16**	**23**	**12**	----	----

A.5 Monitoring Period (19 February 2024 - 20 March 2024)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2402580**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 22-Mar-2024 09:00
Order number	: ES231131	Date Analysis Commenced	: 26-Mar-2024
C-O-C number	: ----	Issue Date	: 03-Apr-2024 17:42
Sampler	: Daniel Nugent		
Site	: ----		
Quote number	: EN/111		
No. of samples received	: 3		
No. of samples analysed	: 3		

NATA

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*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, 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.

- Dust analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in deposition units e.g., g/m².mth where the sampling procedure is not NATA accredited. ALS Mudgee laboratory is NATA accredited for dust sampling, therefore ALS Mudgee reported deposition units are accredited.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			*Sample ID*	**DG01 19/02/24 - 20/03/24**	**DG02 19/02/24 - 20/03/24**	**DG03 19/02/24 - 20/03/24**	----	----
			Sampling date / time	20-Mar-2024 00:00	20-Mar-2024 00:00	20-Mar-2024 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2402580-001**	**EN2402580-002**	**EN2402580-003**	--------	--------
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.5**	**0.8**	<0.1	----	----
Total Insoluble Matter (mg)	----	2	mg	**9**	**15**	<2	----	----

A.6 Monitoring Period (20 March 2024 - 23 April 2024)

VGT Laboratories Pty Ltd.
ABN 77 621 943 600
NATA Accreditation 20375
Unit 4, 30 Glenwood Drive Thornton NSW 2322|
P: (02) 4028 6412 | E: lab@vgt.com.au | www.vgt.com.au

Report Number: 16085

Date Issued: 30/04/2024 Revision Number: 00

Site/Job: Luddenham Dusts

Client: EMM Consulting Pty Ltd
Address Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
Contact Cale Kennedy

The following 3 Dust Deposition sample(s) were received on 23/04/2024

Client Sample Reference	Date On	Date Off	Lab ID	Matrix	Comments or Non-Compliances
DG01	20/03/2024	23/04/2024 13:46	16085/1	Dust	Funnel was sitting below/inside top of pvc casing (now ok). 34 day sampling period due to initial scheduling.
DG02	20/03/2024	23/04/2024 14:10	16085/2	Dust	Funnel was sitting below/inside top of pvc casing (now ok). 34 day sampling period. Adjacent casuarinas require trimming
DG03	20/03/2024	23/04/2024 13:30	16085/3	Dust	Funnel was sitting below/inside top of pvc casing (now ok). 34 day sampling period due to initial scheduling.

The sample(s) have been tested as received and results relate specifically to the samples tested.
The following reports are included:

- Test Report
- Sampling Report
- Chain of Custody (if available)

Authorised by:

Liane Peyra
Technical Officer

Anthony Crane
Laboratory Manager

Results have been approved and report finalised on 30/04/2024.

Test Report Number: 16085

Date Issued: 30/04/2024 Revision No: 00

Results

Deposited Matter	Method	Lab ID Sample Date Sample ID Units	16085/1 23/04/2024 DG01	16085/2 23/04/2024 DG02	16085/3 23/04/2024 DG03
Date Tested	AS 3580.10.1	--	26/04/2024	26/04/2024	26/04/2024
Number of Days	AS 3580.10.1	days	**34**	**34**	**34**
Insoluble Solids	AS 3580.10.1	g/m2/mth	1.1	1.5	0.8
Ash	AS 3580.10.1	g/m2/mth	0.8	1.2	0.5
Combustible Matter	AS 3580.10.1	g/m2/mth	0.3	0.3	0.3
Calculated Rain	AS 3580.10.1	mm	107	100	102

Report Comments:

Where present, indicates NATA accreditation does not cover the performance of this service. Results in **bold** indicate an exceedance of the relevant guideline. When considering the pass or fail of tests the measurement of uncertainty of each parameter must be considered. https://www.vgt.com.au/measurement-uncertainty [NT]: Not tested

Location Analysed : 4/30 Glenwood Dr Thornton NSW 2322.

Sampling Report Number: 16085

Date Issued: 30/04/2024 Revision No: 00

Sampling Conditions: Fine, 25 °C

Lab ID	Client Sample Reference	Licence/ Reference	Sampler	Date Sampled	Method of Sampling	Pre-treatment / Preservation
16085/1	DG01		T & D.Walker	23/04/2024 13:46	AS3580.10.1	CuSO4
16085/2	DG02		T & D.Walker	23/04/2024 14:10	AS3580.10.1	CuSO4
16085/3	DG03		T & D.Walker	23/04/2024 13:30	AS3580.10.1	CuSO4

Lab ID	Client Sample Reference	GPS-Easting	GPS-Northing	Sampling Observations
16085/1	DG01	288811	6249243	Full, minor insects
16085/2	DG02	289102	6249474	Full, insects
16085/3	DG03	288833	6249702	Full, minor algae

Sampling procedures have been approved and report finalised on 30/04/2024.
Where method is "unknown" sampling procedures are not endorsed

A.7 Monitoring Period (23 April 2024 - 21 May 2024)

VGT Laboratories Pty Ltd.
ABN 77 621 943 600
NATA Accreditation 20375
Unit 4, 30 Glenwood Drive Thornton NSW 2322|
P: (02) 4028 6412 | E: lab@vgt.com.au | www.vgt.com.au

Report Number: 16155

Date Issued: 30/05/2024 Revision Number: 00

Site/Job: Luddenham Dusts

Client: EMM Consulting Pty Ltd
Address Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
Contact Cale Kennedy

The following Dust Deposition sample(s) were received on 21/05/2024

Client Sample Reference	Date On	Date Off	Lab ID	Matrix	Comments or Non-Compliances
DG01	23/04/2024 13:46	21/05/2024 13:02	16155/1	Dust	
DG02	23/04/2024 14:10	21/05/2024 13:10	16155/2	Dust	
DG03	23/04/2024 13:30	21/05/2024 12:49	16155/3	Dust	

The sample(s) have been tested as received and results relate specifically to the samples tested.
The following reports are included:

- Test Report
- Sampling Report
- Chain of Custody (if available)

Authorised by: Liane Peyra, Technical Officer; Anthony Crane, Laboratory Manager

Results have been approved and report finalised on 30/05/2024.

Test Report Number: 16155

Date Issued: 30/05/2024 Revision No: 00

Results

Deposited Matter	Method	Lab ID Sample Date Sample ID Units	16155/1 21/05/2024 DG01	16155/2 21/05/2024 DG02	16155/3 21/05/2024 DG03
Date Tested	AS 3580.10.1	--	28/05/2024	28/05/2024	28/05/2024
Number of Days	AS 3580.10.1	days	28	28	28
Insoluble Solids	AS 3580.10.1	g/m2/mth	0.8	1.5	0.7
Ash	AS 3580.10.1	g/m2/mth	0.7	1.1	0.5
Combustible Matter	AS 3580.10.1	g/m2/mth	0.1	0.4	0.2
Calculated Rain	AS 3580.10.1	mm	69	69	72

Report Comments:

Where present, indicates NATA accreditation does not cover the performance of this service.

Results in **bold** indicate an exceedance of the relevant guideline.
When considering the pass or fail of tests the measurement of uncertainty of each parameter must be considered.
https://www.vgt.com.au/measurement-uncertainty

[NT]: Not tested

Location Analysed : 4/30 Glenwood Dr Thornton NSW 2322.

Sampling Report Number: 16155

Date Issued: 30/05/2024 Revision No: 00

Sampling Conditions: Fine, 20 °C

Lab ID	Client Sample Reference	Licence/ Reference	Sampler	Date Sampled	Method of Sampling	Pre-treatment / Preservation
16155/1	DG01		T & D.Walker	21/05/2024 13:02	AS3580.10.1	CuSO4
16155/2	DG02		T & D.Walker	21/05/2024 13:10	AS3580.10.1	CuSO4
16155/3	DG03		T & D.Walker	21/05/2024 12:49	AS3580.10.1	CuSO4

Lab ID	Client Sample Reference	GPS-Easting	GPS-Northing	Sampling Observations
16155/1	DG01	288811	6249243	
16155/2	DG02	289102	6249474	
16155/3	DG03	288833	6249702	

Sampling procedures have been approved and report finalised on 30/05/2024.
Where method is "unknown" sampling procedures are not endorsed

A.8 Monitoring Period (20 May 2024 - 18 June 2024)

VGT Laboratories Pty Ltd.
ABN 77 621 943 600
NATA Accreditation 20375
Unit 4, 30 Glenwood Drive Thornton NSW 2322|
P: (02) 4028 6412 | **E**: lab@vgt.com.au | **www.vgt.com.au**

Report Number: 16340

Date Issued: 27/06/2024 Revision Number: 00

Site/Job: Luddenham Dusts

Client: EMM Consulting Pty Ltd
Address: Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
Contact: Tasman Coupe

The following Dust Deposition sample(s) were received on 18/06/2024

Client Sample Reference	Date On	Date Off	Lab ID	Matrix	Comments or Non-Compliances
DG01	21/05/2024 13:02	18/06/2024 13:49	16340/1	Dust	
DG02	21/05/2024 13:10	18/06/2024 13:58	16340/2	Dust	
DG03	21/05/2024 12:49	18/06/2024 13:39	16340/3	Dust	

The sample(s) have been tested as received and results relate specifically to the samples tested.
The following reports are included:

- Test Report
- Sampling Report
- Chain of Custody (if available)

Authorised by: Liane Peyra
Technical Officer

Results have been approved and report finalised on 27/06/2024.

Accredited for compliance with ISO/IEC 17025 – Testing.

Test Report Number: 16340

Date Issued: 27/06/2024 Revision No: 00

Results

Deposited Matter	Method	Lab ID Sample Date Sample ID Units	16340/1 18/06/2024 DG01	16340/2 18/06/2024 DG02	16340/3 18/06/2024 DG03
Date Tested	AS 3580.10.1	--	25/06/2024	25/06/2024	25/06/2024
Number of Days	AS 3580.10.1	days	28	28	28
Insoluble Solids	AS 3580.10.1	g/m2/mth	2.1	1.5	0.8
Ash	AS 3580.10.1	g/m2/mth	1.5	0.9	0.5
Combustible Matter	AS 3580.10.1	g/m2/mth	0.6	0.6	0.3
Calculated Rain	AS 3580.10.1	mm	71	62	67

Report Comments:

Where present, indicates NATA accreditation does not cover the performance of this service.

Results in **bold** indicate an exceedance of the relevant guideline.
When considering the pass or fail of tests the measurement of uncertainty of each parameter must be considered.
https://www.vgt.com.au/measurement-uncertainty

[NT]: Not tested

Location Analysed : 4/30 Glenwood Dr Thornton NSW 2322.

Sampling Report Number: 16340

Date Issued: 27/06/2024 Revision No: 00

Sampling Conditions: Fine, 17 °C

Lab ID	Client Sample Reference	Licence/ Reference	Sampler	Date Sampled	Method of Sampling	Pre-treatment / Preservation
16340/1	DG01		T & D.Walker	18/06/2024 13:49	AS3580.10.1	CuSO4
16340/2	DG02		T & D.Walker	18/06/2024 13:58	AS3580.10.1	CuSO4
16340/3	DG03		T & D.Walker	18/06/2024 13:39	AS3580.10.1	CuSO4

Lab ID	Client Sample Reference	GPS-Easting	GPS-Northing	Sampling Observations
16340/1	DG01	288811	6249243	
16340/2	DG02	289102	6249474	
16340/3	DG03	288833	6249702	

Sampling procedures have been approved and report finalised on 27/06/2024.
Where method is "unknown" sampling procedures are not endorsed

A.9 Monitoring Period (18 June 2024 - 16 July 2024)

VGT Laboratories Pty Ltd.
ABN 77 621 943 600
NATA Accreditation 20375
Unit 4, 30 Glenwood Drive Thornton NSW 2322|
P: (02) 4028 6412 | E: lab@vgt.com.au | www.vgt.com.au

Report Number: 16556

Date Issued: 23/07/2024 Revision Number: 00

Site/Job: Luddenham Dusts

Client: EMM Consulting Pty Ltd
Address Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
Contact Tasman Coupe

The following Dust Deposition sample(s) were received on 16/07/2024

Client Sample Reference	Date On	Date Off	Lab ID	Matrix	Comments or Non-Compliances
DG01	18/06/2024 13:49	16/07/2024 14:25	16556/1	Dust	
DG02	18/06/2024 13:58	16/07/2024 14:17	16556/2	Dust	
DG03	18/06/2024 13:39	16/07/2024 14:15	16556/3	Dust	

The sample(s) have been tested as received and results relate specifically to the samples tested.
The following reports are included:

- Test Report
- Sampling Report
- Chain of Custody (if available)

Authorised by:

Liane Peyra
Technical Officer

Anthony Crane
Laboratory Manager

Results have been approved and report finalised on 23/07/2024.

Test Report Number: 16556

Date Issued: 23/07/2024 Revision No: 00

Results

Deposited Matter	Method	Lab ID Sample Date Sample ID Units	16556/1 16/07/2024 DG01	16556/2 16/07/2024 DG02	16556/3 16/07/2024 DG03
Date Tested	AS 3580.10.1	--	18/07/2024	18/07/2024	18/07/2024
Number of Days	AS 3580.10.1	days	28	28	28
Insoluble Solids	AS 3580.10.1	g/m2/mth	1.2	3.6	0.4
Ash	AS 3580.10.1	g/m2/mth	1.1	3.1	0.3
Combustible Matter	AS 3580.10.1	g/m2/mth	0.1	0.5	0.1
Calculated Rain	AS 3580.10.1	mm	36	115	35

Report Comments:

Where present, indicates NATA accreditation does not cover the performance of this service. Results in **bold** indicate an exceedance of the relevant guideline. When considering the pass or fail of tests the measurement of uncertainty of each parameter must be considered. https://www.vgt.com.au/measurement-uncertainty [NT]: Not tested

Location Analysed : 4/30 Glenwood Dr Thornton NSW 2322.

