



Strength. Performance. Passion

Lynwood Quarry
2022 Annual Review
1 January 2022 – 31 December 2022

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Appendix

- Appendix 1 - Noise Monitoring Results
- Appendix 2 - Environmental Monitoring Results
- Appendix 3 - Community Funded Projects

Title Block

<u>Name of operation</u>	Lynwood Quarry
<u>Name of operator</u>	Holcim (Australia) Pty Ltd
<u>Development consent #</u>	DA 128-5-2005
<u>Annual review start date</u>	1 January 2022
<u>Annual review end date</u>	31 December 2022
<p>I, Wayne Beattie, certify that this audit report is a true and accurate record of the compliance status of Lynwood Quarry for the period 1 January 2022 to 31 December 2022 and that I am authorised to make this statement on behalf of Holcim.</p> <p>Note.</p> <p>a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</p> <p>b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents – maximum penalty 2 years imprisonment or \$22,000, or both).</p>	
<u>Name of authorized reporting officer</u>	Wayne Beattie
<u>Title of authorized reporting officer</u>	Lynwood Quarry Manager
<u>Signature of authorised reporting officer</u>	
<u>Date</u>	31/03/2023

1.0 Statement of Compliance

This Annual Review has been prepared to provide a summary of the performance of the Lynwood Quarry operations over the period 1 January 2022 to 31 December 2022 (referred to hereafter as the report period). The compliance of the operation with relevant approvals is summarised in **Table 1**.

Table 1 below provides a statement of compliance for the report period. The non-compliances have been ranked according to the risk matrix included in **Table 2**. A description of each non-compliance is provided in **Table 3**.

Table 1: Statement of Commitments

Relevant Approval	All Conditions Complied With?
Development Consent (DA) 128-5-2005 (Mod 5)	No
Environment Protection Licence (EPL) 12939	No

Table 2: Compliance Status Key for Table 3

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of likelihood of occurrence
Medium	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> Potential for serious environmental consequences, but is unlikely to occur; or Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> Potential for moderate environmental consequences, but is unlikely to occur; or Potential for low environmental consequences, but is likely to occur
Administrative Non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval condition)

Source: Annual Review Guideline (NSW Government, 2015).

Table 3: 2022 Non-Compliances

Relevant approval	Condition	NC Summary	Compliance status	Comment from Holcim	Where addressed in this Report
DA128-5-2005 (Mod 5) EPL 12939	Condition 15 of Schedule 3 (Air Quality Management Plan) Condition 12 of Schedule 3 (Impact Air Assessment) Condition M2.2 (EPL Air Quality Monitoring Requirements)	Multiple invalidated samples recorded during the 2022 reporting period.	Low Non-Compliance	DDG 6 exceeded annual average, recording 4.74 (g/m ² /month) above allowed 4(g/m ² /month) HVAS 1 PM ₁₀ missed samples occurred on: <ul style="list-style-type: none"> • 3 May 2022 • 31 May 2022 • 4 July 2022 • 6 July 2022 • 15 July 2022 • 22 July 2022 • 28 July 2022 • 3 August 2022. PM ₁₀ monitoring via HVAS units 1 will continue.	Section 6.3
DA128-5-2005 (Mod 5)	Condition 20 of Schedule 3 (Water Management Plan) Condition 23 of Schedule 3 (Water Management Plan)	Full monitoring was not undertaken at SW8 across 2022, resulting in some absent results.	Low Non-Compliance	The parameters pH, TSS, or EC were not monitored at surface monitoring location SW8 on a quarterly basis. This is a low non-compliance because the full monitoring schedule outlined in the WMP was not implemented.	Section 6.4
DA128-5-2005 (Mod 5)	Condition 4 of Schedule 3	Full monitoring was not undertaken during the night at location N3 resulting in absent results.	Low Non-Compliance	Noise monitoring access will be sought through the locked gate or an alternative publicly accessible location on Munro Road will be used for future monitoring.	Section 6.6

2.0 Introduction

Holcim (Australia) Pty Ltd (Holcim) owns and operates Lynwood Quarry, a hard rock quarry located west of Marulan, approximately 160 km southwest of Sydney and 27 km northeast of Goulburn in New South Wales (NSW), as seen in **Figure 1** and **Figure 2**.

Holcim is the trading name for Holcim (Australia) Pty Ltd which, as a member of the Large Holcim group, is one of the leading suppliers of heavy construction material products in Australia, operating over 80 quarries, over 200 fixed concrete plants and a fleet of over 900 concrete delivery trucks. Holcim began quarry operations at Lynwood Quarry in 2015 and since this time has provided high quality sand and aggregates for use in construction and landscaping across the local, regional and Sydney markets.

Holcim was granted Development Consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of Lynwood Quarry. There have been 5 modifications approved to the Development Consent under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) since 2005.

On 18 May 2016, Lynwood Quarry was granted modification to commence quarrying and associated activities in an alternative resource known as the Granite Pit located to the north-west of the Approved Pit area (refer to **Table 4**). The approval also allowed for the reduction in the extent of the approved pit to reflect limitations within the ignimbrite resource. Operations have continued in the Granite Pit since this time.

2.1 Quarry Contacts

The Lynwood Quarry Works Manager is responsible to the regulatory authorities for all aspects of environmental compliance at the site. Key personnel at Lynwood Quarry are described in **Table 4**.

Table 4: Key personnel responsible for environmental management

Name	Role	Company	Contact Details
Wayne Beattie	Quarry Manager	Holcim	M +62 4820 7007 O +61 419 476 900
Mohsen Vafaeifard	Support Services Supervisor	Holcim	M +61 411 161 286
Rob Townsend	Acting Environment Manager - NSW	Holcim	M (02) 9412 6600

2.2 Annual Review Requirements

Condition 10 of Schedule 5 of the Lynwood Quarry Development Consent requires an Annual Review (AR) to be prepared and submitted to the Department of Planning Industry and Environment (DPE). This report has been prepared in accordance with the *NSW Government Annual Review Guideline* (NSW Government, 2015) and details the operational and environmental management activities of Lynwood Quarry during the report period 1 January 2022 to 31 December 2022. Development Consent requirements along with an explanation of where each requirement is addressed within this document are provided in **Table 5**.

Table 5: Development Consent 128-5-2005 (MOD 5) conditions for the Annual Review

Conditions		Addressed in Section
Schedule 2 – General Administrative Conditions		
Production Data		
13.	The Applicant must (a) Provide annual quarry production data to DRG using the standard form for that purpose; and (b) Include a copy of this data in the Annual Review.	Section 4.2
Schedule 3 – Specific Environmental Conditions		
Monitoring of Quarry Product Transport		
33A.	The Applicant must keep accurate records of all laden truck movements from the site (weekly, monthly and annually) and publish a summary of records in its Annual Review.	Section 4.2.2
Schedule 3 – Specific Environmental Conditions		
Retirement of Biodiversity Credits		
48A.	The Applicant must retire the biodiversity credits specified in Table 11 to the satisfaction of the Secretary and OEH. The retirement of credits must be undertaken in accordance with the Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects by: (a) acquiring or retiring credits under the Biobanking Scheme in the TSC Act; (b) making payments into an offset fund that has been developed by the NSW Government; or (c) providing supplementary measures.	Section 6.7
Schedule 3 – Specific Environmental Conditions		
Waste Management		
53	The Applicant must: (d) Report on waste management and minimisation on the Annual Review to the satisfaction of the Secretary.	Section 6.10
Schedule 5 – Environmental Management, Reporting and Auditing		
Annual Review		
10	By the end of September each year, or other timing as may be agreed by the Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Secretary. This review must:	This document
	(a) Describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year;	Section 4.0, Section 6.0 and Section 8.0
	(b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against: <ul style="list-style-type: none"> ● The relevant statutory requirements, limits or performance measures/criteria; ● The requirements of any plan or program required under this consent; ● The monitoring results of previous years; and ● The relevant predictions in the documents listed in condition 2(a) of Schedule 2; 	Section 6.0 and Section 9.2

Conditions		Addressed in Section
	(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	Section 1.0 and Section 11.0
	(d) Identify any trends in the monitoring data over the life of the development;	Section 6.0
	(e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of significant discrepancies;	Section 6.1
	(f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development;	Section 6.0
	(g) Describe the area of vegetation cleared as part of the development and identify the area proposed to be cleared over the next 5 years;	Section 6.7
	(h) Calculate the number of additional Bio Banking (or equivalent) credits that will need to be purchased, before that clearing can be done; and	Section 6.7
	(i) Report on the number of Bio Banking (or equivalent) credits that have been purchased to allow ongoing clearing and completion of stages.	Section 6.7



FIGURE 2.1
Locality Plan

File Name (A4): R01/4543_001.dgn
20190321 13.46

Figure 1: Locality Plan (Umwelt, 2016)

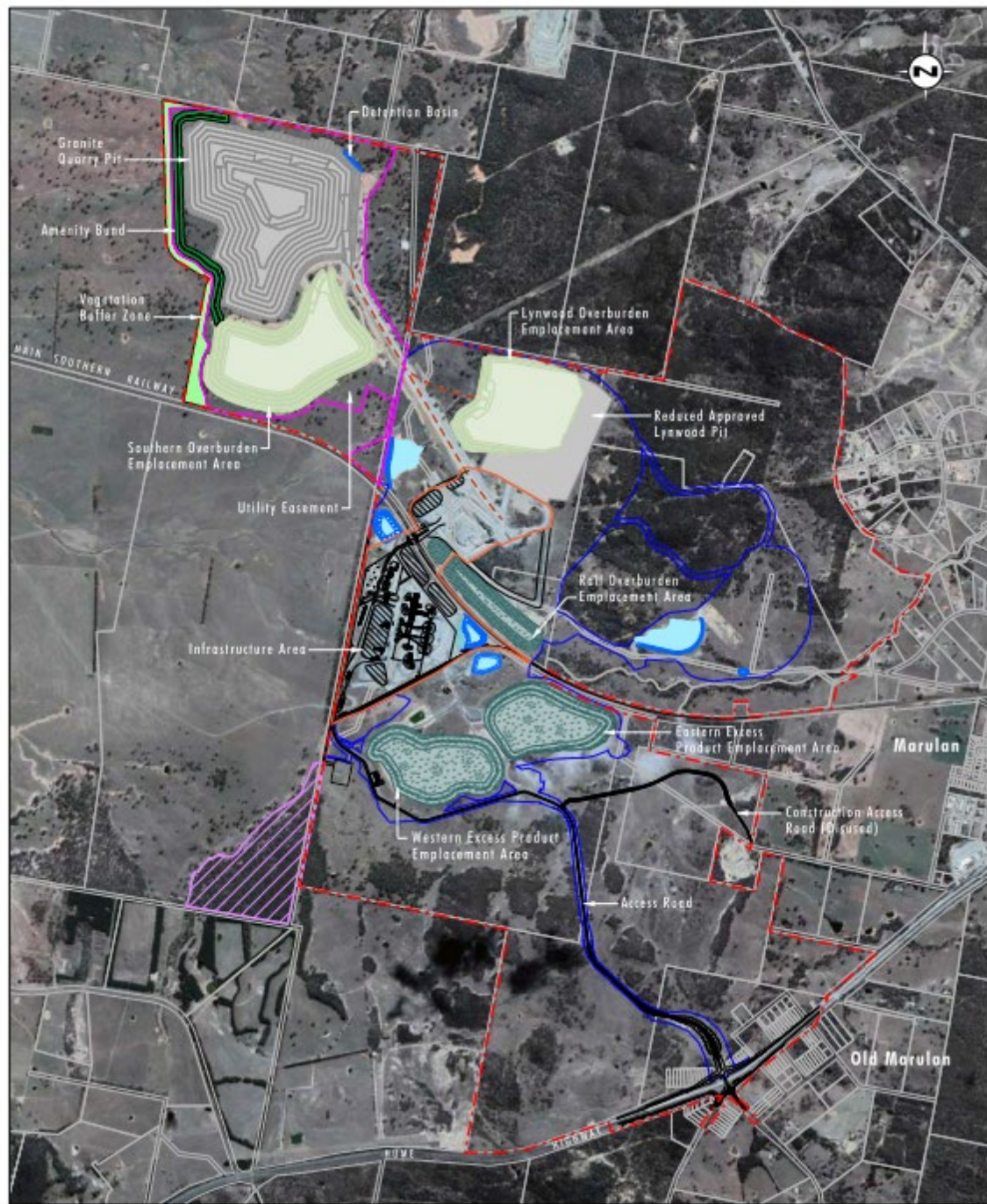


Image Source: Google Earth [2012], Holcim (2012, 2014)
 Data Source: LPI [2014], Holcim Australia [2015]

0 0.5 1.0 1.5 km
 1:30 000

Legend

- - - Approved Project Area
- - - Lynwood Infrastructure Area
- - - Approved Disturbance Footprint
- - - Granite Pit Disturbance Footprint
- - - Lynwood Infrastructure layout
- - - Habitat Management Area
- Quarry Pit
- Employment Area
- Dam
- Overburden Employment Area
- Vegetation Buffer Zone
- Amenity Bund
- - - Haul Road

File Name (A4): R01/4541_002.dgn
 20190321 13.46

FIGURE 2.2
 Overview of Operations

Figure 2: Overview of Operations (Umwelt, 2016)

3.0 Approvals

Approvals currently held by Lynwood Quarry are listed in **Table 6**.

Table 6: Lynwood Quarry approvals

Approval and Relevant Legislation	Details
Development Consent (DA) 128-5-2005 (Mod 5) <i>NSW Environmental Planning and Assessment Act 1979</i>	The MOD 5 Development Consent applied through the report period. Mining operations permitted to 1 January 2038 in accordance with the MOD 5 Development Consent.
Part 3A permit <i>Water Management Act 2000</i>	Obtained for works within 40 m of stream.
Part 2 Licence <i>Water Act 1912 Part 2</i>	Obtained for surface water capture and use.
Part 5 Licence <i>Water Act 1912 Part 5</i>	Obtained for groundwater monitoring.
Controlled Activity Approval (CAA) No. 10 ERM 2011/0446 <i>Rivers and Foreshores Improvement Act 1948</i>	Works within the riparian zones on site.
Environment Protection Licence (EPL) 12939 <i>Protection of the Environment Operations Act 1997</i>	Held by Holcim over the Lynwood Quarry premises.
Water Access Licence (WAL) No. 25575	Obtained under the water sharing plan for the Upper Nepean and Upstream Warragamba Water source (refer to Section 7.2)
Aboriginal Heritage Impact Permit (AHIP) No. 1100264 <i>National Parks and Wildlife Act 1974</i>	Discussed further in Section 6.11 .

3.1 Development Consent History

The original Lynwood Quarry Development Consent 128-5-2005 (Development Consent) was granted on 21 December 2005. Subsequent modifications to the Development Consent were approved in 2009, 2011, 2016 and 2017. The Development Consent permits carrying out quarrying operations until 1 January 2038.

On 18 May 2016, Lynwood Quarry was granted modification (MOD 4) to commence quarrying and associated activities in an alternative resource known as the Granite Pit immediately north-west of the existing operations.

MOD 4 of the Development Consent included:

- Development of a new Granite Pit to the west of the existing Approved Pit;

- Construction of an additional haul road, to connect the new Granite Pit to the existing infrastructure, water management structures and other minor additions;
- Emplacement of overburden from the Granite Pit in the Approved Pit;
- Construction of an amenity bund to the west and northwest of the Granite Pit; and
- A reduction in total disturbance area due to a decrease in the Approved Pit disturbance footprint and associated overburden storage and haul roads.