Sampling Report Number: 16556

Date Issued: 23/07/2024 Revision No: 00

Sampling Conditions: Cloudy, 14 °C

Lab ID	Client Sample Reference	Licence/ Reference	Sampler	Date Sampled	Method of Sampling	Pre-treatment / Preservation
16556/1	DG01		T & D.Walker	16/07/2024 14:25	AS3580.10.1	CuSO4
16556/2	DG02		T & D.Walker	16/07/2024 14:17	AS3580.10.1	CuSO4
16556/3	DG03		T & D.Walker	16/07/2024 14:15	AS3580.10.1	CuSO4

Lab ID	Client Sample Reference	GPS-Easting	GPS-Northing	Sampling Observations
16556/1	DG01	288811	6249243	
16556/2	DG02	289102	6249474	Full (not rainfall), minor algae
16556/3	DG03	288833	6249702	

Sampling procedures have been approved and report finalised on 23/07/2024.
Where method is "unknown" sampling procedures are not endorsed

A.10 Monitoring Period (16 July 2024 - 13 August 2024)

VGT Laboratories Pty Ltd.
ABN 77 621 943 600
NATA Accreditation 20375
Unit 4, 30 Glenwood Drive Thornton NSW 2322|
P: (02) 4028 6412 | **E**: lab@vgt.com.au | **www.vgt.com.au**

Report Number: 16662

Date Issued: 21/08/2024 Revision Number: 00

Site/Job: Luddenham Dusts

Client: EMM Consulting Pty Ltd
Address Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
Contact Tasman Coupe

The following Dust Deposition sample(s) were received on 13/08/2024

Client Sample Reference	Date On	Date Off	Lab ID	Matrix	Comments or Non-Compliances
DG01	16/07/2024 14:25	13/08/2024 13:08	16662/1	Dust	
DG02	16/07/2024 14:17	13/08/2024 13:19	16662/2	Dust	
DG03	16/07/2024 14:15	13/08/2024 12:57	16662/3	Dust	

The sample(s) have been tested as received and results relate specifically to the samples tested.
The following reports are included:

- Test Report
- Sampling Report
- Chain of Custody (if available)

Authorised by:

Liane Peyra
Technical Officer

Anthony Crane
Laboratory Manager

Results have been approved and report finalised on 21/08/2024.

Test Report Number: 16662

Date Issued: 21/08/2024 Revision No: 00

Results

Deposited Matter	**Method**	**Lab ID Sample Date Sample ID Units**	**16662/1 13/08/2024 DG01**	**16662/2 13/08/2024 DG02**	**16662/3 13/08/2024 DG03**
Date Tested	AS 3580.10.1	--	16/08/2024	16/08/2024	16/08/2024
Number of Days	AS 3580.10.1	days	28	28	28
Insoluble Solids	AS 3580.10.1	g/m2/mth	**5.7**	2.3	0.9
Ash	AS 3580.10.1	g/m2/mth	5.0	1.9	0.5
Combustible Matter	AS 3580.10.1	g/m2/mth	0.7	0.4	0.4
Calculated Rain	AS 3580.10.1	mm	17	16	15

Report Comments:

Where present, indicates NATA accreditation does not cover the performance of this service.

Results in **bold** indicate an exceedance of the relevant guideline.
When considering the pass or fail of tests the measurement of uncertainty of each parameter must be considered.
https://www.vgt.com.au/measurement-uncertainty

[NT]: Not tested

Location Analysed : 4/30 Glenwood Dr Thornton NSW 2322.

Sampling Report Number: 16662

Date Issued: 21/08/2024 Revision No: 00

Sampling Conditions: 100% Cloudcover, 17 °C

Lab ID	Client Sample Reference	Licence/ Reference	Sampler	Date Sampled	Method of Sampling	Pre-treatment / Preservation
16662/1	DG01		T & D.Walker	13/08/2024 13:08	AS3580.10.1	CuSO4
16662/2	DG02		T & D.Walker	13/08/2024 13:19	AS3580.10.1	CuSO4
16662/3	DG03		T & D.Walker	13/08/2024 12:57	AS3580.10.1	CuSO4

Lab ID	Client Sample Reference	GPS-Easting	GPS-Northing	Sampling Observations
16662/1	DG01	288811	6249243	
16662/2	DG02	289102	6249474	
16662/3	DG03	288833	6249702	

Sampling procedures have been approved and report finalised on 21/08/2024.
Where method is "unknown" sampling procedures are not endorsed

Australia

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

E.2 Realtime Monitoring Annual Review

Luddenham Quarry

Real-time air quality monitoring campaign - September 2024

Prepared for Luddenham Operations Pty Ltd

September 2024

Luddenham Quarry

Real-time air quality monitoring campaign - September 2024

Luddenham Operations Pty Ltd

E231131 RP4

September 2024

Version	Date	Prepared by	Reviewed by	Comments
1	20 September 2024	Amie Gilbert	Scott Fishwick	Draft
2	27 September 2024	Amie Gilbert	Scott Fishwick	Final

Approved by

Scott Fishwick
National Technical Lead – Air Quality and Climate
27 September 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

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1 Introduction

1.1 Overview

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by state significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd has reactivated and is operating at the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003, which was granted by the NSW Department of Planning, Housing and Infrastructure (DPHI then DPIE) on 24 May 2021.

This report provides a summary of the four week real-time particulate matter (PM) monitoring campaign conducted at the site during August and September 2024 (the assessment period), to satisfy the requirements of the development consent (as modified).

1.2 Air quality management plan and monitoring program

Condition 4 (Schedule 4) of the development consent (as modified) requires the preparation of an air quality management plan (AQMP). The AQMP was completed in September 2021 and most recently updated in June 2024. It is noted that at the time of commencing this assessment approval had yet to be provided by DPHI for the updated AQMP, as a result the 2021 AQMP is used as reference for the remainder of this report.

As identified in Chapter 5 of the AQMP, the requirements for ambient air quality monitoring at the site are outlined in Condition 3 (Schedule 4) as follows:

> carry out regular air quality monitoring to determine whether the development is complying with the relevant conditions in this consent.

The specific AQMP requirements outlined in Condition 4 (Schedule 4) requires a monitoring program that:

> (i) is capable of evaluating the performance of the development against the air quality criteria;
>
> (ii) adequately supports the air quality management system; and
>
> (iii) 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 Continuous particulate matter monitoring

Section 5.2.2 of the AQMP relates to continuous particulate matter (PM) monitoring and is reproduced in this section.

To evaluate compliance with the air quality criteria for TSP, PM_{10} and $PM_{2.5}$ (see Chapter 2), two continuous PM monitoring instructions will be deployed on a campaign basis[1].

[1] If all three size fractions cannot be measured simultaneously by the selected instrument, preference will be given to PM_{10} and $PM_{2.5}$ and TSP will be derived from PM_{10} concentrations based on the assumption that PM_{10} is 40% of TSP.

The instruments will be solar powered and relocatable and will be positioned upwind and downwind of the main dust generation activities occurring during the monitoring campaign. The upwind and downwind monitoring will enable compliance assessment against the short-term air quality criteria, which are evaluated against the increment increase from the development alone, as follows:

- PM contribution from quarry = downwind concentration minus upwind concentration.

Seasonal wind roses for the Bureau of Meteorology (BoM) Badgerys Creek automatic weather station (AWS) are presented in Figure A.1 (of the AQMP), which can be used to determine which locations are upwind and downwind for each monitoring campaign. Compliance assessment will use the meteorological monitoring data collected for the period of each monitoring campaign to determine upwind and downwind conditions on a daily basis.

The monitoring campaigns would run for a period of one month, repeated twice a year. After the first year, the need to continue the real-time particulate matter monitoring campaigns will be reviewed in conjunction with DPHI.[2]

Compliance assessment against the long-term air quality criteria will be based on monitoring data collected at both locations across each monitoring campaign. The monthly average concentrations will be used as a proxy for compliance assessment against the annual average concentrations. Any identified extraordinary events during each monitoring campaign will be excluded from the calculation of the monthly average.

[2] Following the approval of the latest AQMP (updated June 2024) future monitoring campaigns will occur for a 14-day period, once per year during extractive/ haulage operations.

2 Applicable criteria

Condition 1 of Schedule 4 lists the relevant air quality criteria for the development (replicated below in Table 2.1 and Table 2.2).

The long-term criteria in Table 2.1 are assessed against the total cumulative impact (the development contribution plus all other sources), whereas the short-term criteria in Table 2.2 apply to the incremental impact (development contribution alone).

Table 2.1 Long-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion	Basis
Total suspended particulate matter (TSP)	Annual	90 µg/m^3	Total impact (incremental increase from development plus all other sources) but excluding extraordinary events such as bushfires, prescribed burning, dust storms.
Particulate matter <10 µm (PM_{10})	Annual	25 µg/m^3	
Particulate matter <2.5 µm ($PM_{2.5}$)	Annual	8 µg/m^3	

Table 2.2 Short-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion	Basis
Particulate matter <10 µm (PM_{10})	24 hour	50 µg/m^3	Incremental impact (increase in concentrations from the development alone).
Particulate matter <2.5 µm ($PM_{2.5}$)	24 hour	25 µg/m^3	

As the monitoring campaign is four weeks in duration, the short-term 24 hour average criteria will be the focus of this monitoring report. Discussion regarding compliance with the annual average criteria will be derived from the period averaging concentrations recorded.

3 Monitoring network and methodology

3.1 Monitoring network

In accordance with Section 5.2.2 of the AQMP, the continuous PM monitoring network installed at the site for the four-week campaign consists of two continuous PM monitoring units.

In the absence of site-specific meteorological measurements, historical wind conditions recorded by the BoM Badgerys Creek AWS (located 2.3 km to the south-east of the site) for the assessment period were reviewed. The data analysis identified a dominance of winds from the north-east and south-west. Consequently, to record upwind and downwind PM concentrations at the site, the two continuous PM monitoring units were sited at the north-east and south-west corners of the site.

For the 2024 monitoring campaign period, concurrent meteorological monitoring data from the BoM Badgerys Creek AWS was collated. Further, to provide an understanding of potential regional-scale air quality events, concurrent measurements from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Bringelly air quality monitoring station (AQMS), located 5.9 km to the south-east of the site, have been collated.

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

Table 3.1 Summary of monitoring network adopted in monitoring campaign at Luddenham quarry

	Location ID	Description	Coordinates (MGA 56)	
			Easting (m)	Northing (m)
Onsite air quality	AQM01	Site boundary in south-west corner	288812	6249239
	AQM02	Site boundary in north-east corner	289187	6249481
Reference air quality	DCCEEW AQMS	Bringelly AQMS	293102	6244719
Meteorology	BoM AWS	Badgerys Creek AWS	289920	6246951

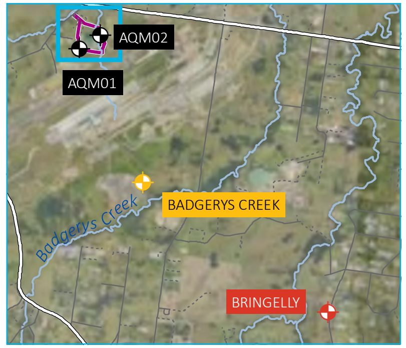
3.2 Monitoring methodology

The BoM Badgerys Creek AWS continuously measures mean wind speed, mean wind direction, the standard deviation of wind direction (referred to as 'sigma-theta'), mean temperature, mean relative humidity, pressure and accumulated rainfall. The measurements are recorded as 1 hour averages from 1 minute data.

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

Photograph 3.1 AQM01 monitoring location

Photograph 3.2 AQM02 monitoring location



KEY
- Study area
- On site air quality monitor
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

INSET KEY
- Study area
- Major road
- Named watercourse
- BoM AWS
- DPE AQMS
- On site air quality monitor

Source: EMM (2024); ABS (2021); DFSI (2020, 2021); ESRI (2024); GA (2011)

0 100 200 m
GDA 1994 MGA Zone 56
N

Luddenham quarry monitoring network

Luddenham Quarry
Air quality monitoring report
Figure 3.1

creating opportunities

4 Meteorological data

4.1 Overview of meteorological data

This section of the report presents a summary and analysis of the meteorological data that were collected by the BoM Badgerys Creek AWS during the reporting period.

An overview of the continuous data from the BoM Badgerys Creek AWS is provided in Figure 4.1. 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 bars indicating missing data. Some summary statistics for the reporting period are also given, 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.

The key descriptive statistics and time series plots for the meteorological parameters collected at the BoM Badgerys Creek AWS during the reporting period are provided in the following sections.

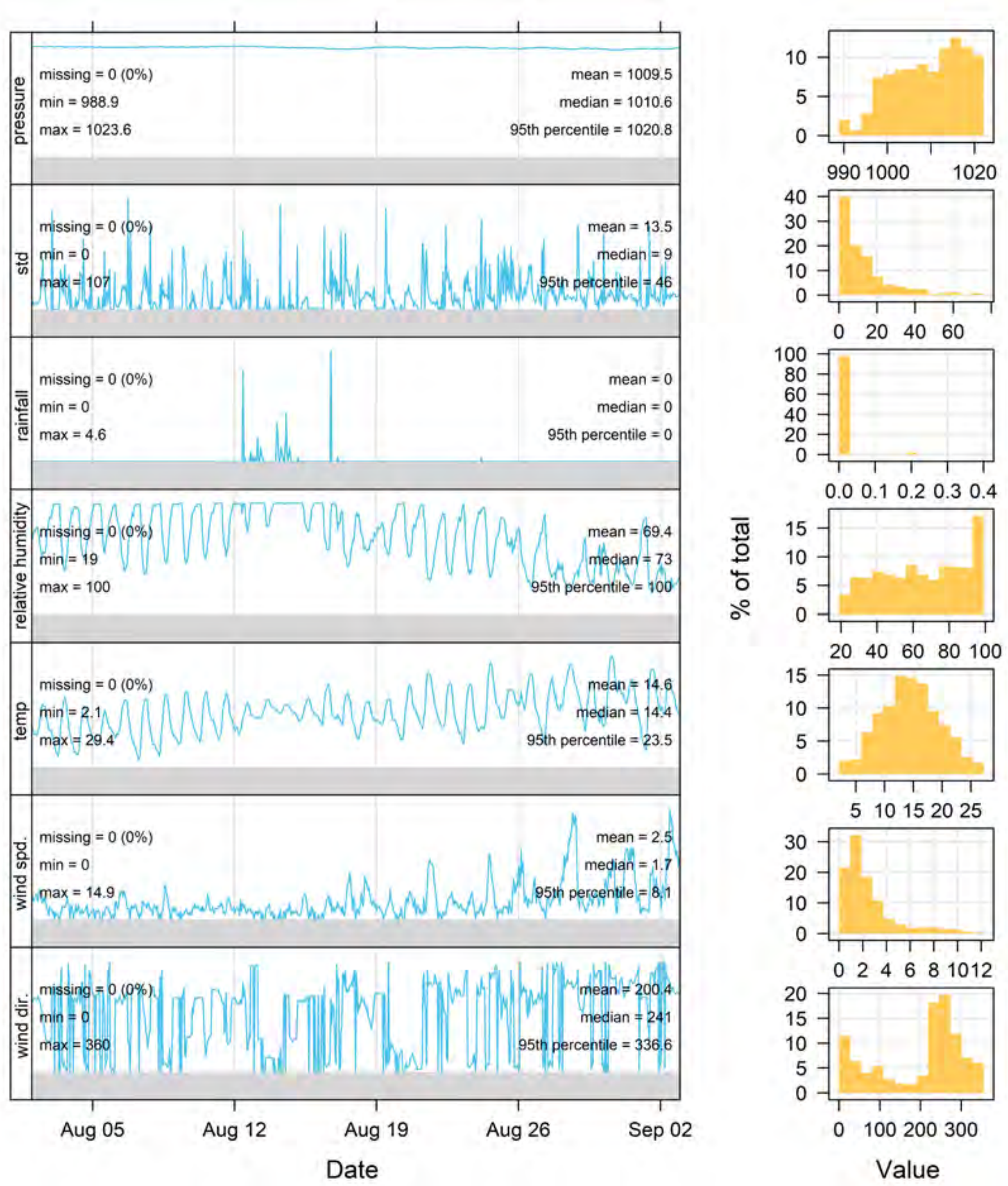


Figure 4.1 Meteorological data summary – BoM Badgerys Creek AWS

4.2 Meteorological data

Key descriptive statistics for the meteorological data collected at the BoM Badgerys Creek AWS during the reporting period are provided in Table 4.1. The statistics are calculated from the 1 hour values and are shown for the assessment period.

Table 4.1 Summary of meteorological data – assessment period 2024 – BoM Badgerys Creek AWS

Parameter	Minimum	Maximum	Median	Average	Standard deviation
Temperature (°C)	2.1	29.4	14.5	14.6	5.3
Wind speed (m/s)	0.0	14.9	1.7	2.5	2.5
Rainfall (mm)	0.0	4.6	0.0	0.0	0.2
Relative Humidity (%)	19.0	100.0	73.0	69.4	24.8

The wind rose for the 2024 monitoring campaign from the BoM Badgerys Creek AWS is presented in Figure 4.2. The wind rose shows that winds during the assessment period were predominately from the north-east and south-west, and therefore indicate that the two continuous PM monitoring units installed at the site are appropriately located to record upwind and downwind particulate matter concentrations.

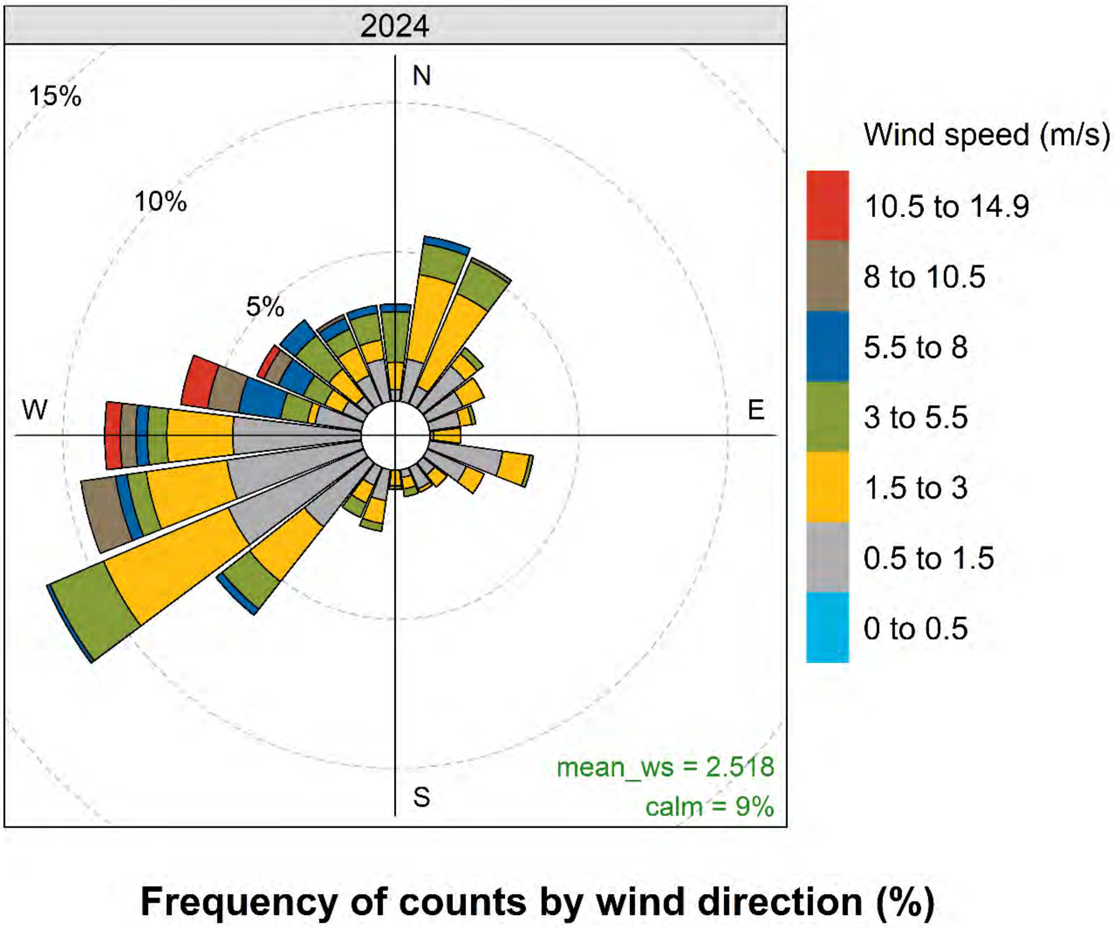


Figure 4.2 Wind rose for the assessment period – BoM Badgerys Creek AWS

5 Air quality data

5.1 Overview of 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 were collected from the onsite monitors during the reporting period. The data from the DCCEEW Bringelly AQMS are included for comparison.

An overview of the continuous (hourly) data from the two PM_{10}/$PM_{2.5}$ monitors located at the site in provided in Figure 5.1. Measurements were collected starting from 12:00 am on 2 August 2024 to 12:00 am on 2 September 2024.

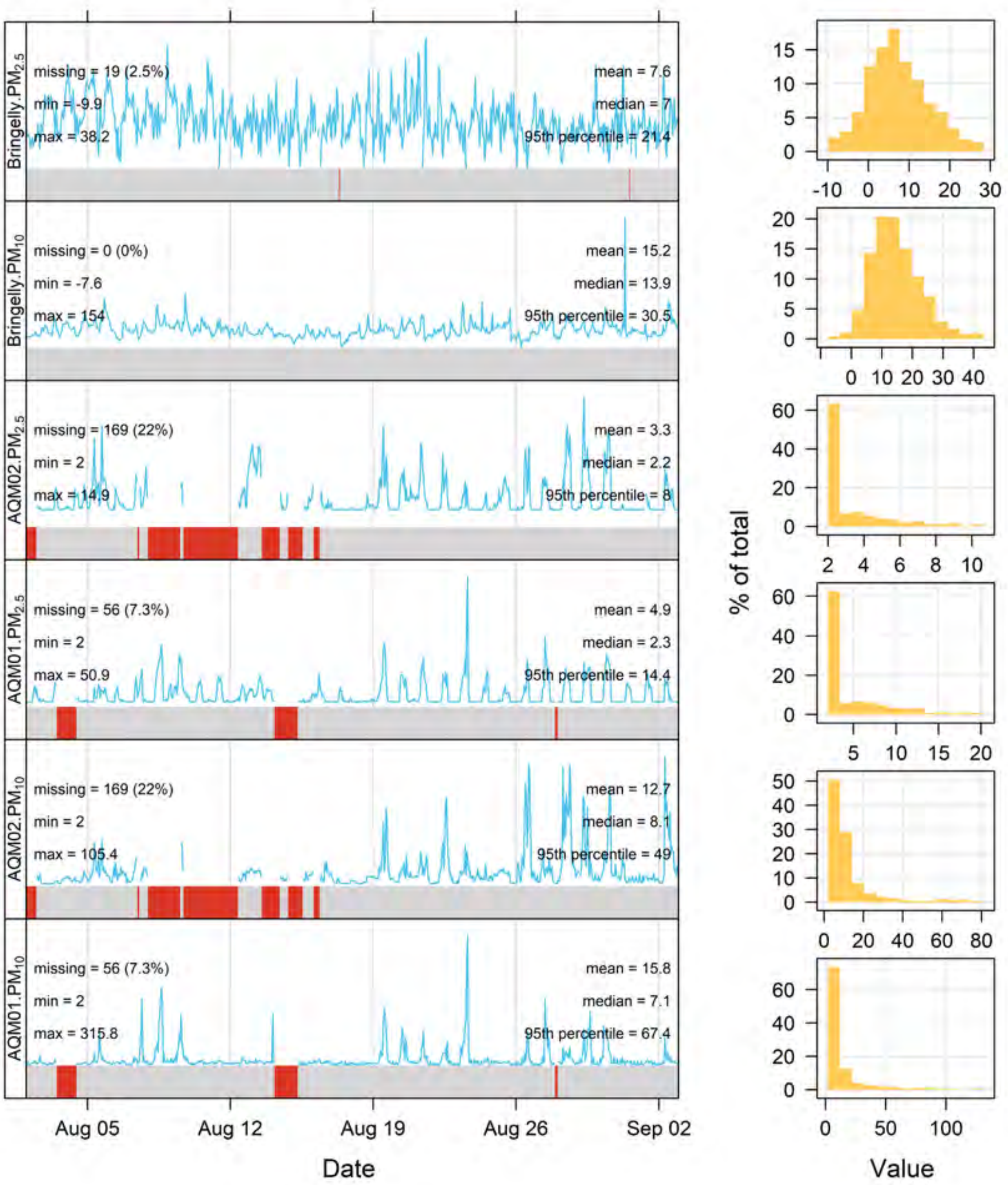


Figure 5.1 Air quality monitoring data – DCCEEW Bringelly and onsite monitors – assessment period

5.2 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 recorded (AQM01) and (AQM02) at the site during the reporting period is provided in Table 5.1. The corresponding values from the DCCEEW Bringelly AQMS are included for comparison.

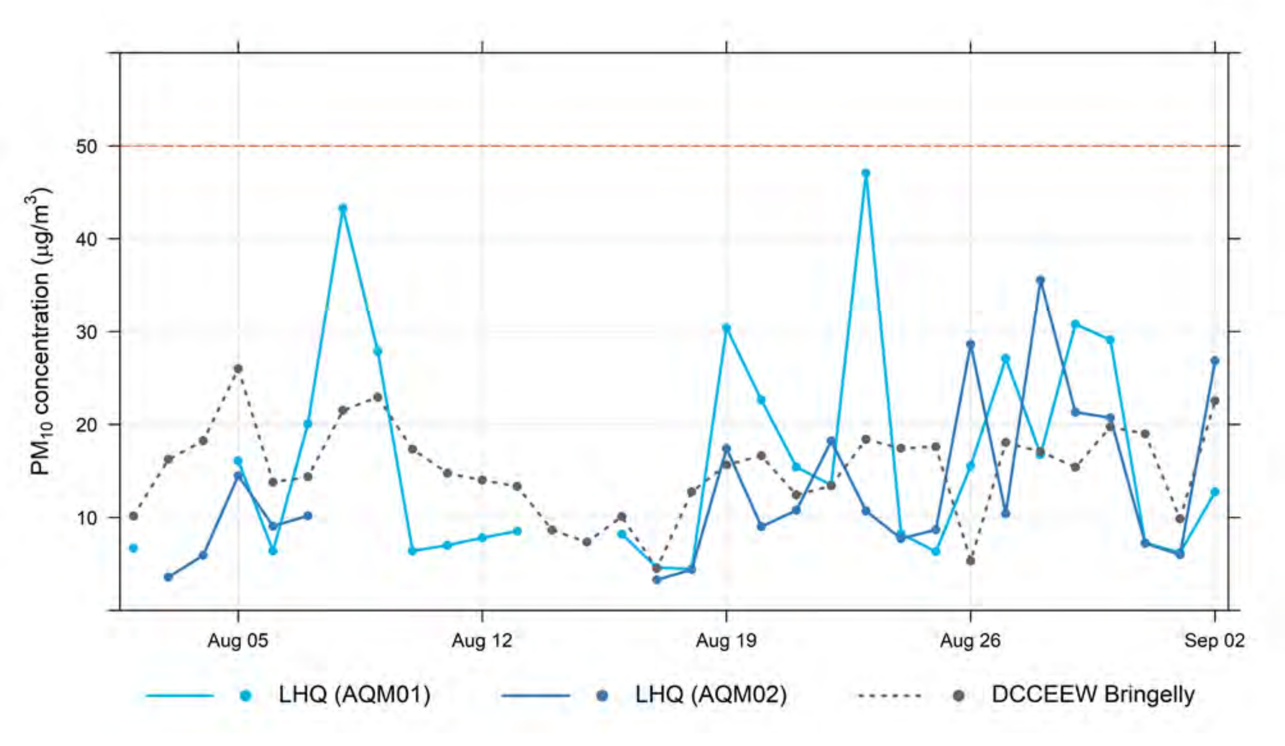
The period mean PM_{10} concentrations for the onsite monitoring and the DCCEEW Bringelly AQMS were generally similar, with average concentrations at the AQM01 slightly higher than at the DCCEEW Bringelly AQMS.

No exceedances of the 24 hour PM_{10} criterion of 50 µg/m³ were recorded at any location during the campaign.

Table 5.1 Statistics for PM_{10} 24 hour average concentration

Monitoring location	Mean (µg/m³)	Median (µg/m³)	Maximum (µg/m³)	Standard deviation	Days above 50 µg/m³
AQM01	16.3	13.1	47.1	11.8	0
AQM02	13.2	10.3	35.6	8.8	0
DCCEEW Bringelly AQMS	15.2	15.5	26.0	5.0	0

The time series of 24 hour PM_{10} concentrations recorded at the site and DCCEEW Bringelly AQMS are plotted in Figure 5.2. The concentrations at all three sites were only generally similar on occasion, with the AQM01 (south-west corner) and AQM02 (north-east corner) generally following a similar pattern. However, it is noted that concentrations were generally higher at the AQM01, this is likely due to the monitors proximity to the main haul route.