In May 2018, Lynwood Quarry was granted approval (MOD 5) to modify Condition 48A of Schedule 3 of the Development Consent. This condition related to the retirement of biodiversity credits for the site. All references to Development Consent conditions within this document refer to the MOD 5 unless stated otherwise.

Approvals and licences held by Holcim are provided in **Table 6**.

3.2 Management Plan Approvals

Environmental monitoring data and a copy of the current Lynwood Quarry Management Plans are published on the Holcim website (<https://www.holcim.com.au/lynwood>). During the preparation of this Annual Review, Holcim has assessed the need to review or update Management Plans. This must be submitted within 3 months under schedule 5 condition 5.

The following Management Plan have been approved in the 2022 reporting period:

- Aboriginal Heritage Management Plan (2022).

The following Management Plans have been submitted to DPE during the reporting period and are awaiting approval:

- Rehabilitation and Landscape Management Plan ; and
- Air Quality Management Plan .

4.0 Operations Summary

A summary of the operations undertaken at Lynwood Quarry during the reporting period is presented in the following sections.

4.1 Quarrying Operations

Quarrying operations commenced in the Granite Pit in 2017 and continued in 2022.

The quarrying process on site consists of the following four stages:

- Clearing and topsoil stripping – typically undertaken using a dozer and/or excavator in accordance with Lynwood Quarry’s clearing procedure, with selected material stockpiled for later use in rehabilitation;
- Overburden removal and emplacement – overlain material is typically removed via blasting and hauled to emplacement areas;
- Blasting, loading and haulage of primary raw feed (PRF) material – target resource removed via drill and blast then loaded by front-end loaders into haul trucks for transportation to the primary crusher; and
- Crushing and screening – resources are processed by the primary crusher and are then transported via conveyor to the infrastructure area for tertiary processing and screening. Products are stockpiled awaiting transport to local, regional and Sydney markets via road and rail transportation methods.

The construction of the earthen visual amenity bund was completed in October 2022 as part of rehab. On completion of the construction of the earthen visual amenity bund was planted out and planting ended in November.

4.2 Production Limits

Production in 2022 met the limits on total saleable product and amount of product transported by road outlined in Schedule 2 Condition 13 of the Development Consent. During the report period, a total of 2,085,790 tonnes of quarry product was transported from the quarry by road and rail. This is more than the total production for the previous reporting period. In 2022 a total of 1,188,775 tonnes was transported from the quarry by road transport using Hume Highway.

Table 7 provides the annual production and transportation volumes from 2019 to 2022 reporting periods and provides a forecast for the 2023 report period.

Table 7: Long-term Production Summary

Material	Approved limit DA 128-5-2005	2019 (actual) (t)	2020 (actual) (t)	2021 (actual) (t)	2022 (actual) (t)	2023 (forecast) (t)	Compliance
Product - total	5 million tonnes from the site in a year	2,262,468	2,257,967	2,018,000	2,085,790	2,400,000	Yes
Product Transported - Rail	5 million tonnes from the site in a year	1,386,838	1,063,128	696,409	897,015	1,200,000	Yes
Product Transported - Road	1.5 million tonnes from the site in a year by road	875,630	1,194,840	1,129,000	1,188,775	1,200,000	Yes

4.2.1 Hours of Operation

Lynwood Quarry operates in accordance with the operating hours specified in **Table 8** below.

Table 8: Operating hours at Lynwood Quarry

Activity	Day	Time	Compliance with Operating Hours during this report period
Construction works.	Monday – Friday	7am to 6pm	Yes
	Saturday	8am to 1pm	Yes
	Sunday and Public Holidays	None	Yes
Topsoil/overburden removal/emplacement; drilling.	Any day	7am to 6pm	Yes
Blasting.	Monday – Saturday	9am to 5pm	Yes
	Sunday and Public Holidays	None	Yes
Extraction.	Any day	7am to 10pm	Yes
Processing (crushing, screening, stockpiling); loading, delivery and distribution; maintenance.	Any day	Anytime	Yes

4.2.2 Vehicle Movements

In accordance with Condition 33A of Schedule 3 of the Development Consent, the number of laden truck movements from Lynwood Quarry are summarised in **Table 9**. Product transported by road from Lynwood Quarry is restricted to less than 1.5 million tonnes per annum. The 2022 report period road transport tonnages comply with the approved limits.

Table 9: Summary of Laden Trucks Movements 2022

Month	Laden Truck Movements	Product by Road Transport (tonnes)
January	2603	90,781.04
February	2262	100,756.79
March	1039	73,390.65
April	2395	96,094.29
May	1448	102,729.91
June	1985	120,757.68
July	2698	92,166.53
August	3088	107,776.43
September	2980	126,800.73
October	2064	70,820.13
November	2225	100,902.80
December	2215	105,797.84
Total	27,002	1,188,774.82

4.3 Construction Activities

The construction of the earthen visual amenity bund was completed in October 2022 as part of ongoing rehabilitation. Further detail regarding rehabilitation is provided in Section 8.1.

5.0 Actions Required from Previous Annual Review

5.1 Actions from 2021 Annual Review – DPE Actions

Holcim did not receive a letter from DPE following the submission of the 2021 Annual Review in March 2022.

5.2 Actions From the 2021 Annual Review – Holcim Proposed 2022 Actions

Actions proposed to be undertaken at Lynwood Quarry during this reporting period (2022) based on the previous Annual Review are detailed in **Table 10**.

Table 10: Actions Required from the 2021 Annual Review

Actions from Previous Annual Review	Works Undertaken	Where addressed in this Document
Implementation of approved Environmental Management Plans	All Management Plans have been implemented by Lynwood in 2022.	Section 6 – Environmental Performance
Undertake nest box and fauna monitoring in accordance with the Lynwood Quarry Rehabilitation and Landscape Management Plan	Nest box monitoring undertaken in 2022 as per the Rehabilitation and Landscape Management Plan, including by a suitably qualified expert.	Section 6.7 and Section 8.0
Finalise the Development Approval for the construction and management of the Keeping Place	Progress towards finalisation of the agreed process for the Keeping Place construction and management was ongoing in 2022.	Section 6.11 – Indigenous Heritage
Continued extraction within the Granite Pit.	Extraction continued in 2022.	Section 4.0 - Operations Summary
Continue works associated with construction of the visual amenity bund to the west of the Granite Pit	Construction of the visual amenity bund was completed in October 2022.	Section 4.0 Operations Summary

6.0 Environmental Performance

The following sections provide a summary of environmental monitoring and management undertaken during the report period. In accordance with the Development Consent, Lynwood Quarry has prepared several management plans in consultation with relevant stakeholders.

The environmental monitoring network is shown in **Figure 3**.

6.1 Summary of Performance Against EA Predictions

The Lynwood Quarry has been subject to three environmental assessments (EA) and five modifications since the original environmental impact statement and development application was approved in 2005. MOD 4 involved expanding quarrying operations to the west of the existing operations. This was assessed by the most recent EA dated November 2015 (Umwelt, 2015). The results of environmental monitoring data obtained during the report period have been compared to the predictions in the EA dated November 2015 within this Annual Review. During the report period, monitoring was undertaken at Lynwood Quarry for meteorological, noise, air quality, surface water and groundwater.

A summary of environmental performance during the report period is given in **Table 11**.

Table 11: Summary of the environmental performance during the report period

Aspect	Approval Criteria/ EIS Prediction	Performance during the report period	Trend / key management implications	Implemented / proposed management actions
Air Quality (Refer to Section 6.3)	Refer to Section 6.1.1/ Section 6.3.2	Compliant with the monitoring program and criteria levels.	Depositional dust and PM ₁₀ monitoring results continued to trend below impact assessment criteria limits during the report period and remained within historical range.	Actions to be undertaken are detailed in Section 6.3 .
Surface Water Quality (refer to Section 6.4)	Refer to Section 6.1.2 / Refer to Section 6.4.2	Non-compliance due to six exceedances in oil and grease. There was one exceedance in pH at site SW9 and two exceedances in TSS at site SW9 and SW10. There was no monitoring at site SW8 throughout all of the 2022 reporting period.	Generally, surface water monitoring results were below impact assessment criteria during the report period and remained within historical range. There were some increased levels of oil and grease in 2022 compared to 2021 which were reported to DPE. SW8 monitoring site was dry during the report period therefore, no samples could not be taken for all of 2022.	Actions to be undertaken are detailed in Section 6.4
Groundwater (Refer to Section 6.5)	Refer to Section 6.1.3/	Non-compliance as pH exceedances occurred during quarter one and two for location GPZ1, quarter two, three and four for location GPZ5 and quarter 3 for locations GPZ6 and GPZ8 in 2022. Site MP1 depth to	Generally, groundwater results were below impact assessment criteria during the report period and remained within historical ranges. However, exceedances of the trigger levels from the WMP	Actions to be undertaken are detailed in Section 6.5 .

Aspect	Approval Criteria/ EIS Prediction	Performance during the report period	Trend / key management implications	Implemented / proposed management actions
	Refer to Section 6.5.2	water level was 1.27m and below groundwater monitoring criteria 1.64 m.	occurred for some pH results. This is not a non -m compliance, rather a trigger for actions.	
Noise (Refer to Section 6.6)	Refer to Section 6.1.4/ Refer to Section 6.6.2	Compliant with the monitoring program and criteria levels.	Noise results were below impact assessment criteria in 2022.	Any further actions to be undertaken are in Section 6.6.
Biodiversity (Refer to Section 6.7)	Refer to Section 6.7.2 Refer to Section 8.3	Compliant with the monitoring program and Consent.	Rehabilitation outcomes continue to improve. Fauna monitoring was undertaken during the report period.	Any further actions to be undertaken are in Section 6.7.
Blasting (refer to Section 6.9)	Refer to Section 6.9	Compliant.	Blasting monitoring was undertaken in 2021 and complied with the Consent and EPL Criteria.	Any further actions to be undertaken are in Section 6.9.

6.1.1 Air Quality Predictions Against the EA

An Air Quality Impact Assessment (PEL, 2015) was completed as part of the Lynwood Quarry Extraction Area Modification EA (Umwelt, 2015). The assessment predicted that as operations move in a westerly direction, there would be no predicted exceedances of the assessment criteria for all PM₁₀ and Depositional Dust at private residences during the operational phase of the quarry. In summary, the EA concluded that:

- EPA air quality impact assessment criteria were not predicted to be exceeded at nearby residences; and
- The modification is not anticipated to cause adverse impacts offsite.

A discussion of air quality monitoring results recorded during the report period is provided in Section 6.3.

The annual depositional dust averages were below the impact assessment criteria and EA predictions for this report period. Depositional dust averages were calculated from 12 months of data.

PM₁₀ results for 2022 were similarly below impact assessment criteria and EA predictions. There were no short-term exceedances. A summary of these invalid or contaminated monitoring events for PM₁₀ is presented in **Table 17**.

6.1.2 Surface Water Quality Predictions Against the EA

The outcomes of the surface water assessment (Umwelt 2005 & 2015) indicated that Lynwood Quarry would not significantly alter the flow regimes or annual flow volumes in the surrounding creek network in terms of

peak discharges, flood levels or peak in-stream velocities either upstream or downstream of Lynwood. No adverse impacts are predicted in terms of channel stability, in-stream habitat of either Joarimin Creek or Lockyersleigh Creek systems. No adverse impacts are predicted in terms of water quality in Joarimin Creek, Lockyersleigh Creek or the downstream drainage systems.

A discussion of the surface water quality results recorded during report period is provided in **Section 7**. All surface water quality results were generally consistent with criteria. Little to low flow was observed at a number of sampling events. There was no evidence that the site caused impact to water quality downstream.

6.1.3 Groundwater Predictions Against the EA

Drawdown impacts are expected within the immediate vicinity of the quarry pit. As the expansion of the granite pit continues, a progressively deepening and slightly expanding cone of depression surrounding the pit is expected (Umwelt, 2015). Groundwater inflow rates are predicted to be negligible given the early stage of operations in the extension area.

Groundwater results for 2022 were generally consistent with the historical minimum and maximum bounds reaching back to 2010. Groundwater results indicated there has been no considerable impact on the local groundwater from operations. Exceedances in the maximum triggers occurred in some GPZ series bores for pH. All other parameters were compliant with the criteria outlined in the WMP. A discussion of groundwater level and water quality results is provided in **Section 7**.

6.1.4 Noise Predictions Against the EA

The results of the noise impact assessment identified that noise impacts from the operations will meet the existing development consent criteria at all locations and time of day periods except receiver location 11 (Monitoring Location - N3) where a minor 1 dB exceedance is predicted at night (Umwelt, 2015).

No noise monitoring exceedances were recorded during the report period and all results remained below impact assessment criteria. A discussion of noise monitoring results recorded during the report period is provided in **Section 6.6** and all noise monitoring reports are presented in **Appendix 1**.

6.2 Meteorological Monitoring

A summary of monthly rainfall was retrieved from the Bureau of Meteorology (BOM) Station 070330 Goulburn Airport, which is approximately 24 kilometres from site. The site uses this meteorological monitoring data to inform daily operations as per the Development Consent.

A summary of meteorological results for the report period are outlined in **Table 12**.

Table 12: Meteorological Monitoring Results Summary 2022.

Month	Total Rainfall (mm)	Minimum Temperature (°C)	Maximum Temperature (°C)
January	189.6	8.7	32.2
February	40.8	5.0	30.4
March	176.0	6.4	28.8
April	74.8	3.3	25.5
May	77.6	-3.2	22.5
June	21.4	-7.5	15.0
July	57.8	-8.1	17.1
August	67.2	-3.3	19.0
September	67.6	-3.1	19.7
October	98.2	0.8	24.5
November	111.8	0.7	27.2
December	45.6	0.6	33.2
Annual TOTAL	1028.4		

Goulburn Airport received a total of 1028.4mm of rainfall over the 2022 report period. The highest monthly rainfall occurred in January, with 189.6 mm falling during this period. The least amount of monthly rainfall in April with only 21.4 mm received at Goulburn Airport.

The minimum recorded temperature in the region occurred in July (-8.1°C). The maximum was 33.2°C in December 2022.

6.3 Air Quality

6.3.1 Environmental Management Measures

Lynwood's *Air Quality Management Plan* was revised during the reporting period and approved in February 2023 .

The air quality monitoring network consists of five dust deposition gauges (DD5, DD8, DD11, D12, DD13) and two High Volume Air Samplers (HVAS1 and HVAS2), which are used to measure depositional dust and particulate matter <math><10\mu\text{m}</math> (PM_{10}), respectively. Dust monitoring locations are provided in **Figure 3**.

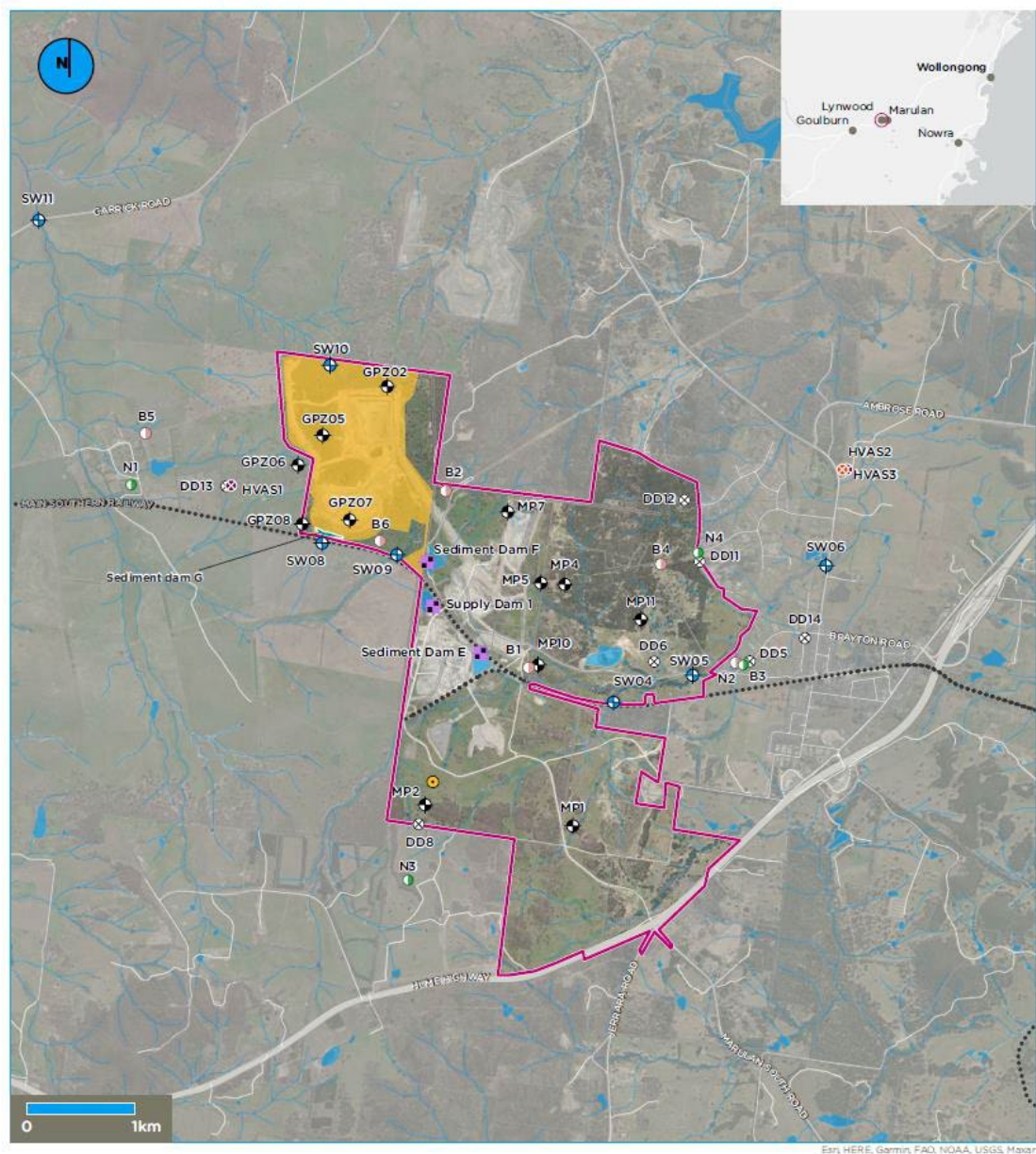
Lynwood trialled the use of an automatic water spray system in the site production area in 2022 The automatic water sprays were purposed as a dust suppression system. The automatic system continues to be used as an effective dust mitigation measure.

6.3.2 Performance Criteria

Holcim is required to ensure that dust and particulate emissions do not cause exceedances of the criteria specified in the Development Consent. The air quality assessment criteria specified in the Development Consent are provided in **Table 13**.

Table 13: Air quality impact assessment criteria

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual average	90 $\mu\text{g}/\text{m}^3$
Particulate matter <math><10\mu\text{m}</math> (PM_{10})	Annual average	30 $\mu\text{g}/\text{m}^3$
	24 hour average	50 $\mu\text{g}/\text{m}^3$
Deposited dust	Annual average (maximum total)	4 $\text{g}/\text{m}^2/\text{month}$
	Annual average (maximum increase)	2 $\text{g}/\text{m}^2/\text{month}$



- Legend**
- Approved project area
 - Granite pit disturbance footprint
 - Cadastral boundary (NSW Spatial Service, 2021)
 - Waterway (NSW Spatial Service, 2021)
 - Marulan Childrens Centre
 - Marulan Public School
 - Residence location
 - Meteorological station
 - Blasting monitoring location
 - Noise monitoring location

- Sample locations**
- Dust deposition sample location
 - HVAS PM2.5 sample location
 - HVAS PM10 sample location
 - Dam sample location
 - Surface water sample location
 - Groundwater sample location

A4
150,000

Figure 1 : Site layout and sample locations

Figure 3: Environmental Monitoring Network (AQMP, 2023).

6.3.3 Environmental Outcomes

6.3.3.1 Depositional Dust

As noted in **Table 14**, depositional dust monitoring during the report period took place on a monthly basis. Most of the sampling sites were compliant with Development Consent criteria for annual average total deposited dust and ranged between 0.7 – 1.7 g/m²/month with exception of DD6.

Throughout the reporting period, the site was mostly compliant, with DD6 recording an exceedance of 4.7 (g/m²/month) as an annual average. It should also be noted that there were two monthly samples that were invalidated due to the flowering Sifton Bush (Cassinia) and flowering acacias located in and around the location of the deposition gauges. This was recorded at DD6 in July and December, and DD5 in December. Lynwood Quarry notified DPE of the results, given that it is listed in the Lynwood Air Quality Management Plan. These two invalidated samples were removed from the annual averages. It is likely that the annual average exceedance at DD6 is due to ongoing contribution of organic matter to the sample from surrounding vegetation.

During September the location of DD14 was invalid due to the stand falling into the drain.

Table 14: 2022 Depositional Dust Monitoring Results.

Month	Total Insoluble Solids (g/m ² /month)						
	DD5	DD6	DD8	DD11	DD12	DD13	DD14
January	0.7	3.2	1	1.2	2.8	0.7	0.6
February	0.7	4.1	0.7	0.7	0.5	1	1.1
March	0.7	3.6	0.8	0.8	0.6	0.5	1.2
April	0.5	7.3	1.1	0.4	2.3	0.3	0.5
May	0.7	0.9	0.5	0.4	7.6	0.4	0.3
June	1.3	7.3	0.3	0.1	0.3	0.3	0.3
July	0.3	30.0*	0.4	0.5	0.4	0.2	0.7
August	0.3	4.2	0.3	0.3	0.5	0.2	0.2
September	0.1	3.6	0.2	0.1	0.3	0.2	NS
October	0.4	4.3	0.6	0.4	0.2	0.5	0.3
November	0.9	9.1	0.3	0.3	1.5	0.4	1.5
December	15*	5.4*	1.2	1.3	0.6	0.7	0.5
Annual Average	0.6	4.7	0.6	0.5	1.5	0.5	0.7
Minimum	0.1	0.9	0.2	0.1	0.2	0.2	0.2
Maximum	15*	30*	1.3	1.3	7.6	1	1.5

Note: Contaminated samples are marked with an asterisk (*) and have been removed from the annual average. NS indicates where a sample was invalidated due to contamination.

6.3.3.2 PM₁₀/ TSP

PM₁₀ monitoring via HVAS units 1 (Lockyersleigh) and 2 (Brayton Road) was undertaken during the report period. There were 60 sampling events at HVAS 1 and 61 sampling events at HVAS 2 in the report period, as shown in **Table 15**.

Table 15: 2022 PM₁₀ Compliance Summary

Category	HVAS 1	HVAS 2
Total number of HVAS monitoring rounds required in 2022	62	62
Number of completed monitoring rounds	60	61
Number of incomplete monitoring rounds, contamination, or equipment failure.	8	0
Number of valid samples	52	61

There were zero instances of the HVAS exceeding the short term 24-hour average criteria of 50 µg/m³ in 2022. Those sampling events which were impacted by equipment failure are presented in **Table 16**. Monitoring records note there were few instances of minor contamination to samples, however the results were still valid.

Table 16: Summary of Non-Compliant or Invalid PM₁₀ Monitoring Results

Date	PM ₁₀ (µg/m ³)	Cause
HVAS1		
May 3, 2022	NS	HVAS did not run. Issue was recorded.
May 31, 2022	NS	HVAS did not run. Issue was recorded.
July 4, 2022	NS	HVAS did not run. Issue was recorded.
July 6, 2022	NS	HVAS did not run. Issue was recorded.
July 15, 2022	NS	HVAS did not run. Issue was recorded.
July 22, 2022	NS	HVAS did not run. Issue was recorded.
July 28, 2022	NS	HVAS did not run. Issue was recorded.
August 3, 2022	NS	HVAS did not run. Issue was recorded.
HVAS2		
-	-	-

Table 17 and **Table 18** display the PM₁₀ monitoring results at HVAS 1 and HVAS 2, respectively.

Table 17:HVAS 1 2022 PM₁₀ Monitoring Results

HVAS 1 (Lockyersleigh)			
Sampling Date	PM10	TSP	Compliance Status
January 6, 2022	7.9	19.7	Compliant
January 12, 2022	6	15.1	Compliant
January 18, 2022	5.8	14.4	Compliant
January 24, 2022	9.4	23.5	Compliant
January 30, 2022	5.2	12.9	Compliant

HVAS 1 (Lockyersleigh)			
Sampling Date	PM10	TSP	Compliance Status
February 5, 2022	8.8	14.9	Compliant
February 11, 2022	8.8	22.1	Compliant
February 17, 2022	21.8	22.1	Compliant
February 23, 2022	6	54.4	Compliant
March 1, 2022	5.6	14	Compliant
March 7, 2022	4.6	11.5	Compliant
March 13, 2022	6.1	15.2	Compliant
March 19, 2022	5.9	14.7	Compliant
March 25, 2022	4.5	11.4	Compliant
March 31, 2022	6.5	16.1	Compliant
April 6, 2022	9.3	23.4	Compliant
April 12, 2022	10	25	Compliant
April 18, 2022	11.4	28.6	Compliant
April 24, 2022	6.3	15.7	Compliant
April 30, 2022	NS	NS	Missed sampling
May 6, 2022	5.3	NS	Compliant
May 12, 2022	5.1	13.4	Compliant
May 18, 2022	3.9	12.8	Compliant
May 24, 2022	2.9	9.8	Compliant
May 30, 2022	NS	7.4	Missed sampling
June 5, 2022	3.4	8.6	Compliant
June 11, 2022	4	10	Compliant
June 17, 2022	2.2	5.4	Compliant
June 23, 2022	1.3	3.2	Compliant
June 29, 2022	NS	NS	Missed sampling
July 5, 2022	NS	NS	Missed sampling
July 11, 2022	NS	NS	Missed sampling
July 17, 2022	NS	NS	Missed sampling
July 23, 2022	NS	NS	Missed sampling
July 29, 2022	NS	NS	Missed sampling
August 4, 2022	3	7.5	Compliant
August 10, 2022	3	7.5	Compliant
August 16, 2022	2.5	6.3	Compliant
August 22, 2022	3.9	9.7	Compliant
August 28, 2022	3.1	7.7	Compliant
September 3, 2022	3.9	9.7	Compliant
September 9, 2022	7.9	11.1	Compliant
September 15, 2022	5.7	19.7	Compliant
September 21, 2022	12.8	14.1	Compliant
September 27, 2022	6.5	32.1	Compliant
September 10, 2022	4.7	16.3	Compliant
October 3, 2022	4.4	11.8	Compliant
October 15, 2022	14.9	37.3	Compliant

HVAS 1 (Lockyersleigh)			
Sampling Date	PM10	TSP	Compliance Status
October 21, 2022	5.7	14.1	Compliant
October 27, 2022	9.6	24.1	Compliant
November 2, 2022	6.7	16.7	Compliant
November 8, 2022	7.6	13.4	Compliant
November 14, 2022	8.2	19.1	Compliant
November 20, 2022	8.6	20.6	Compliant
November 26, 2022	6.6	21.5	Compliant
December 2, 2022	5.3	16.6	Compliant
December 8, 2022	12.2	30.6	Compliant
December 14, 2022	9	22.6	Compliant
December 20, 2022	10.4	26	Compliant
December 26, 2022	15.6	39	Compliant
Minimum	1.3	3.2	Compliant
Annual Average	6.9	17.3	Compliant
Maximum	15.6	54.4	Compliant

Note: Samples impacted by contamination or damaged equipment are marked with an asterisk (*). NS indicates the result could not be retrieved.

Table 18: HVAS 2 2022 PM10 Monitoring Results

HVAS 2 (Brayton Road)			
Sampling Date	PM10	TSP	Compliance Status
January 6, 2022	7.3	18.3	Compliant
January 12, 2022	5.7	14.1	Compliant
January 18, 2022	6	14.9	Compliant
January 24, 2022	5.3	13.4	Compliant
January 30, 2022	9.6	24.1	Compliant
February 5, 2022	7	17.5	Compliant
February 11, 2022	9	22.6	Compliant
February 17, 2022	19.1	47.6	Compliant
February 23, 2022	4.5	11.4	Compliant
March 1, 2022	5.5	13.7	Compliant
March 7, 2022	3.9	9.8	Compliant
March 13, 2022	6.2	15.5	Compliant
March 19, 2022	6.5	16.1	Compliant
March 25, 2022	4.7	11.7	Compliant
March 31, 2022	8.2	20.6	Compliant
April 6, 2022	4.7	11.7	Compliant
April 12, 2022	9.8	24.4	Compliant
April 18, 2022	12.6	31.5	Compliant
April 24, 2022	6.9	17.4	Compliant
April 30, 2022	8.7	21.8	Compliant
May 6, 2022	9.1	22.7	Compliant
May 12, 2022	6.4	16	Compliant
May 18, 2022	4.2	10.4	Compliant

HVAS 2 (Brayton Road)			
Sampling Date	PM10	TSP	Compliance Status
May 24, 2022	3.6	8.9	Compliant
May 30, 2022	4.6	11.5	Compliant
June 5, 2022	4	10	Compliant
June 11, 2022	5.5	13.8	Compliant
June 17, 2022	5.2	12.9	Compliant
June 23, 2022	2.9	7.4	Compliant
June 29, 2022	10.2	25.5	Compliant
July 5, 2022	5.6	14	Compliant
July 11, 2022	6.3	15.8	Compliant
July 17, 2022	9.3	23.2	Compliant
July 23, 2022	3.6	9.1	Compliant
July 29, 2022	7.1	17.8	Compliant
August 4, 2022	7.1	17.8	Compliant
August 10, 2022	5.9	14.7	Compliant
August 16, 2022	4.1	10.3	Compliant
August 22, 2022	14.6	36.6	Compliant
August 28, 2022	7.4	18.4	Compliant
September 3, 2022	9	22.6	Compliant
September 9, 2022	11.6	29	Compliant
September 15, 2022	9.9	24.7	Compliant
September 21, 2022	19.5	48.9	Compliant
September 27, 2022	9.5	23.8	Compliant
October 3, 2022	6.9	17.4	Compliant
October 15, 2022	8.1	20.3	Compliant
October 21, 2022	7.5	18.7	Compliant
October 27, 2022	10.1	25.2	Compliant
November 2, 2022	5.6	14	Compliant
November 8, 2022	17.7	44.2	Compliant
November 14, 2022	6.7	16.7	Compliant
November 20, 2022	8	20	Compliant
November 26, 2022	13.3	33.3	Compliant
December 2, 2022	8.1	20.3	Compliant
December 8, 2022	15	37.5	Compliant
December 14, 2022	11.6	29	Compliant
December 20, 2022	9.3	23.2	Compliant
December 26, 2022	14.3	35.6	Compliant
Minimum	2.9	7.4	Compliant
Average	8	20.2	Compliant
Maximum	19.5	48.9	Compliant

Note: Samples impacted by contamination or damaged equipment are marked with an asterisk (*). NS indicates the result could not be retrieved.