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

Figure 5.2 Daily mean PM_{10} concentration

The measured PM_{10} concentrations from the two onsite monitors at the site and recorded by the DCCEEW Bringelly AQMS are also presented below using bivariate polar plots and polar annulus plots.

The bivariate plots (Figure 5.3 to Figure 5.5) show how PM_{10} concentrations vary by wind speed and wind direction over the reporting period. The plots provide a graphical impression of potential sources influencing PM_{10} concentrations at the monitoring locations.

The following points are noted from the bivariate polar plots (Figure 5.3 to Figure 5.5):

- The bivariate polar plot for AQM01 (Figure 5.3) shows a signal to the north-east, which is likely to be associated with emissions from the site.
- The bivariate polar plot for AQM02 (Figure 5.4) shows a signal to the east and west, which is likely to be associated with emissions from the site as well as neighbouring activities, including emissions from the Western Sydney Airport.
- The bivariate polar plot for the DCCEEW Bringelly AQMS (Figure 5.5) shows a signal from the east and the west, which is likely to be associated with emissions from domestic heating and road traffic.

The polar annulus plots (Figure 5.6 to Figure 5.8) show the temporal variation in the PM_{10} concentration by wind direction during the whole reporting period. In this case, the temporal variation is by hour of the day (0 to 23).

- The polar annulus plots for AQM01 and AQM02 (Figure 5.6 and Figure 5.7, respectively) show that the highest concentrations occur between 8:00 am and 4:00 pm, and are likely to be associated with operations at the site.
- The polar annulus plots for the DCCEEW Bringelly AQMS (Figure 5.8) shows that the highest concentrations occur between in the morning (approximately 12:00 am to 8:00 am) and in the late afternoon to night (8:00 pm to 12.00 am), supporting the earlier conclusion that recorded concentrations are likely to be associated with emissions from domestic heating (night) and road traffic (morning).

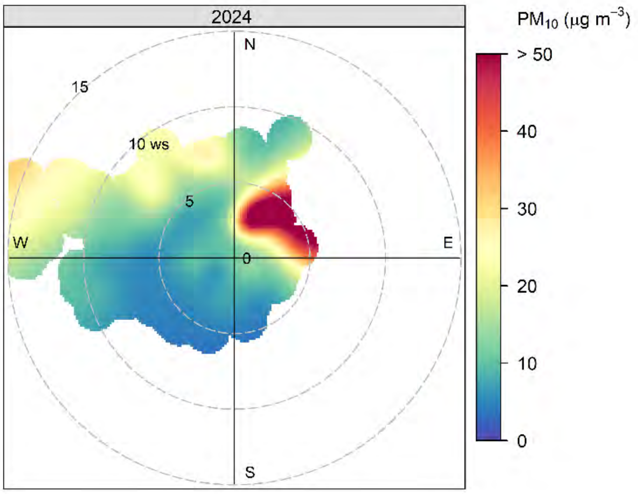


Figure 5.3 Assessment period bivariate polar plot for PM_{10} at AQM01

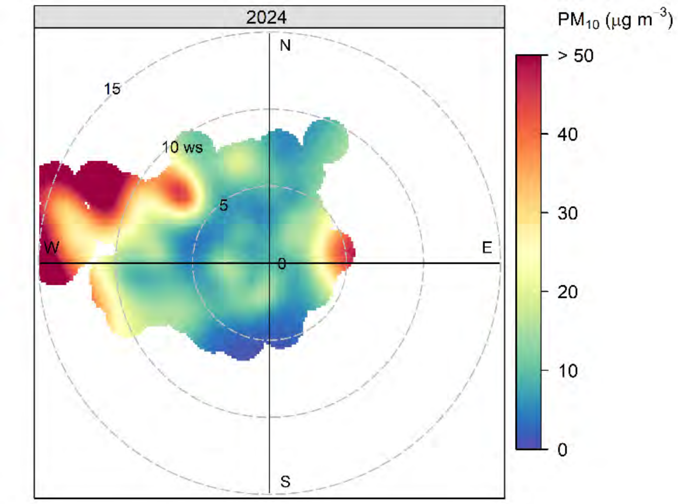


Figure 5.4 Assessment period bivariate polar plot for PM_{10} at AQM02

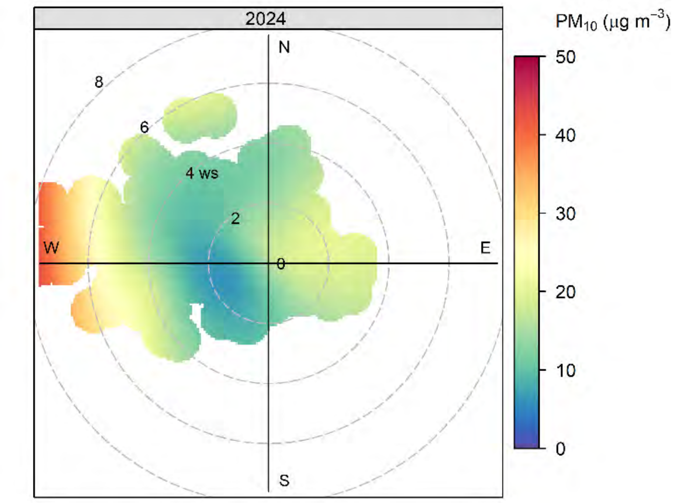


Figure 5.5 Assessment period bivariate polar plot for PM_{10} at DCCEEW Bringelly

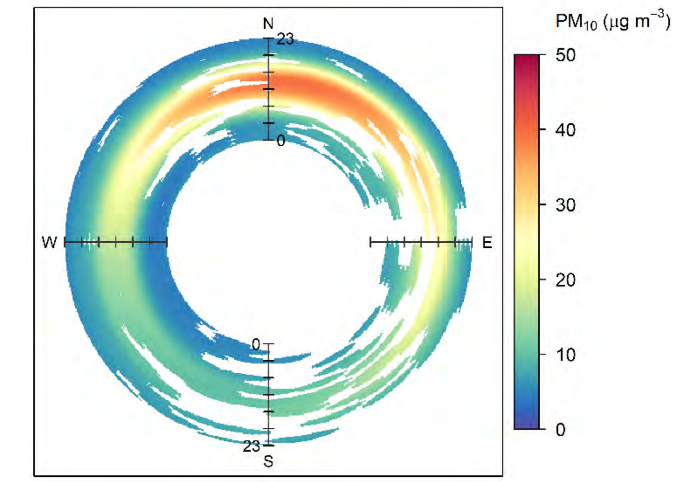


Figure 5.6 Polar annulus plot for PM_{10} at AQM01

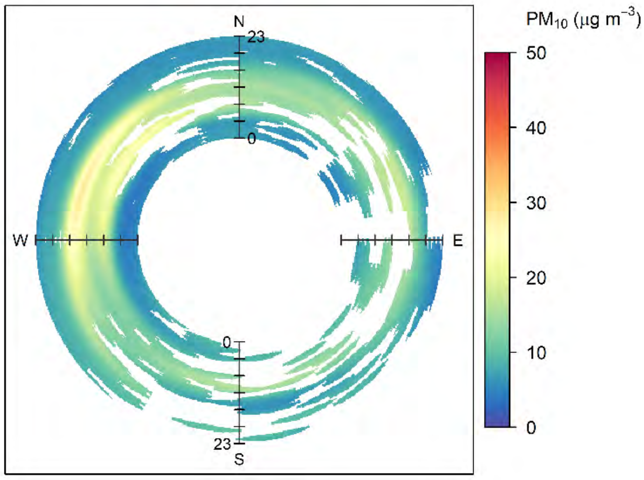


Figure 5.7 Polar annulus plot for PM_{10} at AQM02

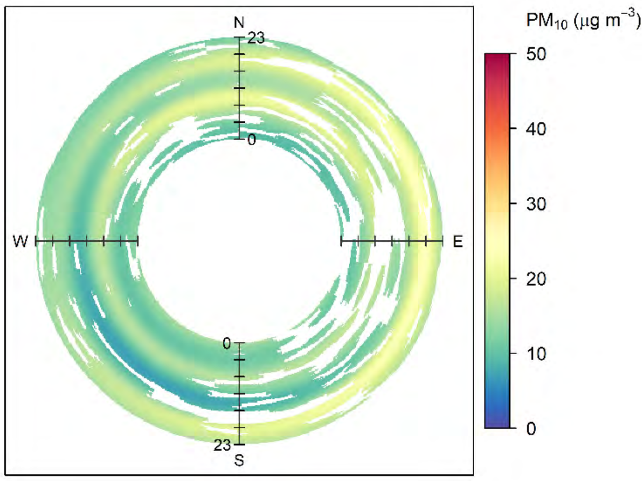


Figure 5.8 Polar annulus plot for PM_{10} at DCCEEW Bringelly

5.3 $PM_{2.5}$ 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 at the site during the reporting period is provided in Table 5.2. The corresponding values from the DCCEEW Bringelly AQMS are included for comparison.

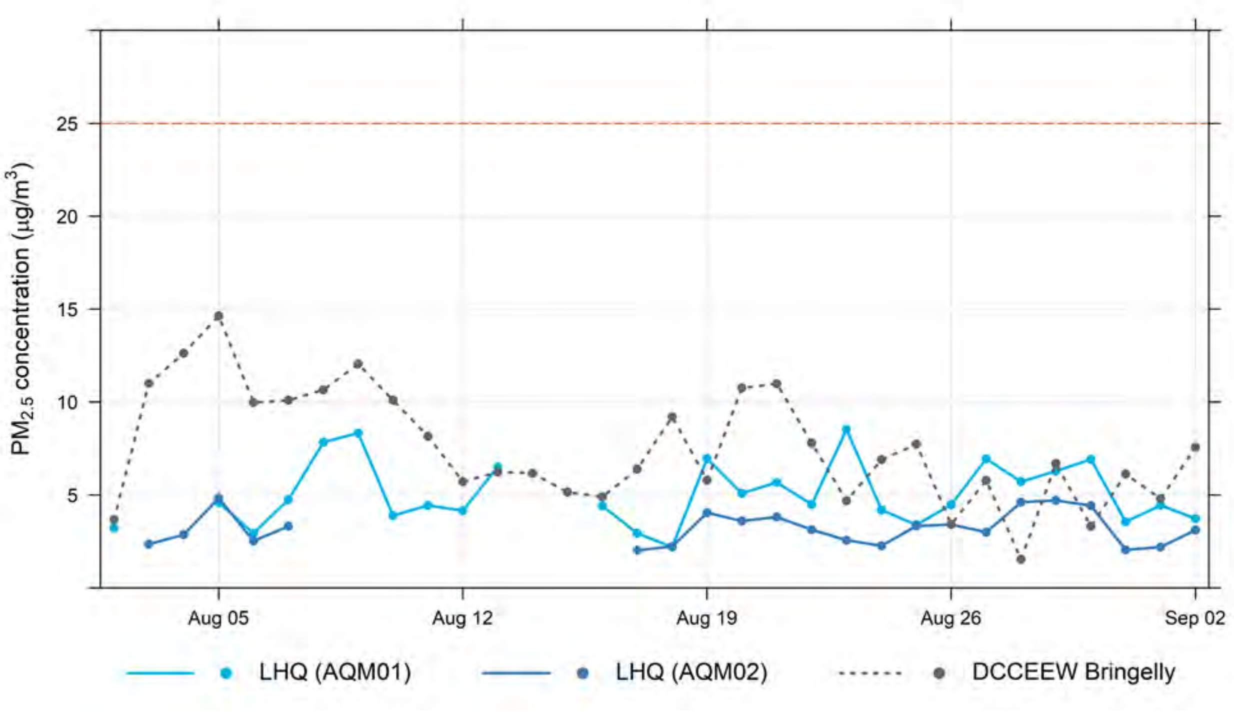
For the monitoring campaign period, the $PM_{2.5}$ concentrations at the quarry were generally lower than at the DCCEEW Bringelly AQMS.

No exceedances of the 24 hour average $PM_{2.5}$ criterion (25µg/m^3) were recorded at any of the monitoring locations.

Table 5.2 Statistics for $PM_{2.5}$ 24 hour average concentrations

Monitoring location	Mean (µg/m³)	Median (µg/m³)	Maximum (µg/m³)	Standard deviation	Days above 25 µg/m³
AQM01	5.0	4.5	8.5	1.7	0
AQM02	3.2	3.1	4.8	0.9	0
DCCEEW Bringelly AQMS	7.5	6.8	14.6	3.1	0

The time series of 24 hour $PM_{2.5}$ concentrations recorded at the site and Bringelly are presented in Figure 5.9. Concentrations at the site were generally lower than at the DCCEEW Bringelly AQMS; however, the three monitoring sites generally followed a similar trend.



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

Figure 5.9 Daily mean $PM_{2.5}$ concentration

The bivariate polar plots for $PM_{2.5}$ are shown in Figure 5.10 to Figure 5.12, and the polar annulus plots are shown in Figure 5.13 to Figure 5.15.

The following points are noted from the bivariate polar plots (Figure 5.10 to Figure 5.12):

- The bivariate polar plots for AQM01 and AQM02 (Figure 5.10 and Figure 5.11, respectively) show generally low concentrations in all directions; however, there are slightly higher concentrations recorded when winds are from the north-east and north-west. This is most notable for AQM01 and is likely to be associated with emissions from the quarry.
- The bivariate polar plot for the DCCEEW Bringelly AQMS (Figure 5.12) shows a signal from the east and the west, which is likely to be associated with emissions from domestic heating and road traffic.

The polar annulus plots (Figure 5.13 to Figure 5.15) show the temporal variation in the $PM_{2.5}$ concentration by wind direction during the whole reporting period. In this case the temporal variation is by hour of the day (0 to 23):

- The polar annulus plots for AQM01 and AQM02 (Figure 5.13 and Figure 5.14 , respectively) show that the highest concentrations occur between 8:00 am and 4:00 pm, and are likely to be associated with quarrying activities.