6.3.4 Trends in data

6.3.4.1 Depositional Dust

A summary of annual average monitoring results from 2014 to 2022 is provided in **Figure 4**. Gauges DD11, DD12 and DD13 were installed in December 2016 following a revision to the depositional dust monitoring network and the approval of the Development Consent (Mod 4). As a result, limited data is available to compare against historical operations. Gauges DD5 and DD8 provide a longer-term comparison of monitoring results. 2022 is the first year that DDG6 and DDG14 have been included.

As shown in **Figure 4**, a comparison of depositional dust monitoring results indicates all sites were compliant with the development consent against maximum allowable annual increase criteria. Depositional dust results continue to be below the impact assessment criteria of 4(g/m²/month) at all sites. All gauges decreased in annual average from 2022, with the exception of DDG12 which has a slight increase. Results are generally lower than previous years. DDG6 recorded an exceedance above the impact criteria, recording an annual average of 4.7(g/m²/month. An assessment by Lynwood staff have concluded that this exceedance is likely due to the ongoing organic contribution from surrounding vegetation.

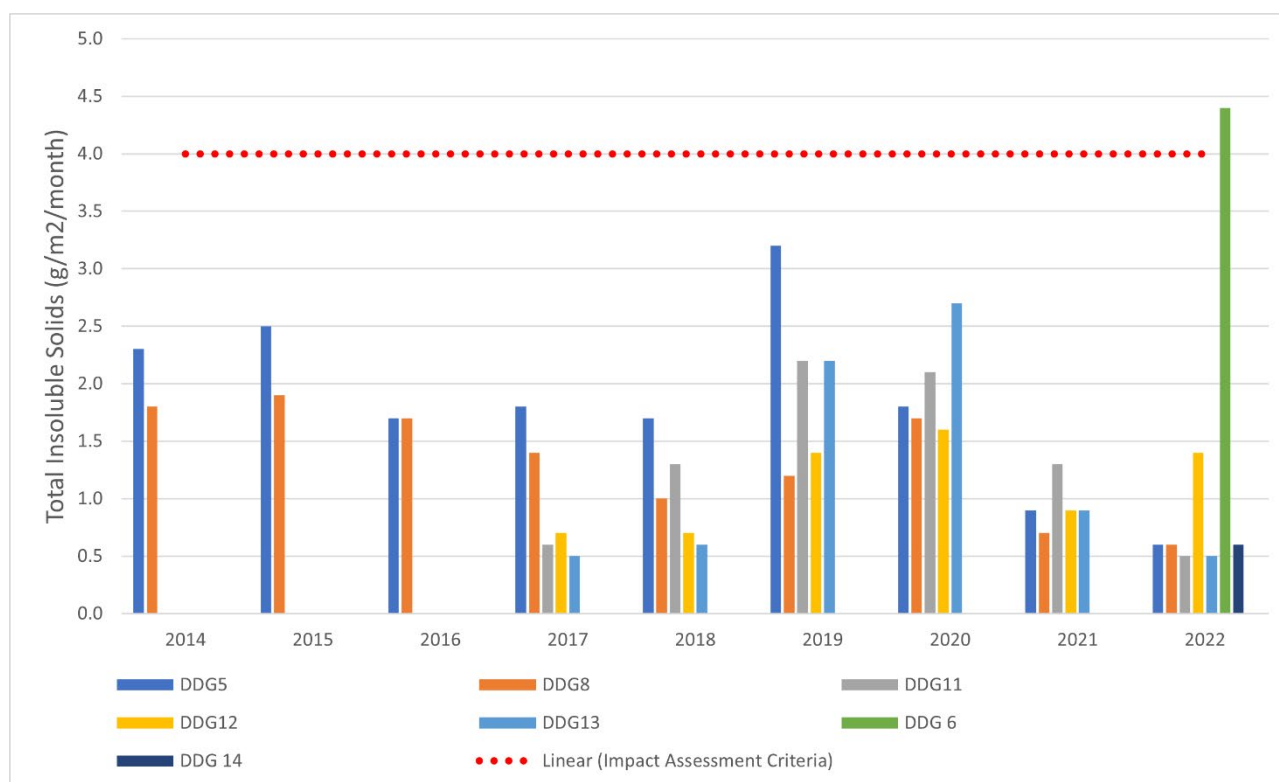


Figure 4: Historical Depositional Dust Monitoring

6.3.4.2 PM₁₀

Annual average PM₁₀ monitoring results from this report period to 2011 are provided in Figure 5. All results are below the annual average impact assessment criteria. As seen in Figure 5, a gap in data occurs in 2013 for HVAS 2 as a result of the unit not recording the required number of samples due to power supply issues.

The 2022 annual averages at HVAS 1 and HVAS 2 were 6.9 µg/m³ and 8 µg/m³, respectively. Annual averages at HVAS 1 and HVAS 2 in 2019 are higher than all other years represented. High 2019 results were

attributed to excessive dust generated by drought conditions and particulate matter from heavy bushfire smoke. 2020, 2021 and 2022 results are more consistent with levels seen prior to 2019.

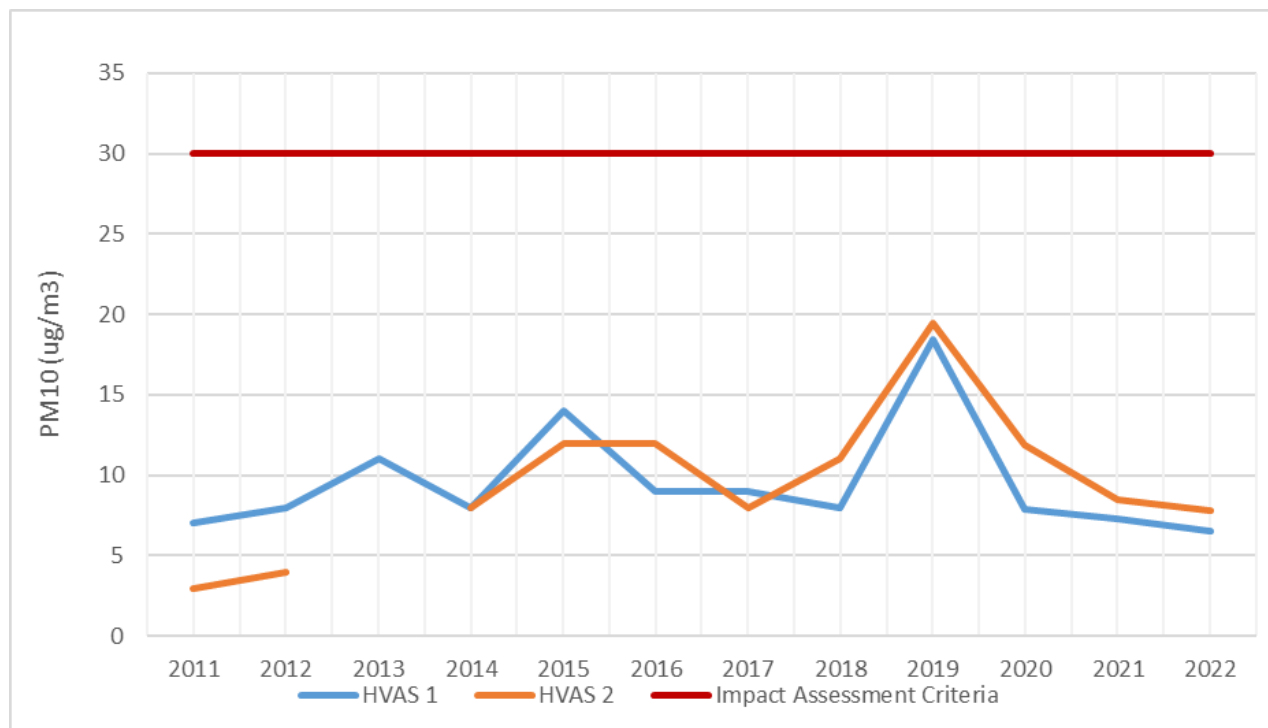


Figure 5: Historical PM₁₀ Monitoring Results

6.3.5 Proposed Improvements for the Next Report Period

In the 2022 reporting period Lynwood trailed a fog cannon machine for dust suppression. Trials will continue into 2023.

Lynwood will continue progressing towards assessing the automated haul Road dust control spray system in 2023.

The suitability of the location of Dust Deposition Gauge 6 will be assessed given the ongoing contribution of organic matter from surrounding vegetation to the samples.

6.4 Surface Water

6.4.1 Environmental Management Measures

Lynwood has developed and implemented a Surface Water Monitoring Program in accordance with the requirements of the Development Consent. The overall Water Management Plan (including component plans) was revised in 2020, with DPE approving the WMP on 16 November 2020. This includes a revision of trigger levels which have been outlined in this Annual Review.

The SWMP provides details on:

- Baseline water quality data;
- Surface water impact criteria;
- Monitoring surface water flow and quality;
- Surface water impact trigger levels and management actions; and
- Erosion and sediment controls implemented onsite.

Surface water management infrastructure at the Quarry was established during the initial construction and operational phase of the Quarry. The water management system includes a series of clean water diversion drains, catch drains and sedimentation dams. These structures have been constructed to minimise the interaction between clean and dirty water and to provide controls to treat captured dirty water to a standard acceptable for discharge off-site.

As of September 2021, upon the approval of the Riparian Management Plan for Joarimin Creek Catchment Area, quarterly inspections of Joarimin Creek undertaken by Holcim staff commenced. The riparian quality inspections assess sediment and erosion controls, creek stability, and riparian zone conditions.

6.4.2 Performance Criteria

6.4.2.1 Surface Water Monitoring Criteria/Trigger Levels

Trigger levels are provided in the 2020 Water Management Plan within the Surface Water Monitoring Program. These trigger levels are outlined in **Table 20** and have been based on an extended period of monitoring data from Lynwood surface water (SW) locations.

Table 19: Surface Water Criteria from Surface Water Management Plan

Water Quality	Trigger Value			
Variable	³ SW 1 and 2 (Marulan Creek) SW 3 and 4 Joarimin Creek SW 7 Lockyersleigh Creek	Joarimin Creek (SW4-SW6)	SW8 to SW11	⁴ Site Water Management System Dams (excluding SW5, SW6 and SW8 to SW11)
pH	No longer monitored. No trigger levels proposed.	5.3 to 9.7	6.4 to 7.8	6.5 to 8.5 ¹
Electrical Conductivity		Maximum of 3255 µS/cm	Maximum of 3922 µS/cm	No criteria listed in the Development Consent. No trigger levels proposed.
Oil and Grease		10 mg/L or none visible	10 mg/L or none visible	10 mg/L or none visible ¹
Total Suspended Solids		Less than 320 mg/L	Less than 320 mg/L ²	50 mg/L ¹

Notes:

¹ Triggers marked with ¹ are from Schedule 3 Condition 17;

² For SW8 to 11 there has been very few samples obtained. The highest TSS level recorded across a total of four sampling events has been low (16 mg/L). Holcim have therefore used the Joarimin Creek TSS range for the TSS trigger value for SW8 to 11.

³ SW1 – 3 are no longer monitored, hence there are no proposed criteria. SW7 is also no longer monitored.

⁴ Criteria associated with site water dams are only applicable during discharge events offsite from these dams (controlled discharge dams).

6.4.3 Environmental Outcomes

There were no discharges from Lynwood Quarry during the reporting period. Surface water quality sampling was undertaken at Sediment Dam E, Sediment Dam F, and Supply Dam 1 in addition to the required monitoring points presented below.

Surface Water Monitoring Program

Lynwood is required to conduct surface water monitoring across the site on a monthly basis at monitoring locations consistent with those shown in **Figure 3**. Surface water monitoring records captured during the report period are provided in a summary provided in **Table 20**. Surface water monitoring is undertaken when an appropriate volume of water is available to enable a representative sample to be obtained.

Table 20: Summary of Results – Surface Water 2022

Site	EC (µs/cm)			pH			TSS (mg/L)			Oil & Grease (mg/L)			P (mg/L)			N (mg/L)			Flow
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	
Sediment Dam E	271	399.4	555	7.4	8.6	10	5	124.8	330	5	7.3	14	0.01	0.1	0.55	1.7	3	5	No Flow (12)
Sediment Dam F	291	438.2	582	7.5	8.3	9.4	5	28.2	100	5	10.7	32	0.01	0	0.11	1.4	3.9	8.7	No Flow (12)
Sediment Dam G1	725	920.2	1050	7.9	9	10.1	5	11.9	64	5	9.7	25	0.01	0	0.15	6.4	10.6	18.3	No Flow (12)
Supply Dam	330	399.7	536	7.7	8.7	9.7	5	13.2	62	5	8.5	22	0.01	0	0.04	0.2	2.1	4.9	No Flow (12)
SW4	105	251.3	662	6.6	7.3	8.4	5	19.9	39	5	8.2	25	0.03	0	0.1	0.2	1.3	2.9	No Flow (8) Flow (4)
SW5	180 1	397.6	758	7	7.8	8.6	5	8.4	14	5	7.5	25	0.02	0.1	0.17	0.2	5.2	49	No Flow (7) Flow (5)
SW6	179	373.5	472	6.3	7.4	8.1	6	11.5	30	5	11.4	28	0.01	0.1	0.61	0.2	1.7	5.4	No Flow (10) Flow (2)
SW8	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	No Flow (12)
SW9	279	632.1	1030	7	8	10.1	17	135.3	510	5	13.1	50	0.02	0.1	0.47	0.91	3.5	6.4	No Flow (11) Flow (1)
SW10	142	448.3	759	6.9	7.3	8	9.2	190.4	1800	5	10.4	26	0.01	0.2	0.55	0.2	1.4	5.2	No Flow (7) Flow (5)
SW11	325	1106.3	2150	7.1	7.5	8.3	5	7.7	30	5	9.2	23	0.02	0.1	0.34	0.2	1.4	3.2	No Flow (2) Flow (10)

Note: Minimum and maximum values which are below or above the trigger values are in **bold**.

In the 2021 reporting period Holcim contracted Ramboll to investigate elevated concentrations of oil and grease above the site trigger level at surface water monitoring locations at Lynwood Quarry. This memo investigates results across all current monitoring locations including SW8, SW9, SW10, SW11, Sediment Dam G1, Supply Dam 1, Sediment Dam E and Sediment Dam F, with a focus on SW4, SW5 and SW6 which currently show the highest level of oil and grease across the site.

Lynwood notified DPE regarding oil and grease exceedances reported at SW4 and SW6 in January and February 2022. No evidence was found during the site visit or data analysis to suggest Holcim operations were generating oil and grease impacts. As there were no discharges during the reporting period, Lynwood believes that these exceedances originate offsite. Lynwood also note that SW6 monitoring location is within close proximity to a road and bridge drain into Joarimin Creek.