- The polar annulus plots for the DCCEEW Bringelly AQMS (Figure 5.15) shows that the highest concentrations occur between in the morning (approximately 12:00 am to 8:00 am) and in the late afternoon to night (8:00 pm to 12.00 am), supporting the earlier conclusion that recorded concentrations are likely to be associated with emissions from domestic heating (night) and road traffic (morning).

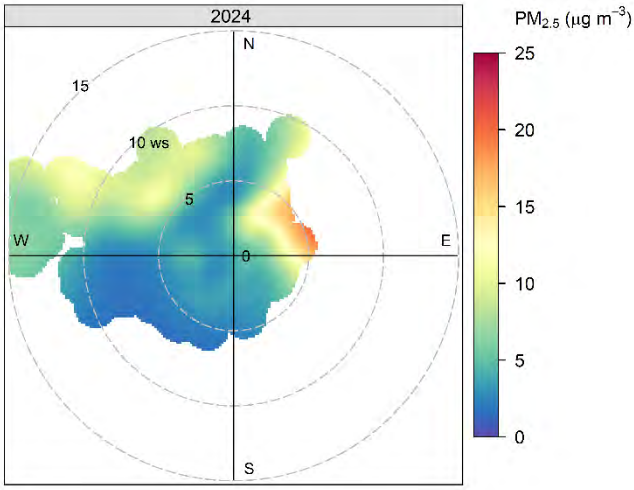


Figure 5.10 Assessment period bivariate polar plot for $PM_{2.5}$ at AQM01

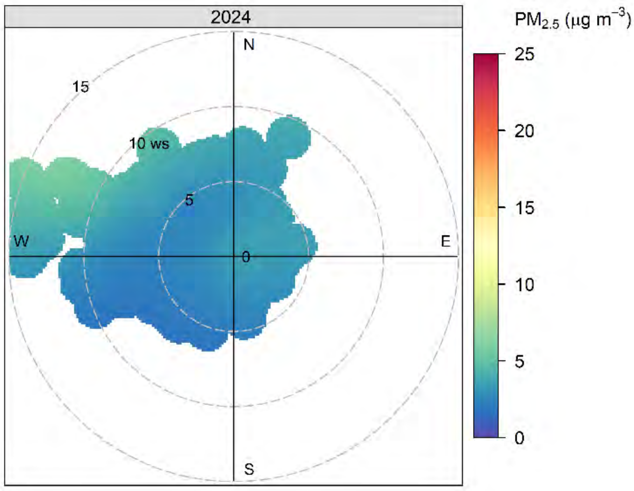


Figure 5.11 Assessment period bivariate polar plot for $PM_{2.5}$ at AQM02

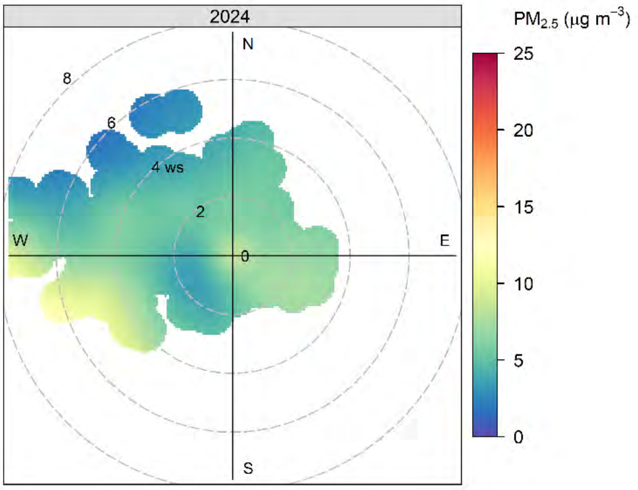


Figure 5.12 Assessment period bivariate polar plot for $PM_{2.5}$ at DCCEEW Bringelly

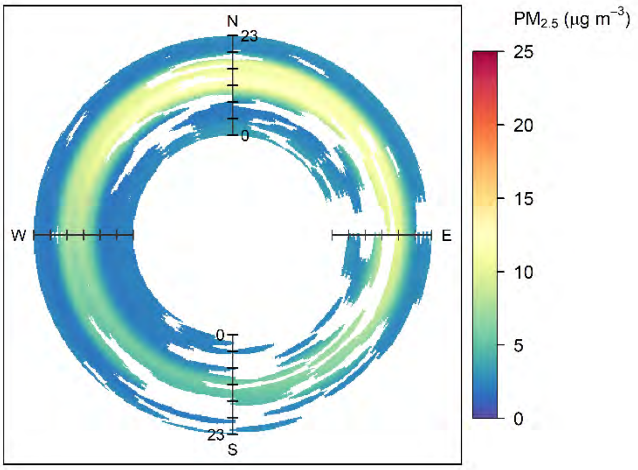


Figure 5.13 Polar annulus plot for $PM_{2.5}$ at AQM01

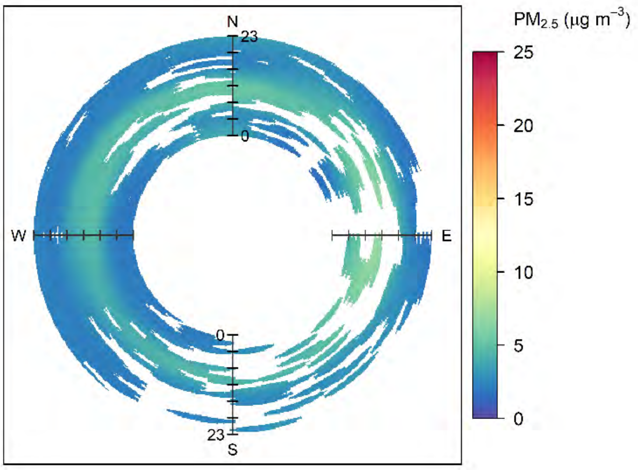


Figure 5.14 Polar annulus plot for $PM_{2.5}$ at AQM02

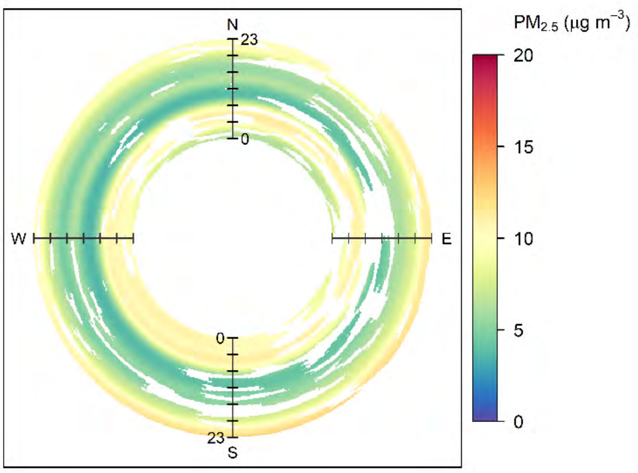


Figure 5.15 Polar annulus plot for $PM_{2.5}$ at DCCEEW Bringelly

5.4 Upwind and downwind concentrations

As stated in Section 1.2, the upwind and downwind monitoring will enable compliance assessment against the short-term air quality criteria, which are evaluated against the increment increase from the development alone, as follows:

- PM contribution from quarry = downwind concentration minus up wind concentration.

To determine the potential contribution from the site to recorded concentrations, the assessment period for the 2024 monitoring campaign where the wind direction aligned with the two onsite PM monitoring locations were examined. For the purpose of this analysis, downwind conditions were considered to occur when winds were between 10° and 99° for AQM01, and 180° and 320° for AQM02. Upwind conditions were considered between 100° and 360° for AQM01, and 0° and 179° for AQM02.

The mean PM_{10} and $PM_{2.5}$ concentration and wind speeds when the site was upwind or downwind of each monitor are given in Table 5.3. The number of hours for each condition is also provided.

For AQM01, PM_{10} and $PM_{2.5}$ concentrations were higher during downwind conditions than upwind conditions. For AQM02 PM_{10} and $PM_{2.5}$ concentrations were higher during upwind conditions relative to downwind conditions.

Table 5.3 PM_{10} and $PM_{2.5}$ concentrations upwind and downwind of the quarry

Parameter		AQM upwind of quarry			AQM downwind of quarry		
		Mean (µg/m³)	Mean wind speed (m/s)	Hours upwind	Mean (µg/m³)	Mean wind speed (m/s)	Hours downwind
PM_{10}	AQM01	11.9	1.2	597	30.5	1.1	154
	AQM02	11.0	1.0	250	14.5	1.3	459
$PM_{2.5}$	AQM01	4.4	1.2	597	6.7	1.1	154
	AQM02	3.5	1.0	250	3.1	1.3	459

The potential contribution of recorded PM_{10} and $PM_{2.5}$ concentrations from onsite emission sources (e.g. quarrying, haulage of material, wind erosion) have been calculated by reviewing the differences in mean measurements at the two locations under upwind and downwind conditions (i.e. AQM01 downwind and AQM02 upwind). The average difference at each site is presented in Table 5.4. For the monitoring period, the average difference (or quarry contribution) is up to 18.6 µg/m^3 for PM_{10}, and up to 2.4 µg/m^3 for $PM_{2.5}$.

Table 5.4 PM contributions from the quarry

Parameters		Average contribution (µg/m^3)
PM_{10}	AQM01	18.6
	AQM02	3.5
$PM_{2.5}$	AQM01	2.4
	AQM02	negligible

5.5 TSP concentrations

Measurements of TSP were not collected at the site during the August to September 2024 monitoring campaign. As stated in Section 1.3, TSP concentrations would be derived from PM_{10} concentrations based on the assumption that PM_{10} is 40% of TSP.

For the average PM_{10} concentrations recorded by the two onsite monitors, the derived average TSP concentrations are 40.8 µg/m^3 and 33.0 µg/m^3 for AQM01 and AQM02 respectively. Both concentrations are well below the applicable assessment criteria of 90 µg/m^3 (Table 2.1); however, it is noted that the TSP assessment criteria applies to annual average concentrations.

6 Conclusion

EMM has been commissioned to manage a short-term ambient air quality monitoring campaign at the site.

A four-week monitoring program was completed during August and September 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 period were sourced from the nearby BoM Badgerys Creek AWS. The onsite PM monitoring data was also compared with monitoring data for the same period from the DCCEEW Bringelly AQMS.

The monitoring equipment was deployed at the north-east and south-west corners of the site, with a specific focus of the monitoring study to record upwind and downwind concentrations.

A summary of the monitoring results are as follows:

- No exceedances of the 24 hour PM_{10} criterion of 50 µg/m^3 were recorded at either of the onsite monitoring locations.
- No exceedances of the 24 hour $PM_{2.5}$ criterion of 25 µg/m^3 were recorded at either of the onsite monitoring locations.
- The PM_{10} concentrations at the quarry were higher than those recorded at the DCCEEW Bringelly AQMS on multiple occasions. It is noted that concentrations were generally higher at the AQM01, this is likely due to the monitors proximity to the main haul route.
- The $PM_{2.5}$ concentrations at the quarry were generally comparable with the concurrent measurements at the DCCEEW Bringelly AQMS for the same period.
- When upwind and downwind concentrations were considered, the contribution from the site did not result in an exceedance of the criteria specified in Chapter 2.
- It is inferred that no exceedances of the annual TSP criterion of 90 µg/m^3 would occur based on the recorded PM_{10} concentrations.

Appendix A

Summary of 24-hour average concentrations recorded on site

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

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m^3)

Date	PM_{10} concentration (µg/m^3)		$PM_{2.5}$ concentration (µg/m^3)	
	AQM01	AQM02	AQM01	AQM02
2/08/2024	6.7	Less than 24 hours of data	3.2	Less than 24 hours of data
3/08/2024	Less than 24-hours of data	3.6	Less than 24 hours of data	2.4
4/08/2024	Less than 24-hours of data	5.9	Less than 24 hours of data	2.9
5/08/2024	16.1	14.5	4.6	4.8
6/08/2024	6.4	9.1	2.9	2.5
7/08/2024	20.1	10.2	4.7	3.3
8/08/2024	43.3	Less than 24 hours of data	7.8	Less than 24 hours of data
9/08/2024	27.9	Less than 24 hours of data	8.3	Less than 24 hours of data
10/08/2024	6.4	Less than 24 hours of data	3.9	Less than 24 hours of data
11/08/2024	7.0	Less than 24 hours of data	4.4	Less than 24 hours of data
12/08/2024	7.8	Less than 24 hours of data	4.2	Less than 24 hours of data
13/08/2024	8.5	Less than 24 hours of data	6.5	Less than 24 hours of data
14/08/2024	Less than 24 hours of data			
15/08/2024	Less than 24 hours of data			
16/08/2024	8.2	Less than 24 hours of data	4.4	Less than 24 hours of data
17/08/2024	4.6	3.3	2.9	2.0
18/08/2024	4.4	4.4	2.2	2.2
19/08/2024	30.4	17.4	7.0	4.0
20/08/2024	22.6	9.0	5.1	3.6
21/08/2024	15.4	10.8	5.7	3.8
22/08/2024	13.5	18.2	4.5	3.1
23/08/2024	47.1	10.7	8.5	2.6
24/08/2024	8.2	7.7	4.2	2.3
25/08/2024	6.3	8.7	3.4	3.3
26/08/2024	15.6	28.7	4.5	3.4
27/08/2024	27.1	10.4	6.9	3.0
28/08/2024	16.8	35.6	5.7	4.6
29/08/2024	30.8	21.3	6.3	4.7
30/08/2024	29.1	20.7	6.9	4.4

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration ($\mu g/m^3$)

Date	PM_{10} concentration ($\mu g/m^3$)		$PM_{2.5}$ concentration ($\mu g/m^3$)	
	AQM01	AQM02	AQM01	AQM02
31/08/2024	7.3	7.2	3.6	2.0
1/09/2024	6.2	6.0	4.4	2.2
2/09/2024	12.7	26.9	3.7	3.1

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

CALGARY
606 4th Street SW 11 Floor
Calgary Alberta T2P 1T1

linkedin.com/company/emm-consulting-pty-limited
emmconsulting.com.au

Appendix F
Noise and Vibration Annual Review

F.1 Noise Monitoring Report - April

CPG Luddenham Quarry

Noise Compliance Report - April 2024

Prepared for Luddenham Operations Pty Ltd

May 2024

CPG Luddenham Quarry

Noise Compliance Report - April 2024

Luddenham Operations Pty Ltd

E231131 RP3

May 2024

Version	Date	Prepared by	Reviewed by	Comments
1	3 May 2024	Jared Blackburn	Carl Fokkema	Final

Approved by

Carl Fokkema
Associate - Acoustics
3 May 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

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1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at Luddenham Quarry (the site) located at Luddenham, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was done during the day periods of 11 and 12 April 2024 at six 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

Location descriptor	Description	Address	Coordinates (MGA56)	
			Easting	Northing
R1	Approximately 880 m northwest of the site	2161–2177 Elizabeth Drive, Luddenham	288807	6250432
R2	Approximately 680 m northwest of the site	2111–2141 Elizabeth Drive, Luddenham	289142	6250089
A1	Approximately 260 m north of site	Northern site boundary utilised to calculate for R3 – 285 Adams Road, Luddenham	288937	6249498
A2	Approximately 635 m southwest	5 Anton Road, Luddenham Southwestern utilised to represent for R4 – 5 Anton Road, Luddenham, R5 – 185 Adams Road, Luddenham and R7 – 161 Adams Road, Luddenham	288345	6249200
A3	Approximately 260 m west of the site	Western site boundary utilised to calculate for R6 – 225 Adams Road, Luddenham	288912	6249491
A4	Approximately 1020 m northwest of the site	196 – 214 Adams Road, Luddenham utilised to calculate for R8 – 2510–2550 Elizabeth Drive, Luddenham	288632	6249769

\\emmsvr1\EMM\Jobs\2019\190749 - CPG Luddenham Quarry\GIS\02_Maps\Modification_Reporting\Noise_Management_Plan\NMP002_AssessmentLocations_20230901_01.mxd 8/09/2023

Source: EMM (2023); DFSI (2017); GA (2011); Nearmap (2020)

Noise Compliance Report
- April 2024

CPG Luddenham Quarry
Noise Compliance Report - April 2024
Figure 1.1

EMM creating opportunities

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 Environment protection licence

Noise assessment criteria for the operations are provided in the site's EPL which is included as Appendix B.2. These are specified at locations which are representative of residences potentially impacted by quarry noise.