These exceedances were reported to DPE in February 2022, and no evidence was found to suggest that the development was the cause of the oil and grease exceedances in Joarimin Creek. The recording of the incident does not preclude the taking alternative action.

It should be noted that the average oil and grease levels from 2022 were slightly elevated compared to 2021 data.

SW4

A summary of SW4 monitoring results is provided in **Table 20**. Surface water results were generally compliant in 2022. Monthly monitoring at SW4 found pH, electrical conductivity, and total suspended solids levels were below trigger values.

In February, oil and grease levels at monitoring location SW4 were exceeded, recording 21 mg/L, yet oil and grease was not visible. In November, the total oil and grease was 25 mg/L and visible. This is an exceedance of the trigger levels outlined in the Surface Water Monitoring Program and **Table 19**. Lynwood believes that the oil and grease exceedances reported in SW4 originate offsite, as no discharges occurred during these time periods, and site investigations revealed no evidence.

The maximum nitrogen result for 2022 (2.9 mg/L in January) was lower when compared to the previous year 2021. However, it should be noted there was no flow and vegetation growing around the area at the time of sampling during 2021.

SW5

A summary of SW5 monitoring results is provided in **Table 20**. Surface water results were generally compliant in 2022. Monthly monitoring at SW5 found pH, electrical conductivity, and total suspended solids levels were within trigger values.

The pH at SW5 ranged from a minimum of 7 in March to a maximum of 8.6 in August 2022. pH did not exceed the trigger levels outline in **Table 19**.

Electrical conductivity was within the trigger level range in 2022. The annual average at SW5 was 397.6 $\mu\text{S}/\text{cm}$ which is a decrease from the 2021 average of 754.3 $\mu\text{S}/\text{cm}$. However, the EC results at SW5 are consistent with historical values.

SW5 total suspended solids did not exceed the trigger value in 2022.

In the November sample, oil and grease was noted to be not visible, however total oil and grease equalled 25 mg/L. This was an exceedance in total oil and grease trigger level. The incident has been recorded by the Department. However, it is noted that no evidence to suggest that the development was the cause of the oil and grease exceedances in Joarimin Creek.

Phosphorous levels did not differ from historical trends. Nitrogen had a maximum in November with a total of 40 which is an increase from the 2021 maximum.

SW6

A summary of SW6 monitoring results is provided in **Table 20**. Monitoring was undertaken on 12 occasions during the report period.

The pH results were within the minimum and maximum trigger values for Joarimin Creek and consistent with long-term results.

Electrical conductivity and total suspended solids were within trigger levels.

Oil and grease for February was not visible, but was measured to be 28 mg/L. This is an exceedance of the total oil and grease trigger, 10 mg/L. The oil and grease exceedances in SW6 are likely to be influenced by the sample location's proximity to a road and bridge drain into Joarimin Creek.

Average nitrogen and phosphorous levels were within long-term trends for SW6.

SW8

During 2022 no pH, TSS, EC or oil and grease monitoring results were recorded for SW8 as per the Surface Water Monitoring Program. It should be noted that the sample location was too dry for all twelve occasions. This is a non-compliance with the implementation of the Water Management Plan.

SW9

A summary of SW9 monitoring results is provided in **Table 20**. Monitoring was undertaken on 12 occasions in 2022, with water flow only observed during the March sampling event.

The SW9 annual average pH is 8 which exceeds the maximum trigger of 7.8. The pH results exceeded the maximum trigger level in six occasions which occurred during February, May, July, September, November and in December showed the maximum pH of 10.

There were no exceedances for Electrical conductivity and total suspended solids in 2022.

There were four occasions that exceeded the maximum trigger of 10 mg/L in 2022 which occurred during March, June, November and December. The maximum total oil and grease was 50 12 mg/L which was recorded in June. Oil and grease were not visible for 11 occasion and only visible in April.

Phosphorous and nitrogen levels at SW9 in 2021 were consistent with long-term data trends.

SW10

A summary of SW10 monitoring results is provided in **Table 20**.

The pH results at SW10 were within the trigger levels outlined in **Table 19** on 10 occasions. In July, monitoring results returned a pH 8 and September the pH result was 7.9 which exceeds the maximum trigger of 7.8.

There were no exceedances for Electrical conductivity and total suspended solids in 2022.

Total suspended solids exceeded the trigger levels in February, with a result of 1800 mg/L. All other TSS results were below the trigger level of 320 mg/L.

Total oil and grease exceeded the trigger level 10 mg/L on 6 occasions. January, March, April, May, June and November saw samples of 13 mg/L during January and March, 12 mg/L, 11mg/L 26 mg/L and 18 mg/L respectively. The monitoring results note that oil was not viable in January, February, March and November.

Phosphorous and nitrogen levels were consistent with 2019 and 2020 results. The maximum phosphorous value was 0.55 mg/L in January. The maximum nitrogen result of 5.2 mg/L was taken in January also. No water flow was noted during January sampling events.

SW11

A summary of SW11 monitoring results is provided in **Table 20**.

Monthly monitoring at SW11 found all TSS and Electrical conductivity results were within the trigger levels.

In August, the pH result was 7.9 and 8.3 in September which exceeds the maximum trigger of 7.8.

2022 results at SW11 are generally consistent with 2021 results. There was a reduction in the annual TSS average in 2022 from 2021. Nitrogen and phosphorous maximums and annual averages in 2022 were lower than those seen in 2021 and were more consistent with previous levels.

6.4.4 Trends in Data

Oil and grease levels exceeded the trigger levels a number of times in 2022 at both Joarimin and Lockyersleigh Creek locations. Oil and grease results from the previous reporting periods noted that the parameter had increased compared to 2018 results. The exceedances in the trigger levels were identified by Holcim and reported to DPE . DPE noted that no evidence was found to suggest that the development was the cause of the oil and grease exceedances.

Electrical conductivity and total suspended solids were generally consistent with long-term results. 2022 pH results generally consistent with long-term results.

6.4.5 Proposed Improvements

Holcim propose to continue to monitor the oil and grease levels across Joarimin Creek and Lockyersleigh Creek sampling locations to identify any emerging trends. Holcim will continue to monitor unusual monitoring results and investigate any exceedances should they occur in 2023.

There were no additional surface water improvements identified in this report period. Holcim will continue to compare results against longer term trends and trigger levels from the WMP.

6.5 Groundwater

6.5.1 Environmental Management Measures

The Lynwood Quarry *Water Management Plan* (WMP) was revised and approved by DPE in 2020. This 2020 WMP includes trigger levels which are used in this annual review. Lynwood has developed and implemented a Groundwater Monitoring Program (GMP) in accordance with the requirements of the Development Consent.

The GMP provides details on:

- Baseline water quality;
- Groundwater Impact Criteria;
- Monitoring regional groundwater level and quality; and
- Groundwater impact trigger levels and management actions.

The groundwater water management system includes a series of piezometers and groundwater monitoring bores.

6.5.2 Performance Criteria

6.5.2.1 Groundwater Inflow and Level Monitoring

As outlined in the *Water Management Plan (2020)* and *Groundwater Monitoring Program*, groundwater level monitoring will be reviewed against long-term monitoring trends and further compared against drawdowns predicted within the Lynwood Quarry EIS (Umwelt, 2005) and Modification EA (Umwelt, 2015). Triggers for groundwater depth are shown in **Table 21**.

6.5.2.2 Groundwater Quality Monitoring Criteria/Trigger Levels

Trigger levels have been updated in the 2020 WMP and are included in **Table 21**. These new trigger levels are based on an extended period of monitoring data from Lynwood GW locations.

Groundwater monitoring is required to occur quarterly.

Table 21: Groundwater Monitoring Criteria (WMP, 2020)

Parameter	Minimum Trigger	Maximum Trigger	General comment
MP Bores			
Depth to groundwater (metres)	1.64	28.05	This was the minimum and maximum levels since regular monitoring commenced in 2010
EC (µS/cm)	No minimum trigger required	11,521	This was the highest EC reading since monitoring commenced for the MP bores.
pH	4.2	9.5	These were the highest and lowest pH readings since monitoring commenced for the MP bores.
Sulphate (mg/L)	No minimum trigger required	152	This was the maximum level recorded since monitoring commenced for sulphate.
Total Nitrogen (mg/L)	No minimum trigger required	2.20	This was the maximum level recorded since monitoring commenced for total nitrogen.
Total Phosphorus(mg/L)	No minimum trigger required	3.02	This was the maximum levels recorded since monitoring commenced for total phosphorus.
GPZ Bores			
Depth to groundwater (metres)	2.13	23.9	This was the minimum and maximum levels since regular monitoring commenced of GPZ bores in April 2017.
EC (µS/cm)	No minimum trigger	8,020	This was the highest EC reading since monitoring commenced for the GPZ bores.
pH	6.1	7.8	These were the highest and lowest pH readings since monitoring commenced for the GPZ bores.
Sulphate (mg/L)	No minimum trigger required	76	This was the maximum levels recorded since monitoring commenced for the GPZ bores.
Total Nitrogen (mg/L)	No minimum trigger required	5.0	This was the maximum levels recorded since monitoring commenced for the GPZ bores.
Total Phosphorus (mg/L)	No minimum trigger required	1.20	This was the maximum levels recorded since monitoring commenced for the GPZ bores.

6.5.3 Environmental Trends and Outcomes

Lynwood conducts groundwater monitoring via a network of monitoring bores across site on a quarterly basis. A summary of groundwater monitoring results is provided in **Table 22**. Further monitoring results are presented in **Appendix 2**.

Monitoring was undertaken at the required frequency for all monitoring bore sites with the exception of GPZ2 at which monitoring ceased after Quarter 2 of 2020 due to the extension of the pit over this area

Table 22: Summary of Quarterly Results – Groundwater 2022

Site	Depth to Water Level (m)			pH			EC (µS/cm)			Sulphate (mg/L)			Total Nitrogen (mg/L)			Total Phosphorous (mg/L)		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
MP Bores																		
MP1	1.27	1.5	1.82	6.5	6.9	7.4	696	859	1050	19	21	24	0.05	0.05	0.05	0.29	0.29	0.29
MP2	14.89	15.5	16.52	6.3	7.1	7.9	183	241	321	2	17	50	0.05	0.05	0.05	0.05	0.05	0.05
MP4	17.27	17.7	18.62	6	6.3	6.9	289	335	430	2	15.3	50	0.05	0.05	0.05	0.11	0.11	0.11
MP5	18.34	18.5	20.42	6.2	6.7	7.4	300	498	704	2	16.8	50	0.05	0.05	0.05	0.02	0.02	0.02
MP7	17.36	17.6	17.77	6.6	7	7.7	4370	5233	6180	31	36	44	0.05	0.05	0.05	0.01	0.01	0.01
MP10	3.86	4.1	4.4	7.1	7.4	8.1	5980	6360	6740	24	53	140	0.08	0.08	0.08	0.01	0.01	0.01
MP11	9.06	9.7	10.6	7.2	7.5	8	414	534	661	2	5.6	6.2	0.05	0.05	0.05	0.01	0.01	0.01
GPZ Bores																		
GPZ1	10.2	10.8	11.71	7.6	8	8.5	576	731	884	7.3	8.6	10	0.05	0.05	0.05	2.6	2.6	2.6
GPZ2																		
GPZ5	8.27	8.5	8.71	7.7	8.1	8.6	3180	3328	3540	3	4.3	5	0.05	0.05	0.05	0.15	0.15	0.15
GPZ6	3.81	4.3	4.99	7	7.4	8	411	504	662	19	27.3	42	2.8	2.8	2.8	0.14	0.14	0.14
GPZ8	7.08	7.4	7.71	7	7.4	8.1	1930	2110	2360	2	12.3	37	0.05	0.05	0.05	0.05	0.05	0.05

6.5.3.1 Depth to Groundwater

Groundwater levels for the Lynwood pit area have been monitored since 2004, with most bores (MP) showing a fluctuation of 1 to 2 meters in water levels throughout these monitoring periods.

Groundwater levels at MP series bores generally remained within the historical range of depth and were consistent with those for 2021. It should be noted that MP1 was under the minimum trigger level 1.64 m on three occasions. November 10 had the minimum 1.27 and is not within the Groundwater Monitoring Criteria.

The Environmental Assessment for MOD 4 in 2015 outlines potential groundwater impacts and interactions. Additional baseline data was obtained through the granite pit modification environmental assessment process (GPZ) bores.

Groundwater levels at the GPZ bores were also consistent with baseline levels and previous results. All GPZ bores were well within the monitoring criteria.

6.5.3.2 pH

The MP bores were consistently between 6 and 8 pH for the quarterly monitoring in 2022. The most acidic (minimum) result was 6 pH at MP4.

All pH results at MP series bores were well within the monitoring criteria. There were big significant changes in the annual averages between 2020 and 2021 at any of the monitoring points, with the largest change being 1.1 units at MP2.

GPZ bores were also near neutral in 2022, however there were multiple exceedances in the GPZ series bores pH maximum trigger in 2022. The pH results at GPZ1 exceeded the maximum trigger of 7.8 in quarter 2 and 3 of 2022, at 8 and 8.5 respectively. pH results at GPZ5 exceeded the maximum trigger in quarters 2, 4 and 4 2021, at 8, 8.6 and 7.9 respectively. GPZ6 exceed the maximum trigger in quarter 3 at 8 and GPZ8 also exceeded the maximum trigger in quarter 3 at 8.1. These results are exceedances with the trigger values outlined in the WMP.

Holcim will continue to assess trends in groundwater results to identify when further mitigation measures are required.

6.5.3.3 Electrical Conductivity

The electrical conductivity levels varied between each MP series bore. However, all 2022 samples were within the trigger levels and historical range of 231 $\mu\text{S}/\text{cm}$ to 9,890 $\mu\text{S}/\text{cm}$.

GPZ series bores were compliant with the maximum trigger for EC. GPZ1's minimum result of 411 $\mu\text{S}/\text{cm}$ was significantly less than the minimum value of 600 $\mu\text{S}/\text{cm}$ from the historical results for GPZ series bores. The average EC at all GPZ bores decreased compared to 2021 results.

All results for electrical conductivity were compliant.

6.5.3.4 Nutrients

Sulphate

The sulphate levels in the MP bores over 2022 were compliant with the sulphate maximum trigger value. The sulphate results over 2022 were generally consistent with 2021 averages.

For all GPZ bores, the 2022 annual average for sulphate was similar to values in 2021. GPZ bores ranged from 2.0 mg/L to 42.0 mg/L which complies with the trigger values.

Total Nitrogen

All MP monitoring sites were well within the trigger levels. MP series bores ranged from a minimum of 0.05 mg/L to a maximum of 0.8 mg/L. These 2022 results have generally increased when compared to 2021 results for total nitrogen.

All GPZ series bores remained within the total nitrogen trigger levels in the report period. GPZ1, GPZ5, and GPZ8 results were consistently 0.05 mg/L.

Total nitrogen levels were decreased compared to 2021 results at GPZ6.

Phosphorous

All total phosphorous monitoring results at MP series bores were below the maximum trigger level of 3.02 mg/L. This is consistent with the results of previous years.

The phosphorous levels at GPZ series bores were below the maximum trigger value of 1.2 mg/L for 2022 with the exception of GPZ1, which had an exceedance of 2.6 mg/L.

All groundwater bores were generally compliant with total phosphorous criteria.

6.5.4 Proposed Improvements

Future Annual Reviews will continue to compare results against longer term trends and trigger levels from the WMP. In particular, Lynwood will the pH levels at GPZ1 and GPZ5 in 2022.

Holcim will continue groundwater data collection at Lynwood Quarry.

6.6 Noise

6.6.1 Environmental Management Measures

The Lynwood *Noise Management Plan* (NMP) was implemented in this reporting period. The NMP has been prepared in accordance with the Development Consent and outlines measures for monitoring and managing noise emissions at Lynwood Quarry. The NMP also outlines a range of design controls, ongoing operational controls, and a noise monitoring program which the site has undertaken in 2022.

6.6.2 Performance Criteria

Noise impact assessment criteria for monitoring are specified in the Development Consent are outlined in **Table 23** below.

Table 23: Noise Criteria

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dBA, LA _{eq} (15min)	dBA, LA _{eq} (15min)	dBA, LA _{eq} (15min)	dBA, LA ₁ (1min)
1	35	35	35	45
2	35	35	35	45
3	35	35	35	45
4	35	37	35	46
5	35	35	35	46
6	35	37	36	46
7	38	38	35	55
8	39	38	36	55
9	39	39	37	56
10	42	42	40	53
11	35	35	35	47
12	37	37	36	47
13	40	38	37	47
14	35	35	35	47
15	35	35	35	47
16	35	35	35	45

6.6.3 Environmental Outcomes

Attended noise monitoring was conducted on a quarterly basis during the report period. Attended noise monitoring was conducted by Muller Acoustic Consulting at four representative monitoring locations surrounding the site during quarrying activities. These noise monitoring reports are provided in **Appendix 1**. Noise monitoring locations are generally considered representative of the nearest private receivers in various directions of the operational area.

Noise monitoring was undertaken on the following dates:

- 19 and 20 February 2022;
- 19 and 21 April 2022;
- 27 and 29 September 2022; and
- 6 and 7 December 2022.

Noise monitoring occurred at the locations shown in **Figure 3** and listed in **Table 24**. As noted in the Lynwood Quarry NMP (SLR, 2020), monitoring at these locations are considered representative of all locations assessed as part of the Noise Impact Assessment (Umwelt, 2015).

The noise monitoring results from 2022 are summarised in **Table 25**. There were no exceedances in the noise criteria during the quarterly monitoring. Quarry noise such as haul truck movements, processing noise, site alarms, or reverse alarms were audible during some assessments, however, did not exceed noise criteria. Extraneous sources of noise included birds, insects, distant traffic, aircraft, and wind.

It should be noted that location N2 exceeded noise criteria during the day and evening. The construction works adjacent to monitoring location confounded ability to isolate quarry noise from construction noise. The quarry contribution was noted as below criteria when it was audible when construction activities ceased.

Location N3 exceeded noise criteria however, these results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance, where quarry contribution was noted.

Further discussion on the findings is found in the MAC Noise Monitoring Assessment reports in **Appendix 1**.

Table 24: Noise Monitoring locations

Location	Address
N1	Residence west of the project area
N2	End of Maclura Drive, Marulan
N3	Residence to the south of the site
N4	North-eastern boundary of the project area at rural residential subdivision, (Dorsett Road).

Table 25: Noise Monitoring Summary

Location	Criteria	Q1	Q2	Q3	Q4	Compliance Status
Day dBA, LA_{eq}(15min)						
N1	35	<35	<35	<35	<35	Compliant
N2	35	<35	<35	<35	<41	Compliant – Refer to reports on external sources.
N3	35	<35	<35	<35	<35	Compliant
N4	35	<37	<35	<35	<37	Compliant – Refer to reports on external sources.
Evening dBA, LA_{eq}(15min)						
N1	35	<35	<35	<35	<35	Compliant
N2	35	<37	<37	<37	<37	Compliant – Refer to reports on external sources.
N3	35	<35	<35	<35	<35	Compliant
N4	37	<37	<37	<37	<37	Compliant
Night dBA, LA_{eq}(15min)						
N1	35	<35	<35	<35	<35	Compliant
N2	35	<36	<36	<36	<36	Compliant
N3	35	<35	<35	<35		Compliant – Refer to reports on external sources.
N4	35	<36	<36	<36	<36	Compliant
Night dBA, LA1(1min)						
N1	45	<45	<45	<45	<45	Compliant
N2	46	<46	<46	<46	<46	Compliant
N3	47	41	<47	<47		Compliant – Refer to reports on external sources.
N4	47	<47	<47	<47	<47	Compliant

Note: NS indicates where equipment failure occurred; and results could not be captured. For Grey cells; location unable to be accessed for night monitoring (i.e. (unexpected; locked gate.)

6.6.4 Trends in Data

Monitoring results recorded during the report period indicates noise levels continue to trend below noise impact assessment criteria as stipulated within Development Consent. There have been no noise exceedances against the noise impact assessment criteria since the 2016 report period. The raw noise monitoring results are included in **Appendix 1**.

6.6.5 Proposed Improvements

No additional management or mitigation measures are proposed to be implemented which are outside of the existing approved NMP.

6.7 Biodiversity

6.7.1 Environmental Management Measures

Lynwood takes a multifaceted approach to managing biodiversity values within the broader landscape with biodiversity and rehabilitation management controls detailed in the Lynwood Quarry *Rehabilitation and Landscape Management Plan* (RLMP). Areas managed in accordance with the RLMP include habitat management areas, riparian zones, and wildlife corridors. Pre-clearance inspections are undertaken to identify the presence of habitat features such as tree hollows or stags and fauna within the disturbance area that can be relocated. Pre-clearance surveys also identify if nest boxes are required to be installed following the removal of habitat features within the disturbance boundary.

6.7.2 Performance Criteria

As noted in **Section 5.0** and in accordance with Schedule 3 Condition 48A of the Development Consent, Lynwood must retire Biodiversity Credits to the satisfaction of the Secretary and OEH. A summary of Biodiversity Credits required to be retired by Lynwood is summarised in **Table 26** below. It is noted that the current status of credits which have been retired are detailed in **Table 27**.

Table 26: Summary of Biodiversity Credits to be Retired.

Credit Type	Credits to be Retired
Ecosystem Credits	
HN614 Yellow Box – Blakey’s Red Gum grassy woodland on the tablelands. South Eastern Highland Bioregion	2,124
HN570 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands. South Eastern Highlands Bioregion	881
HN515 Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands Bioregion	33
Total	3,038
Species Credits	
Squirrel Glider (<i>Petaurus norfolcensis</i>)	1,725
Total	1,725

6.7.3 Environmental Outcomes

Lynwood retired a total of 3,669 Biodiversity Credits during 2018. Zero biodiversity credits were retired in 2019. An outcome of the 2020 IEA was for Lynwood to continue consultation with DPE regarding biodiversity credits and the process of retiring these, which Lynwood continues to consult for and pursue.

A summary of the credits retired in 2018 and the number of credits required to be retired into the future (credit balance) is detailed in **Table 27**.

In accordance with the Development Consent and Lynwood Quarry Extraction Quarry Area Modification Biodiversity Assessment Report (2015), pre-clearing and post-clearing reports were prepared to identify significant habitat features when clearing was undertaken.

Ecological monitoring was undertaken by an external contractor during the reporting period. In 2022 Holcim engaged SLR to perform ecological monitoring to satisfy requirements outlined in the Rehabilitation and Landscape Management Plan.

Key findings from the 2022 ecological monitoring report include the following:

- The areas of retained box gum woodland vegetation within the Biodiversity Offset Area (BOA) are generally in moderate to good condition and no immediate actions are necessary, other than control of isolated occurrences of high threat weeds.
- Other parts of the BOA were also generally in moderate to good condition, although control of high threat weeds is required as patches of these species occur particularly in the southeast portion of the BOA and along the access road to the quarry.
- The rehabilitation areas require weed control, maintenance of plantings and additional planting. Portions of the creek lines across the site (in the vicinity of CR1 and CR2) also require erosion control and bank stabilisation.
- The amenity bund requires additional work to stabilise erosion as well as additional planting in accordance with the Rehabilitation and Landscape Management.
- The site requires targeted weed control of Serrated Tussock and Blackberry, including spot spray techniques using herbicides or hand/mechanical removal with limited soil disturbance wherever practicable to reduce impacts to surrounding native vegetation and waterways.
- Nest box monitoring indicates a high rate of usage by native fauna and general good condition of most nest boxes. Removal of pests and ongoing monitoring of the boxes, particularly along Jaorimin Creek, is recommended to prevent further impacts on the native fauna using the boxes.

Ecological monitoring occurred in Spring 2022 including at the amenity bund, retained Box-Gum Woodland, Habitat Management Area, and Biodiversity Offset Area. Nest box monitoring for the site's 50 nest boxes was undertaken by ecologists in Winter 2022.

Table 27: Summary of Retired Biodiversity Credits

Credit Type	Credits Retired (2018)	Stage of Retirement	Credit Balance
HN614 Yellow Box – Blakey's Red Gum grassy woodland on the tablelands. South Eastern Highland Bioregion	1,063	Partially retired – credits retired for years 2016 – 2030 (inclusive)	1,061
HN570 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands. South Eastern Highlands Bioregion	881	Complete	0
HN515 Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands Bioregion	0	Not required – Area not be disturbed until 2036.	33
Squirrel Glider (<i>Petaurus norfolcensis</i>)	1,725	Complete	0

6.7.4 Trends in Data

Biodiversity performance at Lynwood has been sound through 2022 and previous reporting periods.

Lynwood continues to consult with authorities on the status of conservation areas as well as appropriate Management Plans for these areas.

6.7.5 Proposed Improvements or Actions Next Reporting period

From 2023, Holcim will engage with ecologists on implementing Landscape Function Analysis within the rehabilitation and landscape monitoring program.

No additional management, mitigation measures or monitoring is proposed to be implemented outside of the scope of the approved RLMP.

6.8 Weeds and Feral Animals

6.8.1 Weeds

The dominant weed species that have been found previously within the site include Fireweed (*Chamerion angustifolium*), *Optunia sp.*, Serrated tussock (*Nassella trichotoma*), Blackberry (*Rubus fruticosus*) and St John's Wort (*Hypericum perforate*). Weed management is conducted in accordance with the Rehabilitation and Landscape Management Plan.

Lynwood site staff undertook weed inspections during the report period. Ecological monitoring was also undertaken, as discussed in **Section 6.7**.

Weed inspections found Serrated tussock, St John's Wort, Blackberry, Sifton bush, Cassinia and Water Sedge in multiple areas of the site including the offset area. Spraying and slashing of Sifton bushes and Cassinia in the area was completed in the 2022 reporting year.

Weed control will continue in 2023.

6.8.2 Feral Animals

Lynwood undertook feral animal inspections on two occasions in 2022. A pest service was also engaged in the audit period to bait pest species including rodents in and around the administration areas of the site. **Table 28** details the results of these inspections.

Table 28: Pest Report 2022

Site	Date and Time	Species	Sighted	Removed
Quarry Area and Lands	03/09/2022 5:00 PM	Foxes	4	3
Quarry Area and Lands	03/09/2022 5:00 PM	Rabbits	42	15
Around Office and Buildings	30/09/2022 5:00 PM till 6:30AM	Cats	2	2

The high rainfall and vegetation growth in 2021 and 2022 created favourable conditions for pest populations in the report period. Findings of the rehabilitation and ecological monitoring noted an opportunity to monitor for feral animals such as foxes, cats, and rabbits.

Holcim will assess the need to undertake pest control measures in 2023 for rabbits and foxes on site.

6.9 Blasting and Vibration

6.9.1 Environmental Management Measures

The BMP sets out the criteria, monitoring frequencies, and management measures for blasting during quarrying operations.

Blast monitoring is undertaken at six monitoring locations (refer to **Figure 6.1**). The summary of 2022 blasts in **Table 29** shows that all blasts met airblast overpressure and ground vibration impact criteria for the report period.

6.9.2 Performance Criteria

Blasting performance criteria is set out in the EPL and Development Consent as outlined in **Table 29**.

Table 29: Blast Criteria Summary

Airblast Overpressure Criteria		
Location	Level (dB)	Allowable Exceedance
Residence on Privately owned land	115	5% of the total number of blasts over a period of 12 months
	120	0%
Ground Vibration Impact Assessment Criteria		
Location	Peak Particle Velocity (mm/s)	Allowable Exceedance
Residence on Privately owned land	5	5% of the total number of blasts over a period of 12 months
	10	0%
Main Southern Railway Line	25	0%
Reservoir*		Not applicable
Gas Pipeline	100	0%

* Reservoir is not constructed. Blast monitoring not undertaken at this location.

6.9.3 Environmental Outcomes

A summary of blast monitoring performance during the report period is provided in **Table 30**. Blast monitoring data is provided in **Appendix 2**. All blasts during the report period were undertaken between 9 am – 5 pm Monday – Saturday. No blasts were undertaken on Sundays or Public Holidays. Results from blast monitors during the report period did not exceed the blast criteria in **Table 29**.

There was a total of 89 blasts in 2022. This is on par with the 2021 total number of 86 blasts.

Table 30: Blast Monitoring 2022 Summary

Parameter Summary		Number of Blasts	Percentage of Blasts
Total Number of Blasts		89	NA
Blasts in Ignimbrite Pit		0	0%
Blasts in Granite Pit		89	100%
Blasts exceeding allowable Overpressure criteria		0	0%
Blasts exceeding allowable Ground Vibration criteria		0	0%
Blasts triggering Overpressure measurement	B4 Resident	0	0%
	B5 Resident	3	3%
Blasts triggering Ground Vibration measurement	B4 Resident	0	0%
	B5 Resident	4	4%
	Southern Railway Line	41	46%
	Gas Pipeline	41	46%
Blasts with Data Captured		86	100%

6.9.4 Trends in Data

Blasting results continued to trend below compliance limits during the report period with this also being the case in previous Annual Review periods.

6.9.5 Proposed Improvements

No additional blast management improvements are proposed outside the current approved BMP during the next report period.

6.10 Waste Management

There were no changes to waste management practices during the report period. Waste streams at Lynwood Quarry are collected and disposed of by licenced waste contractors on an as-required basis. Holcim record when waste is collected from site and as well as volumes collected. A summary of the types and quantities of waste generated during the report period is provided in **Table 31**.

Table 31: Long-term Summary of Waste Generation

Waste Category	2022	2021	2020	2019	2018
Cardboard (t)	0.4	0.04	0.37	1.8	47
General Waste (t)	53.91	56.92	48.8	54.7	201.1
Steel (t)	162.05	88.68	84	90.28	106.96
Rubber (t)	<i>Included in General Waste</i>	<i>Included in General Waste</i>	<i>Included in General Waste</i>	<i>Included in General Waste</i>	14.24
Wood (t)	0	0	4.1	4.5	3.24
Oily Water (t)	-	0	-	<i>Included in Used Oil</i>	5.36
Used Oil (L)	20,250	0	-	46,100	42,760
Oil Filter (number of bins)	-	0	18	20	24
Rags (number of bins)	<i>Included in General Waste</i>	<i>Included in General Waste</i>	<i>Included in General Waste</i>	<i>Included in General Waste</i>	1
Grease (L)	0	0	40,000 used in 2020	0	4
Tyres (t)	15	-	-	-	-

General waste continues to decline in the 2022 reporting period. There has been an increase in Cardboard 0.4 t and steel 162.05 t in 2022 compared to previous years. Tyres are included in the 2022 reporting period for waste generation, however Lynwood continues to assess ways to reduce waste generation.