2.2 Noise limits

Noise impact limits based on EPL 21562 are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Location description	Day $L_{Aeq,15minute}$
R1	2161–2177 Elizabeth Drive, Luddenham	41
R2	2111–2141 Elizabeth Drive, Luddenham	43
R3	285 Adams Road, Luddenham	53
R4	5 Anton Road, Luddenham	46
R5	185 Adams Road, Luddenham	45
R6	225 Adams Road, Luddenham	52
R7	161 Adams Road, Luddenham	41
R8	2510–2550 Elizabeth Drive, Luddenham	41

2.3 Meteorological conditions

Condition L2.3 of the EPL states the meteorological conditions which the noise limits apply under:

L3.2 Noise-enhancing meteorological conditions:

a) The noise limits set out in condition L2.1 apply under the meteorological conditions listed in the table below.

b) For those meteorological conditions not referred to in condition L2.1(a) table, the noise limits that apply are the noise limits in conditions L2.1 table plus 5 dB.

Table 2.2 Applicable meteorological conditions

Assessment period	Meteorological conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level; or Stability category E and F with wind speeds up to and including 2 m/s at 10 m above ground level.

Condition L2.4 specifies the source of meteorological data to be used and method for determining stability categories:

L2.4 For the purpose of condition L2.3:

a) The meteorological conditions are to be determined from meteorological data obtained from the meteorological weather station identified as Bureau of Meteorology AWS at Badgerys Creek, NSW (Station no 067108).

b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):

i. Use of sigma-theta data (section D1.4).

It is noted that the site only operates during the day period.

2.4 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 Badgerys Creek automatic weather station (AWS) (station ID 067108) 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 day period at each location. The duration of each measurement was 15 minutes. Where access to a property was not granted or measurement at assessment location was not practical due to localised construction activities, monitoring was completed at alternative representative locations and results were calculated back for the actual assessment location. This approach is consistent with the approved NMP for the site and the NPfI. The attended monitoring was completed during the day period in accordance with section M4.1 of the EPL. The assessment locations are listed in Table 1.1 and shown on Figure 1.1. 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 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
Svan SV36 calibrator	138019	1 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 – April 2024 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
R2	11/04/2024 7:12	83	77	71	67	63	55	50
R2	11/04/2024 7:27	83	77	70	67	62	54	49
R1	11/04/2024 7:45	80	76	71	66	62	53	50
R1	11/04/2024 8:01	84	75	70	65	56	51	47
A4	11/04/2024 8:21	84	76	62	63	54	52	47
A4	11/04/2024 8:37	81	77	64	63	53	51	48
A2	11/04/2024 9:25	77	64	54	53	45	42	40
A2	11/04/2024 9:40	74	67	53	54	43	41	39
A1	11/04/2024 10:07	68	59	53	51	49	46	44
A1	11/04/2024 10:22	74	71	54	56	48	46	44
A3	11/04/2024 10:40	83	62	51	52	46	44	41
A3	11/04/2024 10:55	67	60	53	50	46	43	40
R1	12/04/2024 8:09	82	76	70	66	56	50	45
A2	12/04/2024 8:41	70	65	55	53	48	45	42
A2	12/04/2024 8:56	70	63	54	52	47	43	40
A4	12/04/2024 9:13	81	76	64	62	49	45	40
A4	12/04/2024 9:28	82	76	64	63	49	45	41
A1	12/04/2024 9:43	81	71	57	58	50	48	46
A1	12/04/2024 10:01	75	64	58	55	50	48	46
A3	12/04/2024 10:16	71	55	49	47	45	43	40
A3	12/04/2024 10:32	64	57	51	48	46	44	39
R2	12/04/2024 10:51	86	78	71	67	60	46	39
R2	12/04/2024 11:30	86	78	68	65	55	43	38
R1	12/04/2024 11:46	84	79	67	65	51	46	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 – April 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north [1]	Cloud cover 1/8s
R2	11/04/2024 7:12	10	<0.5	-	0
R2	11/04/2024 7:27	10	<0.5	-	0
R1	11/04/2024 7:45	11	<0.5	-	0
R1	11/04/2024 8:01	12	0.7	248	0
A4	11/04/2024 8:21	14	0.8	215	0
A4	11/04/2024 8:37	15	0.9	220	0
A2	11/04/2024 9:25	17	1.9	211	0
A2	11/04/2024 9:40	18	2.3	257	0
A1	11/04/2024 10:07	19	1	233	0
A1	11/04/2024 10:22	19	0.8	236	0
A3	11/04/2024 10:40	20	1.3	224	0
A3	11/04/2024 10:55	20	1.1	220	0
R1	12/04/2024 8:09	14	1.1	237	0
A2	12/04/2024 8:41	16	<0.5	-	0
A2	12/04/2024 8:56	16	<0.5	-	0
A4	12/04/2024 9:13	17	<0.5	-	0
A4	12/04/2024 9:28	18	<0.5	-	0
A1	12/04/2024 9:43	18	<0.5	-	0
A1	12/04/2024 10:01	19	<0.5	-	0
A3	12/04/2024 10:16	19	<0.5	-	0
A3	12/04/2024 10:32	10	<0.5	-	0
R2	12/04/2024 10:51	10	<0.5	-	0
R2	12/04/2024 11:30	11	<0.5	-	0
R1	12/04/2024 11:46	12	0.7	248	0

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 Badgerys Creek automatic weather station (AWS) (station ID 067108). Noise limits are applicable under all weather conditions but are adjusted during very noise-enhancing weather conditions as defined by the NPfI.

Table 4.3 Site noise levels and limits – April 2024

Location	Start date and time	Wind		Stability class	Very enhancing[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}
R2	11/04/2024 7:12	3.6	240	E	Y	48[1]	N/A	IA	-	Nil	N/A
R2	11/04/2024 7:27	3.1	238	E	Y	48[1]	N/A	IA	-	Nil	N/A
R1	11/04/2024 7:45	2.9	237	E	Y	46[1]	N/A	IA	-	Nil	N/A
R1	11/04/2024 8:01	2.9	237	E	Y	46[1]	N/A	IA	-	Nil	N/A
R8 (A4) [4]	11/04/2024 8:21	3.7	237	E	Y	46[1]	N/A	33	-	Nil	N/A
R8 (A4) [4]	11/04/2024 8:37	3.7	237	E	Y	46[1]	N/A	32	-	Nil	N/A
R4 (A2)	11/04/2024 9:25	4.0	229	D	Y	51[1]	N/A	IA	-	Nil	N/A
R4 (A2)	11/04/2024 9:40	4.0	229	D	Y	51[1]	N/A	IA	-	Nil	N/A
R5 (A2)	11/04/2024 9:25	4.0	229	D	Y	50[1]	N/A	IA	-	Nil	N/A
R5 (A2)	11/04/2024 9:40	4.0	229	D	Y	50[1]	N/A	IA	-	Nil	N/A
R7 (A2)[4]	11/04/2024 9:25	4.0	229	D	Y	46[1]	N/A	28	-	Nil	N/A
R7 (A2) [4]	11/04/2024 9:40	4.0	229	D	Y	46[1]	N/A	27	-	Nil	N/A
R3 (A1)	11/04/2024 10:07	4.5	226	C	Y	58[1]	N/A	47	-	Nil	N/A

Table 4.3 Site noise levels and limits – April 2024

Location	Start date and time	Wind		Stability class	Very enhancing[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}
R3 (A1)	11/04/2024 10:22	3.9	228	B	Y	58[1]	N/A	47	-	Nil	N/A
R6 (A3)	11/04/2024 10:40	3.9	228	B	Y	57[1]	N/A	48	-	Nil	N/A
R6 (A3)	11/04/2024 10:55	3.1	226	B	Y	57[1]	N/A	47	-	Nil	N/A
R1	12/04/2024 8:09	0.6	153	D	N	41	N/A	IA	-	Nil	N/A
R4 (A2)	12/04/2024 8:41	2.0	154	D	N	46	N/A	IA	-	Nil	N/A
R4 (A2)	12/04/2024 8:56	1.4	154	D	N	46	N/A	IA	-	Nil	N/A
R5 (A2)	12/04/2024 8:41	2.0	154	D	N	45	N/A	IA	-	Nil	N/A
R5 (A2)	12/04/2024 8:56	1.4	154	D	N	45	N/A	IA	-	Nil	N/A
R7 (A2) [4]	12/04/2024 8:41	2.0	154	D	N	41	N/A	31	-	Nil	N/A
R7 (A2) [4]	12/04/2024 8:56	1.4	154	D	N	41	N/A	29	-	Nil	N/A
R8 (A4) [4]	12/04/2024 9:13	1.4	154	D	N	41	N/A	26	-	Nil	N/A
R8 (A4) [4]	12/04/2024 9:28	1.4	154	D	N	41	N/A	26	-	Nil	N/A
R3 (A1)	12/04/2024 9:43	1.4	154	D	N	53	N/A	47	-	Nil	N/A
R3 (A1)	12/04/2024 10:01	0.7	117	A	N	53	N/A	47	-	Nil	N/A
R6 (A3)	12/04/2024 10:16	1.0	51	D	N	52	N/A	45	-	Nil	N/A
R6 (A3)	12/04/2024 10:32	1.0	51	D	N	52	N/A	45	-	Nil	N/A
R2	12/04/2024 10:51	1.9	26	D	N	43	N/A	IA	-	Nil	N/A
R2	12/04/2024 11:30	1.9	12	C	N	43	N/A	IA	-	Nil	N/A

Table 4.3 Site noise levels and limits – April 2024

Location	Start date and time	Wind		Stability class	Very enhancing[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}
R1	12/04/2024 11:46	1.9	15	B	N	41	N/A	IA	-	Nil	N/A

Notes: 1. Noise limits are adjusted by +5 dB during 'very noise-enhancing meteorological conditions' in accordance with the NPfI.

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

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

4. Access to this property was not granted or measurement at assessment location was not practical due to localised construction activities, hence attended noise monitoring was completed at an alternative representative locations (refer to Figure 1.1) and site contribution calculated back to the assessment location in accordance with the approved NMP for the site.

5 Summary

EMM was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified EPL limits.

Attended environmental noise monitoring described in this report was done during the day period(s) of 11 and 12 April 2024 at six monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the April 2024 survey.

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

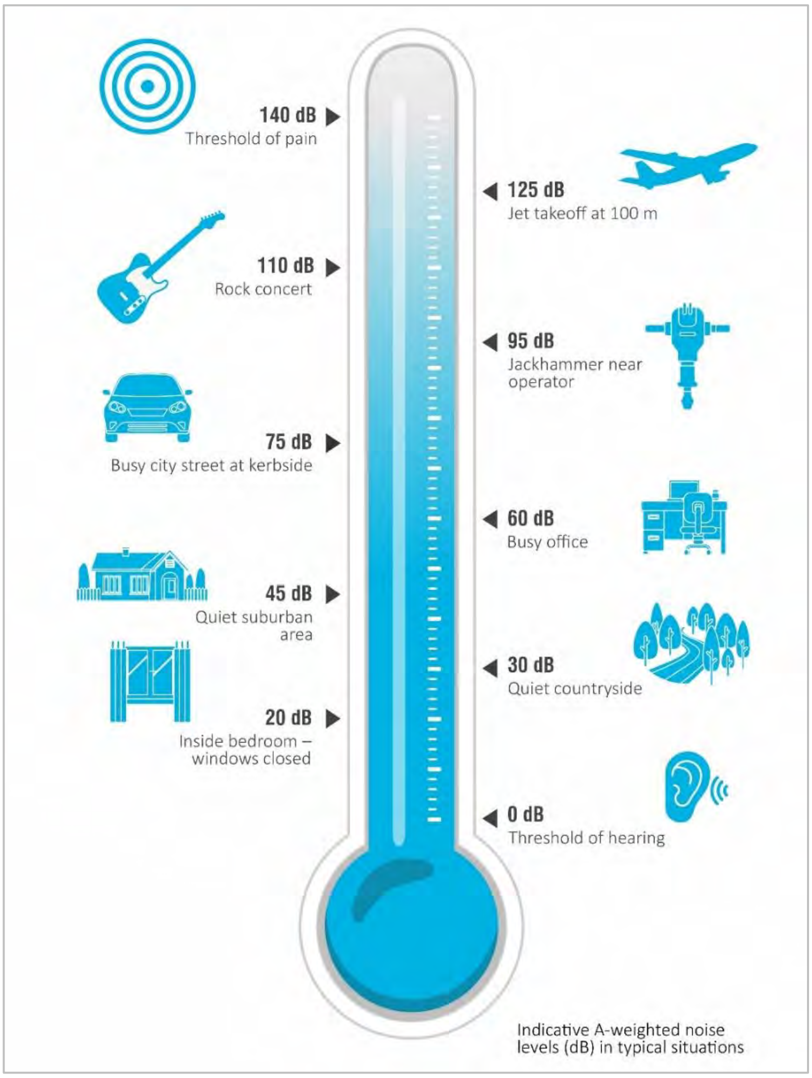

Figure A.1 Common noise levels

Appendix B
Regulator document

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A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi-fication no.	Type of monitoring point	Location description
1	Noise monitoring	2161-2177 Elizabeth Drive, Luddenham
2	Noise monitoring	2111-2141 Elizabeth Drive, Luddenham
3	Noise monitoring	285 Adams Road, Luddenham
4	Noise monitoring	5 Anton Road, Luddenham
5	Noise monitoring	185 Adams Road, Luddenham
6	Noise monitoring	225 Adams Road, Luddenham
7	Noise monitoring	161 Adams Road, Luddenham
8	Noise monitoring	2510-2550 Elizabeth Drive, Luddenham

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Noise limits

L2.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 1

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

POINT 2

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	43

POINT 3

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	53

POINT 4

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	46

POINT 5

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	45

POINT 6

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	52

POINT 7

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

POINT 8

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)

Day	LAeq (15 minute)	2 times a year	41

Note: EPA Identification No. 4 and 7 are entitled to negotiated agreement under the *Voluntary Land Acquisition and Mitigation Policy*. Where negotiated agreements are in place noise limits will not apply.

L2.2 For the purposes of Condition L2.1:

a) Day means the period from 7am to 6pm Monday to Saturday and the period from 8am to 6pm Sunday and public holidays.

L2.3 Noise-enhancing meteorological conditions

a) The noise limits set out in Condition L2.1 apply under the meteorological conditions in the table below.
b) For those meteorological conditions not referred to in the table below, the noise limits that apply are the noise limits in Condition L2.1 plus 5dB.

Assessment Period	Meteorological Conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level; or Stability category E and F with wind speeds up to and including 2m/s at 10m above ground level.

L2.4 For the purposes of Condition L2.3:

a) The meteorological conditions are to be determined from the meteorological weather station identified as BoM monitoring point at Badgerys Creek.
b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):
i. Use of sigma-theta data (section D1.4).

L2.5 To assess compliance:

a) with the LAeq(15 minutes) noise limits in Condition L2.1 and L2.3, the noise measurement equipment must be located:

(i) approximately on the property boundary, where any residence is situated 30 metres or less from the property boundary closest to premises; or where applicable,
(ii) in an area within 30 metres of a residence façade, but not closer than 3 metres where any residence on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable,
(iii) in an area within 50 metres of the boundary of a National Park or Nature Reserve,
(iv) at any other location identified in Condition L2.1.

b) with the LAeq(15 minutes) noise limits in Condition L2.1 and L2.3, the noise measurement equipment must be located:

(i) at the reasonably most affected point at a location where there is no residence at the location; or,
(ii) at the reasonably most affected point within an area at a location prescribed by Condition L2.5 (a).

c) with the LAeq(15 minutes) noise limits in Condition L2.1 and L2.3, where it can be demonstrated that direct measurement of noise from a relevant monitoring point is impractical, the EPA may accept alternative means of determining compliance as per Chapter 7 of the NSW Noise Policy for Industry.

L2.6 A non-compliance of Conditions L2.1 and L2.3 will still occur where noise generated from the premises is measured in excess of the noise limit at a point other than the reasonably most affected point at the locations referred to in Condition L2.5 (a) or L2.5 (b).

Note: The reasonably most affected point is a point at a location or within an area at a location experiencing or expected to experience the highest sound pressure level from the premises.

L2.7 For the purpose of determining the noise generated from the premises, the modifying factor corrections in Table C1 in Fact Sheet C of the Noise Policy for Industry (NSW EPA, 2017) may be applied, if appropriate, to the noise measurements by the noise monitoring equipment.

L2.8 Noise measurements must not be undertaken where rain or wind speed at microphone level will affect the acquisition of valid measurements.

L2.9 The following definitions apply to this licence:

a) Noise Policy for Industry - the document entitled “Noise Policy for Industry” published by the NSW Environment Protection Authority in October 2017.

b) Noise – ‘sound pressure levels’ for the purposes of Conditions L2.1 to L2.8.

- LAeq (15 minute) - the value of the A-weighted sound pressure level of a continuous steady sound that, over a 15 minute time interval, has the same mean square sound pressure level as a sound under consideration with a level that varies with time (Australian Standard AS 1055:2018 Acoustics: description and measurement of environmental noise).
- LAFmax – the maximum sound pressure level of an event measured with a sound level meter satisfying Australian Standard AS IEC 61672.1-2013 Electroacoustics - Sound level meters - Part 1: Specifications set to ‘A’ frequency weighting and fast time weighting.

L3 Hours of operation

L3.1 All works carried out as part of the scheduled activity are restricted to between the hours of 7:00am and 6:00pm Monday to Friday. Maintenance activities may be carried out between 7:00am and 1:00pm on Saturdays.

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
Calibration Date : 12 Jul 2023
Secondary Check: Rhys Gravelle
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.

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 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
Calibration Date : 12 Jul 2023
Secondary Check: Rhys Gravelle
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	**Date of Receipt :**	28/07/2023
Temperature	23	°C ±1° C	**Date of Calibration :**	01/08/2023
Relative Humidity	40	% ±5%	**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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Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
60 W 6th Ave
Vancouver BC V5Y 1K1
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

F.2 Noise Monitoring Report - August

CPG Luddenham Quarry

Noise Compliance Report - August 2024

Prepared for Luddenham Operations Pty Ltd

September 2024

CPG Luddenham Quarry

Noise Compliance Report - August 2024

Luddenham Operations Pty Ltd

E231131 RP6

September 2024

Version	Date	Prepared by	Reviewed by	Comments
1	4 September 2024	Jared Blackburn	Carl Fokkema	Draft
2	9 September 2024	Jared Blackburn	Carl Fokkema	Final

Approved by

Carl Fokkema
Associate - Acoustics
9 September 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

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1 Introduction

1.1 Background

EMM Consulting Pty Limited (EMM) was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at Luddenham Quarry (the site) located at Luddenham, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was done during the day periods of 22 and 23 August 2024 at six 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 and residences.

Table 1.1 Attended noise monitoring locations

Location descriptor	Description	Address	Coordinates (MGA56)	
			Easting	Northing
R1	Approximately 880 m northwest of the site	2161–2177 Elizabeth Drive, Luddenham	288807	6250432
R2	Approximately 680 m northwest of the site	2111–2141 Elizabeth Drive, Luddenham	289142	6250089
A1	Approximately 260 m north of site	Northern site boundary utilised to calculate for R3 – 285 Adams Road, Luddenham	288937	6249498
A2	Approximately 635 m southwest	5 Anton Road, Luddenham – southwest utilised to represent for R4 – 5 Anton Road, Luddenham, R5 – 185 Adams Road, Luddenham and R7 – 161 Adams Road, Luddenham	288345	6249200
A3	Approximately 260 m west of the site	Western site boundary utilised to calculate for R6 – 225 Adams Road, Luddenham	288912	6249491
A4	Approximately 1020 m northwest of the site	196–214 Adams Road, Luddenham utilised to calculate for R8 – 2510–2550 Elizabeth Drive, Luddenham	288632	6249769

Source: EMM (2023); DFSI (2017); GA (2011); Nearmap (2020)

\\emmsvr1\EMM\Jobs\2019\J190749 - CPG Luddenham Quarry\GIS\02 Maps\Modification Reporting\Noise Management Plan\NMP002 AssessmentLocations 20230901 01.mxd 8/09/2023

Noise Compliance Report
- August 2023

CPG Luddenham Quarry
Noise Compliance Report – August 2023
Figure 1.1

EMM
creating opportunities

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 audible 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 Environment protection licence

Noise assessment criteria for the operations are provided in the site's EPL which is included as Appendix B. These are specified at locations which are representative of residences potentially impacted by quarry noise.

2.2 Noise limits

Noise impact limits based on EPL 21562 are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Location description	Day $L_{Aeq,15minute}$
R1	2161–2177 Elizabeth Drive, Luddenham	41
R2	2111–2141 Elizabeth Drive, Luddenham	43
R3	285 Adams Road, Luddenham	53
R4	5 Anton Road, Luddenham	46
R5	185 Adams Road, Luddenham	45
R6	225 Adams Road, Luddenham	52
R7	161 Adams Road, Luddenham	41
R8	2510–2550 Elizabeth Drive, Luddenham	41

2.3 Meteorological conditions

Condition L3.3 of the EPL states the meteorological conditions which the noise limits apply under:

L3.2 Noise-enhancing meteorological conditions:

a) The noise limits set out in condition L3.1 apply under the meteorological conditions listed in the table below.

b) For those meteorological conditions not referred to in condition L3.3(a) table, the noise limits that apply are the noise limits in conditions L3.1 table plus 5 dB.

Table 2.2 Applicable meteorological conditions

Assessment period	Meteorological conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level; or Stability category E and F with wind speeds up to and including 2 m/s at 10 m above ground level.

Condition L3.4 specifies the source of meteorological data to be used and method for determining stability categories:

L3.4 For the purpose of condition L3.3:

a) The meteorological conditions are to be determined from meteorological data obtained from the meteorological weather station identified as Bureau of Meteorology AWS at Badgerys Creek, NSW (Station no 067108).

b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):

i. Use of sigma-theta data (section D1.4).

It is noted that the site only operates during the day period.

2.4 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 Badgerys Creek automatic weather station (AWS) (station ID 067108) 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 day period at each location. The duration of each measurement was 15 minutes. Where access to a property was not granted or measurement at assessment location was not practical due to localised construction activities, monitoring was completed at alternative representative locations and results were calculated back for the actual assessment location. This approach is consistent with the approved NMP for the site and the NPfI. The attended monitoring was completed during the day period in accordance with section M4.1 of the EPL. The assessment locations are listed in Table 1.1 and shown on Figure 1.1. 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 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
NTi XL2 sound level meter	A2A-12758-E0	20 May 2026	IEC 61672-1:2002
Svantek SV36 calibrator	106879	20 June 2025	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 – August 2024 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
R1	22/08/2024 07:10	92	77	70	68	63	55	51
R1	22/08/2024 07:24	87	78	71	67	63	55	47
R2	22/08/2024 07:42	86	81	73	69	63	53	51
R2	22/08/2024 07:57	87	80	72	69	62	55	51
A4	22/08/2024 08:14	66	63	55	53	47	45	42
A4	22/08/2024 08:30	68	58	53	49	46	44	42
A2	22/08/2024 08:52	77	70	55	56	47	45	43
A2	22/08/2024 09:08	81	73	60	60	48	44	41
A1	22/08/2024 09:34	71	63	54	53	50	49	47
A1	22/08/2024 09:50	82	74	57	60	50	48	47
A3	22/08/2024 10:10	64	63	53	51	45	43	41
A3	22/08/2024 10:28	61	58	50	47	44	42	40
A3	23/08/2024 07:09	75	64	56	55	52	51	49
A3	23/08/2024 07:24	69	65	53	54	51	50	48
A1	23/08/2024 07:41	67	61	54	54	53	52	50
A1	23/08/2024 07:56	77	72	53	57	52	51	50
A4	23/08/2024 08:12	69	59	52	50	47	45	43
A4	23/08/2024 08:28	72	61	50	49	44	42	40
R1	23/08/2024 08:47	80	74	68	64	57	48	41
R1	23/08/2024 09:01	80	74	68	64	57	46	38
R2	23/08/2024 09:17	84	77	71	67	61	50	44
R2	23/08/2024 09:33	83	77	70	66	59	47	40
A2	23/08/2024 09:54	80	72	56	59	45	41	38
A2	23/08/2024 10:09	80	69	55	58	48	46	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 m 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 – August 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north [1]	Cloud cover 1/8s
R1	22/08/2024 07:10	12	<0.5	-	7
R1	22/08/2024 07:24	12	<0.5	-	7
R2	22/08/2024 07:42	12	<0.5	-	7
R2	22/08/2024 07:57	12	<0.5	-	7
A4	22/08/2024 08:14	13	<0.5	-	7
A4	22/08/2024 08:30	14	<0.5	-	7
A2	22/08/2024 08:52	15	<0.5	-	7
A2	22/08/2024 09:08	15	<0.5	-	7
A1	22/08/2024 09:34	16	<0.5	-	6
A1	22/08/2024 09:50	16	<0.5	-	6
A3	22/08/2024 10:10	17	0.8	58	6
A3	22/08/2024 10:28	18	0.6	61	6
A3	23/08/2024 07:09	7	<0.5	-	2
A3	23/08/2024 07:24	7	<0.5	-	2
A1	23/08/2024 07:41	8	<0.5	-	1
A1	23/08/2024 07:56	9	<0.5	-	1
A4	23/08/2024 08:12	10	<0.5	-	1
A4	23/08/2024 08:28	11	<0.5	-	1
R1	23/08/2024 08:47	12	0.7	328	1
R1	23/08/2024 09:01	13	0.8	261	1
R2	23/08/2024 09:17	14	<0.5	-	1
R2	23/08/2024 09:33	15	<0.5	-	1
A2	23/08/2024 09:54	16	0.9	336	1
A2	23/08/2024 10:09	16	<0.5	-	1

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 Badgerys Creek automatic weather station (AWS) (station ID 067108). Noise limits are applicable under all weather conditions but are adjusted during very noise-enhancing weather conditions as defined by the NPfI.