6.11 Indigenous Heritage

An Aboriginal Heritage Management Plan (AHMP) (Revision 3) has been prepared in accordance with the Development Consent. Lynwood Quarry also holds an Aboriginal Heritage Impact Permit (AHIP #1100264) for Quarry operation. The AHMP and AHIP set out relevant monitoring frequencies and management measures required during quarrying operations. Results of Aboriginal Heritage monitoring undertaken are discussed in the sections below.

6.11.1 Results of Aboriginal Heritage Site Monitoring

In compliance with the requirements of the Development Consent, the Lynwood Quarry had an existing Aboriginal Heritage Impact Permit (AHIP #1100264) for the life of the quarry for the Ignimbrite Pit development, Lynwood Quarry is required to undertake monitoring of Aboriginal sites located in proximity to the impact footprint boundary within the Ignimbrite Pit and Granite Pit areas. On a triennial basis, Holcim is required to monitor all the Aboriginal sites within the broader Lynwood Quarry project area.

Monitoring process is undertaken in either November or December each year and reported to the Office of Environment and Heritage (OEH).

The annual site monitoring on the Lynwood Quarry project area was in November 2022.

6.11.2 Meetings of the Aboriginal Heritage Management Committee

The Aboriginal Heritage Management Committee's (AHMC's) ongoing role is to provide guidance and contribute to indigenous related activities and initiatives at Lynwood Quarry as well as review the implementation of the AHMP.

The Aboriginal Heritage Management Plan requires the AHMC to meet on at least a six-monthly basis. During the report period AHMC meetings were held on the 5 April and 11 November 2022.

Discussions at the AHMC Meetings centred around the Aboriginal Heritage Management Plan, annual monitoring outcomes, cultural heritage awareness training and general business.

6.11.3 Keeping Place Contract Development

A meeting was held with the AHMC on 26 November 2018 to discuss the process for the construction and operation of the Keeping Place. At this time, a draft process was agreed and discussions with the AHMC are still ongoing.

Progress towards finalisation of the agreed process for the Keeping Place construction and management was ongoing in this reporting period.

The care of all 'Aboriginal objects' (stone artefacts) recovered from the Lynwood Quarry development footprint is detailed within 'Care' Permits #2761 and #2762 approved by DPC on 27 August 2007. Holcim, GAHAI, GTCAC, PLALC and PFC were all signatories to the Care Permit.

Holcim, PLALC and GTCAC are currently undergoing consultation in relation to setting up a Keeping Place within the Lynwood Quarry project area for future 'Long Term Care' of the Aboriginal objects. It is proposed that the Keeping Place will have display facilities for a selection of the Aboriginal objects and teaching materials to educate Aboriginal and non-Aboriginal visitors.

6.11.4 Revisions to the Aboriginal Heritage Management Plan

In accordance with the conditions of MOD 4, Holcim was required to revise its AHMP to include management requirements for Aboriginal sites and potential archaeological deposits within the Granite Pit area.

This AHMP provides a framework for the ongoing management of Aboriginal sites and potential archaeological deposits (PADs) conserved in-situ for the life of Lynwood Quarry. The AHMP also sets out the requirements for long-term management of Aboriginal sites and PADs located within a Cultural Heritage Management Zone (CHMZ) set up within the broader Lynwood Quarry project area. The CHMZ

6.12 Non-Indigenous Heritage

No additional European Heritage management actions were undertaken during the 2022 report period. Actions from the Old Marulan European heritage report were reviewed and completed in 2017.

There are no proposed actions concerning European heritage for the next report period.

6.13 Bushfire Management

Bushfire hazards are managed in accordance with the Rehabilitation and Landscape Management Plan (RLMP).

Measures and safeguards included in the RLMP to minimise bushfire risk at Lynwood Quarry include:

- Fire breaks in the form of access and haul roads, rail lines, electricity easements, quarry pits and out-of-pit emplacement areas;
- Fuel reduction activities, as required, in consultation with the local Rural Fire Service;
- Selective grazing to assist with management of fuel loads;
- Asset protection zones in the form of hardstand areas, lawn and bare earth around the quarry's permanent infrastructure;
- A range of onsite firefighting equipment including two water carts, fire hydrants and hose reels, to be used as required, and extinguishers located on infrastructure, mobile equipment and light vehicles;
- Availability of water through the site water management system; and
- Emergency preparedness training for all quarry personnel.

No bushfires occurred in proximity to the site in 2022. Fuel reduction activities were undertaken to reduce the risk of severe bushfires in future reporting periods.

6.14 Public Safety

Access to the site by members of the public is via contact at the quarry office where visitors or contractors can only be escorted by site personnel around the site. Warning signs have been placed on extremities of operations to make members of the public are aware of quarrying operations.

There were no incidents related to public safety during the report period.

During the reporting period it was identified that some maintenance of signage was required. This was completed.

7.0 Water Management

7.1 Water Management System

Lynwood manages site inflows such as runoff, groundwater inflow, and external water sourced from Johnniefields Quarry Dam as well as discharge events as per the Water Management Plan (2020) (WMP). Lynwood is committed to the minimisation of water consumption through strategies outlined in the WMP including:

- Continued construction of water management devices to achieve the aims of the WMP;
- Vegetating non-operational areas;
- Calibration of water use for product quality; and
- The use of misting in fixed plant to reduce water used by dust suppression sprays.

As shown in **Figure 3** the Lynwood water management system consists of a number of onsite storage dams and diversion drains. Control structures have been constructed to minimise the interaction between clean and dirty water and to provide controls to treat captured dirty water to a standard acceptable for discharge off site. In addition to the storage of external water, storage dams are used to opportunistically capture runoff from the disturbed catchment area along with any groundwater seepage into the quarry pits. In 2019 a new stormwater sediment dam, G1, with capacity of 26 ML, was constructed at the Granite Pit. There were no changes to the water management system in 2022.

7.2 Water Take and Discharge

7.2.1.1 External Water Use

Water imported onto the project site on an “as needs” basis is continually tracked against its licenced allocation. In 2022 there was no water pumped from the Johnniefields Dam for use onsite. This is compliant with the water sourcing limit under the landholder’s agreement.

Table 32 provides a summary of water take during the report period. There was no water take from licensed bores.

Table 32: 2022 Water Take Summary

Water Licence	Water sharing plan, source and management zone (as applicable)	Entitlement	Passive take/ inflows (ML)	Active pumping	Total (units)
WAL: 25575 (continuing, unregulated river) 10UA119159 (expires May 2025) Reference: 10AL102708 Other reference numbers: 10WA102709 (lower Wollondilly management zone), 10BL164515.	Upper Nepean and Upstream Warragamba Water source.	130 units (ML) of which Holcim have access to 80 ML due to a landholder agreement.	0	0 ML	0 ML

7.2.1.2 Licenced Discharges

Lynwood did not undertake any controlled or any uncontrolled discharges from site during the report period.

7.3 Erosion and Sedimentation

7.3.1 Environmental Management Measures

The WMP Erosion and Sediment Control (ESC) Plan provides a framework for the management of erosion and sedimentation at Lynwood. ESC measures are implemented to minimise impact on the surrounding environment. All ESC measures at Lynwood are designed and constructed to the standard consistent with:

- Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004); and
- Managing Urban Stormwater – Soils and Construction, Volume 2E Mines and Quarries (DECC 2008d).

ESC structures and clean water diversions were constructed and maintained during the development of the Granite Pit. No sediment dams were mined through or decommissioned during this report period.

7.3.2 Proposed Improvements

No additional management or mitigation measures are proposed to be implemented which are outside of the existing WMP (2020) and RLMP (2018).

8.0 Rehabilitation

As with all quarry operations, the progression of the quarry pit will be based on market demand and will therefore be subject to change. The progression of the rehabilitation of the site is therefore also subject to the timeframe influence of market demand. Whilst every opportunity will be taken to progressively rehabilitate areas not required for future operational use, rehabilitation opportunities were limited during the report period. Rehabilitation of the Granite Pit benches will commence once the resource is exhausted and sufficient areas are available for rehabilitation. Backfilling is proposed for the Lynwood Pit resulting in no final void located in this area. Once rehabilitated, these areas will be monitored and managed until self-sustaining. Final rehabilitation areas will achieve the rehabilitation completion criteria specified in the RLMP (2018).

Ongoing opportunities for rehabilitation will be limited to rehabilitation following haul road construction, the western amenity bund, and the southern edge of the overburden emplacement area. Where appropriate, temporary land shaping, seeding and other revegetation works may be undertaken in disturbed areas to minimise the potential for offsite impacts associated with the migration of windblown dust, particularly from stockpiles and stripped soil surfaces not required for operational use. Topsoil stockpiles are temporarily stabilised via seeding to minimise the potential for loss of soil through wind or rainfall erosion.

8.1 Status of Quarrying and Rehabilitation

The construction of the visual amenity bund to the west of Granite pit was completed in October 2022 and planting was completed at the end of November.

Topsoil stockpiles were seeded with the aim of establishing ground cover and reducing soil substrate loss via erosion. This material is planned for use in the rehabilitation of the site following the completion of quarrying operations. 18, 000 m² of Hydromulch Flexterra has been applied during this reporting period to the outer and inner face of the embankment.

The rehabilitation status for Lynwood Quarry is presented in **Table 33**.

Table 33: Rehabilitation Status

Quarry Area Type	Previous Report Period (actual) 2018 (ha)	Previous Report Period (actual) 2019 (ha)	Previous Report Period (actual) 2020 (ha)	Previous Report Period (actual) 2021 (ha)	Report Period (actual) 2022 (ha)	Next Report Period (forecast) 2023 (ha)
A. Total quarry footprint (all areas including active disturbance areas and rehabilitation areas)	36	42	42	62.4	62.4	62.4

Quarry Area Type	Previous Report Period (actual) 2018 (ha)	Previous Report Period (actual) 2019 (ha)	Previous Report Period (actual) 2020 (ha)	Previous Report Period (actual) 2021 (ha)	Report Period (actual) 2022 (ha)	Next Report Period (forecast) 2023 (ha)
B. Total active disturbance (areas within the footprint still requiring rehabilitation)	208	216	216	236	236	236
C. Land being prepared for rehabilitation	0	0	0	3.85	2	2
D. Land under active rehabilitation*	0	0	11	15	17	19
E. Completed rehabilitation (areas that have achieved completion criteria and been signed-off by DRG)	0	0	0	0	0	0

*Conservation area currently undergoing active rehabilitation as well as the amenity bund cover included in this area type.

8.2 Post Rehabilitation Land Uses

The proposed final land use aims to emulate the pre-mining environment. The final land use will enhance local and regional ecological linkages throughout the pit and surface infrastructure areas and with the adjacent surrounding landscape. The primary objective of site revegetation and regeneration is to create a stable final landform with acceptable post-quarrying land use.

8.3 Rehabilitation Activities

Ecological monitoring of revegetated areas, fauna, and nest boxes was completed in 2022 as per the approved RLMP.

Ecological assessments of the Box-Gum Woodland continued in 2022, including site visits. The studies will continue into 2023.

The rehabilitation monitoring was undertaken to assess fauna assemblages, establish baseline conditions for retained vegetation, and monitor vegetation health.

The areas of retained box gum woodland vegetation within the Biodiversity Offset Area (BOA) are generally in moderate to good condition and no immediate actions are necessary, other than control of isolated occurrences of high threat weeds.

Recent planting efforts were focussed on the outer face of the amenity bund, and up till September 2022, more than 8,000 m² of hydro seed and 570 tube stock were planted at the amenity bund.

9.0 Community

9.1 Community Engagement

9.1.1 Community Consultative Committee Meetings

Two community consultative committee (CCC) meetings were held in 2022 with meetings on 8 April and 2 December.

In 2021, the meetings provided updates on the general operations at site, community engagement, complaints received by the site, environmental updates, and an outline on actions for the next 6 months. The outcomes of both CCC meetings are detailed in the meeting notes available on the Lynwood Quarry website (<https://www.holcim.com.au/lynwood>).

9.1.2 Community Activities

Lynwood Quarry supported several community-based activities during the report period. These activities are presented in **Table 36**. The site also supports the Chamber of Commerce, Goulburn and District Show Jumping Club, and Gibraltarr Road residents. Activities of the Quarry are promoted through articles in the local newspaper (Discover Marulan), Community Information Sessions, and a Community Perception Survey

Table 34: 2022 Community Engagement Activities and Sponsorship

Community Activity	Amount Funded in 2022
Tallong Apple Day Festival	\$900
Marulan Football Club	\$500
Tallong Public School P&C	\$900
Cystic Fibrosis Goulburn	\$2000
Goulburn and District Show jumping Competition	\$1000
Convoy for Kids	\$500
Goulburn Mayoral Charity Golf Day	\$5000

9.1.3 Community Investment Fund

The Community Investment Fund (CIF), dedicated to the communities of Marulan and surrounds, is designed to improve the quality of life of the members of the Holcim workforce, their families and the community. The CIF has been designed to improve economic, cultural and social development throughout the region. Lynwood Quarry budgets a total of \$50,000.00 annually for projects which contribute to the goals of the community.

Lynwood's 2015-2019 CIF Plan was last updated in the 2020 report period. Both the current CIF Plan and CIF Application Form are available to the public on the Lynwood Quarry website.

Appendix 4 lists the approved CIF funded projects since the inception of the CIF. Lynwood will continue to support local community projects in 2023 .

9.2 Complaints

In accordance with Condition M5 of the EPL, a community complaints line is operated by Lynwood Quarry during the hours of operation. The complaints line is also displayed on the Lynwood Quarry website. This contact point provides the community with a mechanism by which to raise any concerns that they have with operations at Lynwood Quarry.

The Lynwood Quarry Environment Management Strategy (EMS) details the complaints management and dispute resolution procedures for the site. The Quarry Manager is responsible for the implementation of the complaints management process so that complaints are responded to in a timely manner. Investigation findings and corrective actions implemented are communicated to the complainant as appropriate.

A summary of complaints received by Lynwood Quarry between 2014 and 2022 is presented in **Table 35**. Lynwood Quarry received no complaints during the 2022 reporting period.

As a result of consistent community complaints regarding air quality in previous report periods, Lynwood has consulted with EPA and DPE on the improvement of air quality controls, as well as incorporated Pollution Reduction Program (PRP) titled “Lynwood Dust Management Improvement Plan” into the EPL. A notice of variation of EPL 12939 from the EPA was sent to the Lynwood Quarry Manager on 28 August 2020 to confirm the site’s satisfactory fulfilment of the requirements of this PRP and thus its removal from the EPL. The site has also updated its Air Quality Management Plan in the reporting period which was approved by DPE in February 2023. . The reduction of air quality complaints is testament to Lynwood’s implementation of air quality management strategies. The installation of a new BAM monitor occurred 7 October 2021 for the purpose of measuring PM2.5. The EPA sent confirmation of their satisfaction with this measure on 18 October 2021.

Lynwood Quarry maintains a Complaints Register to record complaints received from the community, with the register contained on the Lynwood Quarry website (<https://www.holcim.com.au/lynwood>).