Table 4.3 Site noise levels and limits – August 2024

Location	Start date and time	Wind		Stability class	Very enhancing[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}
R1	22/08/2024 07:10	1.4	191	C	N	41	N/A	IA	-	Nil	N/A
R1	22/08/2024 07:24	0.9	191	C	N	41	N/A	IA	-	Nil	N/A
R2	22/08/2024 07:42	0.9	191	C	N	43	N/A	IA	-	Nil	N/A
R2	22/08/2024 07:57	0.2	193	C	N	43	N/A	IA	-	Nil	N/A
R8 (A4)[4]	22/08/2024 08:14	0.2	193	D	N	41	N/A	IA	-	Nil	N/A
R8 (A4)[4]	22/08/2024 08:30	0.6	194	D	N	41	N/A	IA	-	Nil	N/A
R4 (A2)	22/08/2024 08:52	0.9	196	D	N	46	N/A	IA	-	Nil	N/A
R4 (A2)	22/08/2024 09:08	0.9	196	D	N	46	N/A	IA	-	Nil	N/A
R5 (A2)	22/08/2024 08:52	0.9	196	D	N	45	N/A	IA	-	Nil	N/A
R5 (A2)	22/08/2024 09:08	0.9	196	D	N	45	N/A	IA	-	Nil	N/A
R7 (A2)[4]	22/08/2024 08:52	0.9	196	D	N	41	N/A	IA	-	Nil	N/A
R7 (A2)[4]	22/08/2024 09:08	0.9	196	D	N	41	N/A	IA	-	Nil	N/A
R3 (A1)	22/08/2024 09:34	0.6	201	D	N	53	N/A	48	-	Nil	N/A
R3 (A1)	22/08/2024 09:50	0.9	120	D	N	53	N/A	49	-	Nil	N/A
R6 (A3)	22/08/2024 10:10	0.9	120	A	N	52	N/A	42	-	Nil	N/A
R6 (A3)	22/08/2024 10:28	1.3	44	A	N	52	N/A	42	-	Nil	N/A
R6 (A3)	23/08/2024 07:09	1.7	248	B	N	52	N/A	42	-	Nil	N/A
R6 (A3)	23/08/2024 07:24	1.7	280	B	N	52	N/A	42	-	Nil	N/A

Location	Start date and time	Wind		Stability class	Very enhancing[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}
R3 (A1)	23/08/2024 07:41	1.7	280	B	N	53	N/A	49	-	Nil	N/A
R3 (A1)	23/08/2024 07:56	1.1	301	B	N	53	N/A	49	-	Nil	N/A
R8 (A4)[4]	23/08/2024 08:12	1.1	301	E	Y	46[1]	N/A	IA	-	Nil	N/A
R8 (A4)[4]	23/08/2024 08:28	1.4	302	E	Y	46[1]	N/A	IA	-	Nil	N/A
R1	23/08/2024 08:47	1.4	302	E	Y	46[1]	N/A	IA	-	Nil	N/A
R1	23/08/2024 09:01	0.9	333	E	Y	46[1]	N/A	IA	-	Nil	N/A
R2	23/08/2024 09:17	0.4	349	A	N	43	N/A	IA	-	Nil	N/A
R2	23/08/2024 09:33	0.4	349	A	N	43	N/A	IA	-	Nil	N/A
R4 (A2)	23/08/2024 09:54	0.9	310	A	N	46	N/A	IA	-	Nil	N/A
R4 (A2)	23/08/2024 10:09	0.9	310	A	N	46	N/A	IA	-	Nil	N/A
R5 (A2)	23/08/2024 09:54	0.9	310	A	N	45	N/A	IA	-	Nil	N/A
R5 (A2)	23/08/2024 10:09	0.9	310	A	N	45	N/A	IA	-	Nil	N/A
R7 (A2)[4]	23/08/2024 09:54	0.9	310	A	N	41	N/A	IA	-	Nil	N/A
R7 (A2)[4]	23/08/2024 10:09	0.9	310	A	N	41	N/A	IA	-	Nil	N/A

Notes:
1. Noise limits are adjusted by +5 dB during ‘very noise-enhancing meteorological conditions’ in accordance with the NPfI.
2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.
3. Degrees magnetic north, “-” indicates calm conditions.
4. Access to this property was not granted or measurement at assessment location was not practical due to localised construction activities, hence attended noise monitoring was completed at an alternative representative locations (refer to Figure 1.1) and site contribution calculated back to the assessment location in accordance with the approved NMP for the site.

5 Summary

EMM was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified EPL limits.

Attended environmental noise monitoring described in this report was done during the day period(s) of 22 and 23 August 2024 at six monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the August 2024 survey.

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

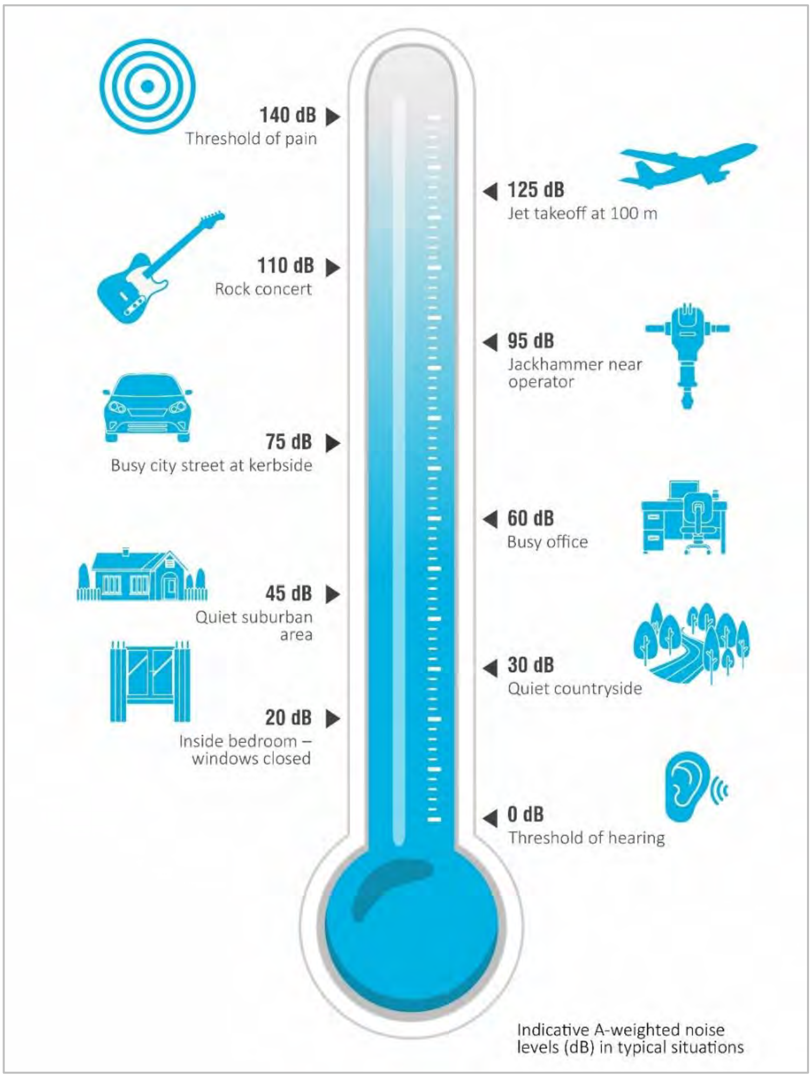

Figure A.1 Common noise levels

Appendix B

Regulator document

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POINT 9

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Conductivity	microsiemens per centimetre				4300
Oil and Grease	Visible				Not visible
pH	pH				6.5-8.8
Turbidity	nephelometric turbidity units				50

POINT 10

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Conductivity	microsiemens per centimetre				2100
pH	pH				6.5-8.5

POINT 12

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Conductivity	microsiemens per centimetre				4300
pH	pH				6.5-8.8
Turbidity	nephelometric turbidity units				50

L2.5 Discharges from Discharge Point 12 must not occur until a rainfall of event of at least 15 millimetres in a day has occurred.

L2.6 Discharges from Discharge Point 12 must immediately cease when conductivity at Monitoring Point 10 reaches 2,100 micro-siemens per centimetre.

L3 Noise limits

L3.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 1

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

POINT 2

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	43

POINT 3

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	53

POINT 4

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	46

POINT 5

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	45

POINT 6

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	52

POINT 7

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

POINT 8

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

Note: EPA Identification No. 4 and 7 are entitled to negotiated agreement under the *Voluntary Land Acquisition and Mitigation Policy*. Where negotiated agreements are in place noise limits will not apply.

L3.2 For the purposes of Condition L3.1:

a) Day means the period from 7am to 6pm Monday to Saturday and the period from 8am to 6pm Sunday and public holidays.

L3.3 Noise-enhancing meteorological conditions

a) The noise limits set out in Condition L3.1 apply under the meteorological conditions in the table below.
b) For those meteorological conditions not referred to in the table below, the noise limits that apply are the noise limits in Condition L3.1 plus 5dB.

Assessment Period	Meteorological Conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level; or Stability category E and F with wind speeds up to and including 2m/s at 10m above ground level.

L3.4 For the purposes of Condition L3.3:

a) The meteorological conditions are to be determined from the meteorological weather station identified as BoM monitoring point at Badgerys Creek.
b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):
  i. Use of sigma-theta data (section D1.4).

L3.5 To assess compliance:

a) with the LAeq(15 minutes) noise limits in Condition L3.1 and L3.3, the noise measurement equipment must be located:

(i) approximately on the property boundary, where any residence is situated 30 metres or less from the property boundary closest to premises; or where applicable,
(ii) in an area within 30 metres of a residence façade, but not closer than 3 metres where any residence on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable,
(iii) in an area within 50 metres of the boundary of a National Park or Nature Reserve,
(iv) at any other location identified in Condition L3.1.

b) with the LAeq(15 minutes) noise limits in Condition L3.1 and L3.3, the noise measurement equipment must be located:

(i) at the reasonably most affected point at a location where there is no residence at the location; or,
(ii) at the reasonably most affected point within an area at a location prescribed by Condition L3.5 (a).

c) with the LAeq(15 minutes) noise limits in Condition L3.1 and L3.3, where it can be demonstrated that direct measurement of noise from a relevant monitoring point is impractical, the EPA may accept alternative means of determining compliance as per Chapter 7 of the NSW Noise Policy for Industry.

L3.6 A non-compliance of Conditions L3.1 and L3.3 will still occur where noise generated from the premises is measured in excess of the noise limit at a point other than the reasonably most affected point at the locations referred to in Condition L3.5 (a) or L3.5 (b).

Note: The reasonably most affected point is a point at a location or within an area at a location experiencing or expected to experience the highest sound pressure level from the premises.

L3.7 For the purpose of determining the noise generated from the premises, the modifying factor corrections in Table C1 in Fact Sheet C of the Noise Policy for Industry (NSW EPA, 2017) may be applied, if appropriate, to the noise measurements by the noise monitoring equipment.

L3.8 Noise measurements must not be undertaken where rain or wind speed at microphone level will affect the acquisition of valid measurements.

L3.9 The following definitions apply to this licence:

a) Noise Policy for Industry - the document entitled “Noise Policy for Industry” published by the NSW Environment Protection Authority in October 2017.

b) Noise – ‘sound pressure levels’ for the purposes of Conditions L3.1 to L3.8.

- LAeq (15 minute) - the value of the A-weighted sound pressure level of a continuous steady sound that, over a 15 minute time interval, has the same mean square sound pressure level as a sound under consideration with a level that varies with time (Australian Standard AS 1055:2018 Acoustics: description and measurement of environmental noise).
- LAFmax – the maximum sound pressure level of an event measured with a sound level meter satisfying Australian Standard AS IEC 61672.1-2013 Electroacoustics - Sound level meters - Part 1: Specifications set to ‘A’ frequency weighting and fast time weighting.

Appendix C
Calibration certificates

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM39830

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	Nti Audio		
Type No:	XL2-TA	**Serial No:**	A2A-12758-E0
Mic. Type:	PMP21	**Serial No:**	230011
Pre-Amp. Type:	MA220	**Serial No:**	6486
Filter Type:	1/3 Octave	**Test No:**	F039829

Owner: EMM Consulting
20 Chandos Street
St Leonards NSW 2065

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure	1006	hPa ±1 hPa	**Date of Receipt :**	17/05/2024
Temperature	24	°C ±1° C	**Date of Calibration :**	20/05/2024
Relative Humidity	57	% ±5%	**Date of Issue :**	20/05/2024

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ....

AUTHORISED SIGNATURE: ....
Heln 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%.

Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS
Head Office & Calibration Laboratory
Unit 14, 22 Hudson Avenue, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Laboratory No. 9262
Acoustic and Vibration Measurements

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C50254

EQUIPMENT TESTED : Acoustic Calibrator

Manufacturer: Svantek
Type No: SV 36 **Serial No:** 106879
Class: 1
Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure	1002	hPa ±1 hPa	**Date of Receipt :**	17/06/2024
Temperature	23	°C ±1° C	**Date of Calibration :**	20/06/2024
Relative Humidity	37	% ±5%	**Date of Issue :**	20/06/2024

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

CHECKED BY: ...HB... **AUTHORISED SIGNATURE:** ....
Hein Soe

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Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS
Head Office & Calibration Laboratory
Unit 14, 22 Hudson Avenue, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

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Accredited Laboratory No. 9262
Acoustic and Vibration Measurements

The Calibrator described in this report has been tested to the requirements of the standard IEC 60942-[Ed 4]:2017-11.
The tests described in Annex B of the standard (Periodic tests) were carried out under the environmental conditions listed above to the following clauses:

Clause	**Test description**
B4.6	Sound Pressure Level (By comparison with a reference calibrator).
B4.7	Frequency (By measurement with a calibrated frequency meter).
B4.8	Total distortion and noise. (By measurement with a calibrated Noise and Distortion meter).

Notes:

1. The calibrator was calibrated with the main axis vertical and facing down.
2. No corrections have been made for atmospheric pressure, temperature, or humidity.

Parameter	Pre-Adj	Adj Y/N	Output: **(dB re 20 µPa)**	Frequency **(Hz)**	THD&N **(%)**
Level1:	NA	N	94.07 dB	1000.01 Hz	0.40 %
Level2:	NA	N	114.05 dB	999.98 Hz	0.20 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

Parameter	Class 1		Class 2	
Nominal Frequency	250 Hz	1 kHz	250 Hz	1 kHz
Output dB SPL	0.25 dB	0.25 dB	0.40 dB	0.40 dB
Frequency Hz	0.7 % (1.75 Hz)	0.7 % (7 Hz)	1.7 % (4.25 Hz)	1.7 % (17 Hz)
THD&N	2.5 %	2.5 %	3.0 %	3.0 %

Tolerance limits from AS/IEC60942 (edition 4)

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.

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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Australia

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au