Table 35: Comparison of complaints for Lynwood 2014 - 2022

Complaint Type	2014	2015	2016	2017	2018	2019	2020	2021	2022
Noise	0	0	0	1	2	4	0	0	0
Air quality (dust)	0	1	0	1	6	41	2	0	0
Blasting	0	2	1	1	0	0	3	0	0
Traffic	0	0	0	0	0	0	1	0	0
Water	0	0	0	0	0	0	0	0	0
Other	3	0	0	0	0	2	1	2	0
Total	3	2	1	3	8	47	7	2	0

9.3 Independent Audit

An Independent Environmental Audit (IEA) was conducted within this reporting period on 29 September 2020 as per Condition 11 of DA 128-5-2005. This was the fourth IEA for the quarry.

An IEA Action Plan was created in response to this IEA and is attached in **Appendix 3**. The IEA Report by Kleinfelder and IEA Action Plan were submitted to DPE on 23 December 2020.

The next IEA is due in September 2023.

10.0 Incidents and Non-Compliances during the Report Period

Lynwood Quarry notified DPE of non-compliances in the reporting period. A summary of these incidents and any internal or external actions undertaken by Lynwood to correct non-compliances or prevent future incidents is presented in **Table 37**.

Table 37: Summary of Incidents

Non-Compliance	Condition	Date	Explanation and Comments
<u>Air Quality Monitoring</u>	Condition 15 of Schedule 3	2022 PM10 24-hour missed samples on: <ul style="list-style-type: none"> 3 May 2022; 31 May 2022; 4 July 2022; 6 July 2022; 15 July 2022; 22 July 2022; 28 July 2022; and <ul style="list-style-type: none"> 3 August 2022; 	Samples across 2022 were missed due to the sample being invalidated as unit did not run for 24 hours.
<u>Groundwater Quality Monitoring</u> pH, TSS, EC or oil and grease were not monitored at surface monitoring location SW8 on a quarterly basis.	Condition 20 of Schedule 3	Throughout 2022	Full monitoring was not undertaken at SW8 across 2022, due to the location being too dry. This is a low non-compliance because the full monitoring schedule outlined in the WMP was not implemented.
<u>Noise Monitoring</u> Night monitoring was not recorded at location N3.	Condition 4 of Schedule 3	6 December 2022	Monitoring was not undertaken at location N3 during the night as the location was unable to be accessed.

11.0 Activities to be Completed in the Next Report Period

Lynwood Quarry proposes to undertake a range of activities during the 2023 report period related to continued quarrying operations and also related to completion of actions required as a result of the 2020 IEA. Actions proposed to be undertaken by Holcim at Lynwood Quarry during 2023 include:

- Implementation of the actions identified in the IEA Action Plan;
- Implementation of approved environmental Management Plans;
- Engage construction of Keeping Place/cultural centre
- Continued extraction within the Granite Pit; and
- Maintenance of visual amenity bund to the west of the Granite Pit.

APPENDIX 1

Noise Monitoring Reports

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 1 Ending January 2022.



Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 1 Ending March 2022

Prepared for: Holcim (Australia) Pty Ltd



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APPENDIX A - GLOSSARY OF TERMS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending March 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria ¹				
Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35 ¹	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2**.

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			LAeq(15min)	LAeq(15min)	LAeq(15min)	LA1(1min)
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan ¹	35	35	35 ²	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

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

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 19 January 2022 and Thursday 20 January 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Wednesday 19 January 2022 and Thursday 20 January 2022 to satisfy the requirements of the NMP.

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

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

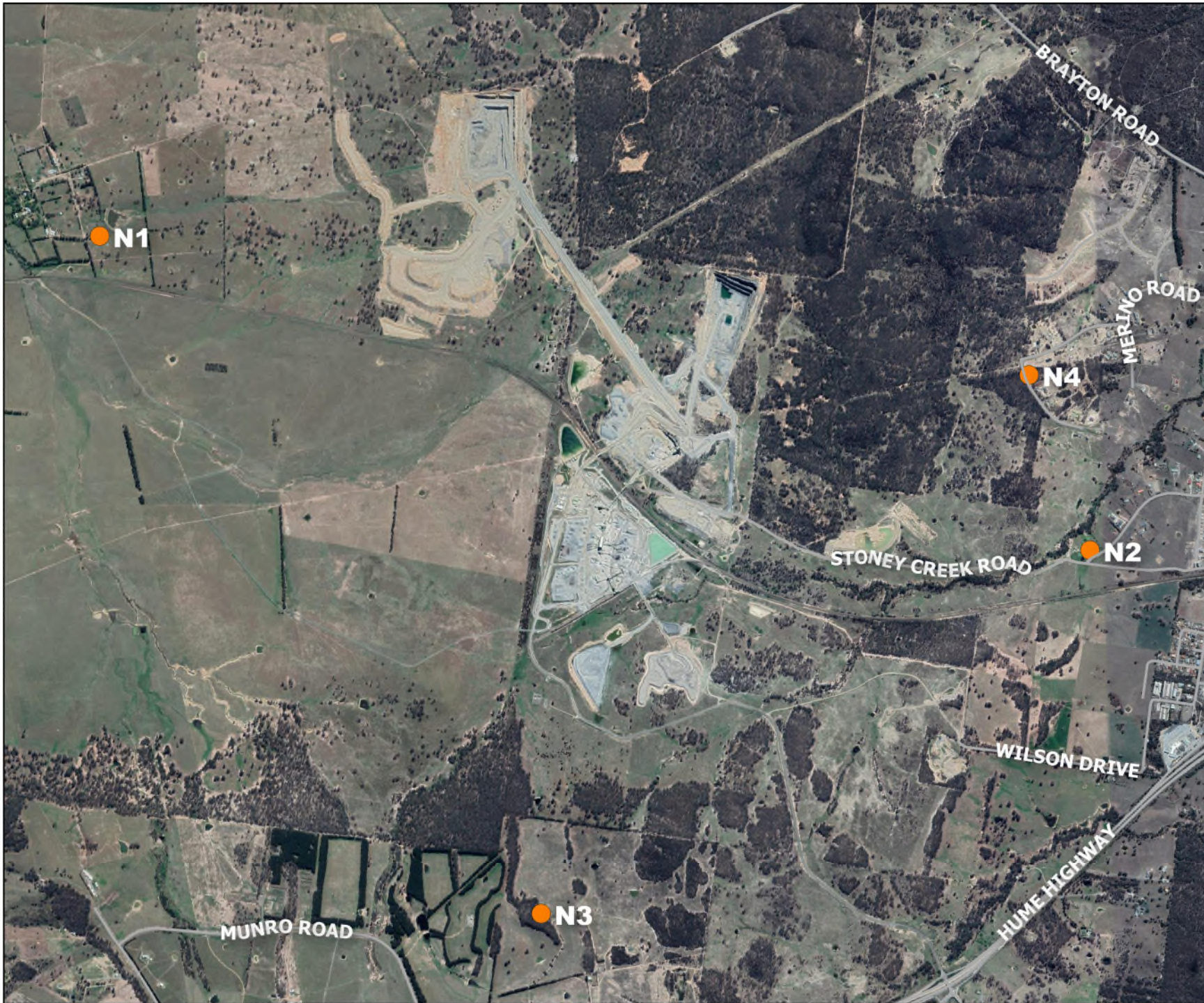


FIGURE 1
Site Locality
MAC180611-02
Holcim Lynwood Quarry

KEY

- Noise Monitoring Locations



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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/01/2022	14:43 (Day)	52	41	38	WD: SE WS: 1.5m/s Rain: Nil	Wind 36-52
						Distant traffic <36
						Birds 33-38
						Quarry – Impacts <35 (multiple 1-2 second durations)
Quarry – Haul Trucks <30 (barely audible 50% measurement)						
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
20/01/2022	21:44 (Evening)	70	51	37	WD: E WS: 1.0m/s Rain: Nil	Insects 34-38
						Wind 31-47
						Train 35-70
						Quarry Haul Trucks 30-35 (just audible 50% measurement)
Quarry – Hum <30 (barely audible throughout)						
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
20/01/2022	22:10 (Night)	44	36	34	WD: E WS: 0.5m/s Rain: Nil	Insects 32-38
						Wind 30-44
						Quarry Haul Trucks 30-33 (just audible <25% measurement)
						Quarry – Hum <30 (barely audible throughout)
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
Lynwood Quarry L _{A1} (1min) Contribution						<45

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

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in **Table 4**.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/01/2022	13:43 (Day)	64	48	45	WD: SE WS: 2.0m/s Rain: Nil	Traffic 43-49
						Wind 40-54
						Birds 40-45
						Train 40-64
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
20/01/2022	20:40 (Evening)	61	51	47	WD: E WS: 1.0m/s Rain: Nil	Insects 44-57
						Traffic 41-51
						Train 45-61
						Wind <40
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<37
20/01/2022	23:14 (Night)	71	51	42	WD: E WS: 1.0m/s Rain: Nil	Traffic 39-51
						Wind 36-45
						Insects 36-43
						Train 45-71
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<36
Lynwood Quarry L _{A1} (1min) Contribution						<46

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

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location N3							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA	
		L _{Amax}	L _{Aeq}	L _{A90}			
19/01/2022	12:59 (Day)	53	45	42	WD: SE WS: 1.0m/s Rain: Nil	Traffic 40-46	
						Wind 37-44	
						Birds 37-50	
						Aircraft 40-53	
						Quarry – Vehicles enter/exit 35-44 (2 movements, 10-20 seconds)	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
20/01/2022	20:00 (Evening)	53	43	40	WD: SE WS: 1.0m/s Rain: Nil	Traffic 37-46	
						Wind 34-49	
						Birds 34-53	
						Insects <35	
						Quarry inaudible	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
20/01/2022	23:53 (Night)	49	41	38	WD: E WS: 1.5m/s Rain: Nil	Traffic 34-45	
						Wind 34-49	
						Insects 37-43	
						Quarry inaudible	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
						Lynwood Quarry L _{A1} (1min) Contribution	<47

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

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in **Table 6**.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/01/2022	14:06 (Day)	57	45	41	WD: SE WS: 1.5m/s Rain: Nil	Wind 36-53
						Traffic 39-57
						Birds 36-40
						Quarry inaudible
		Lynwood Quarry L _{Aeq} (15min) Contribution				<37
20/01/2022	21:02 (Evening)	57	42	40	WD: SE WS: 1.0m/s Rain: Nil	Wind 35-40
						Traffic 37-57
						Insects <35
						Quarry inaudible
		Lynwood Quarry L _{Aeq} (15min) Contribution				<37
20/01/2022	22:51 (Night)	52	41	38	WD: SE WS: 1.0m/s Rain: Nil	Wind 34-40
						Traffic 37-52
						Insects 34-40
						Quarry inaudible
		Lynwood Quarry L _{Aeq} (15min) Contribution				<36
		Lynwood Quarry L _{A1} (1min) Contribution				<47

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

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was just audible during daytime, evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements, rock impacts and general site hum. Extraneous noise sources measured included distant traffic, birds, passing trains, insects and wind.

5.2 Discussion of Results - Location N2

Monitoring Tuesday Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, passing trains, traffic, birds, insects and wind.

5.3 Discussion of Results - Location N3

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site. Extraneous noise sources included aircraft, birds, traffic, insects and wind.

5.4 Discussion of Results - Location N4

Monitoring on Wednesday 19 January 2022 and Thursday 20 January 2022 identified quarry noise was inaudible during daytime, evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, traffic, insects and wind.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 1, ending March 2022.

Attended noise monitoring was undertaken on Wednesday 19 January 2022 and Thursday 20 January 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were audible at two locations, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

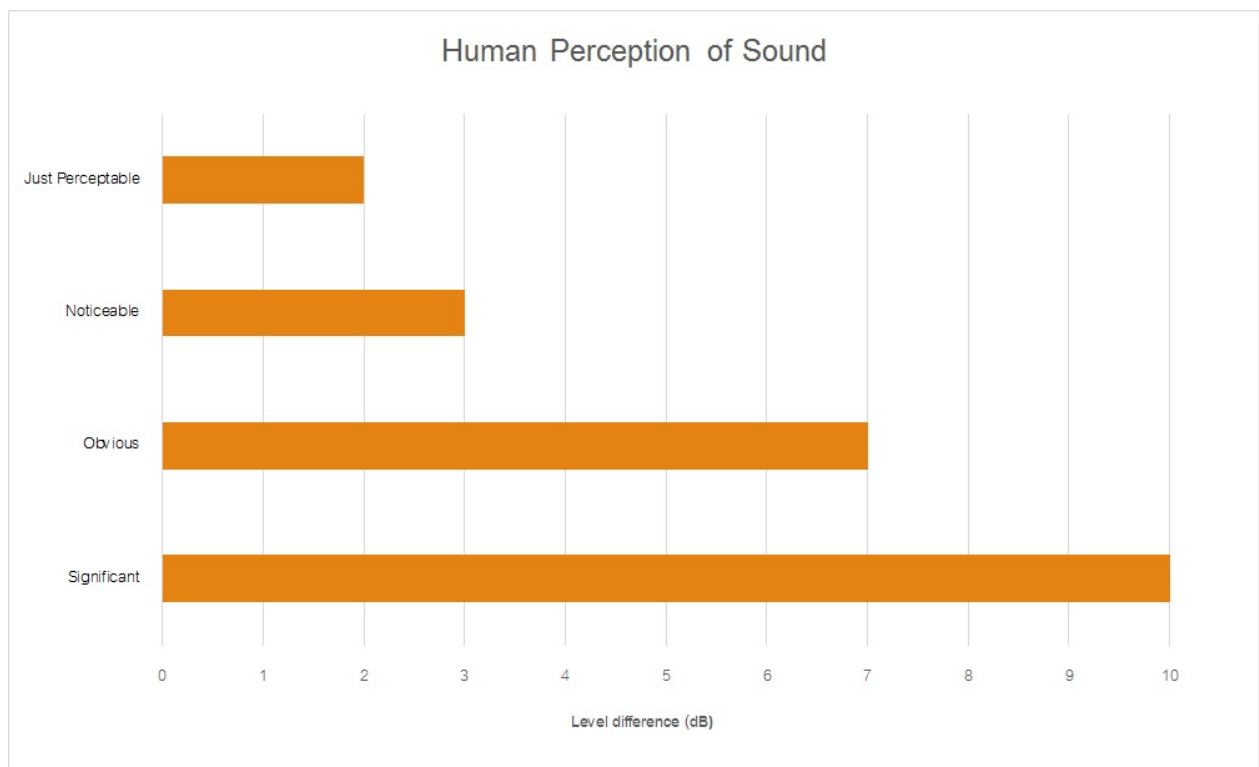
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAm _{ax}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : $= 10 \cdot \log_{10} (W/W_0)$ Where : W is the sound power in watts and W ₀ is the sound reference power at 10-12 watts.

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

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

Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 2 Ending June 2022.



Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 2 Ending June 2022

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APPENDIX A - GLOSSARY OF TERMS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending June 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria ¹				
Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35 ¹	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2**.

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			LAeq(15min)	LAeq(15min)	LAeq(15min)	LA1(1min)
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan ¹	35	35	35 ²	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

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

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 19 April 2022 and Thursday 21 April 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Tuesday 19 April 2022 and Thursday 21 April 2022 to satisfy the requirements of the NMP.

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

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

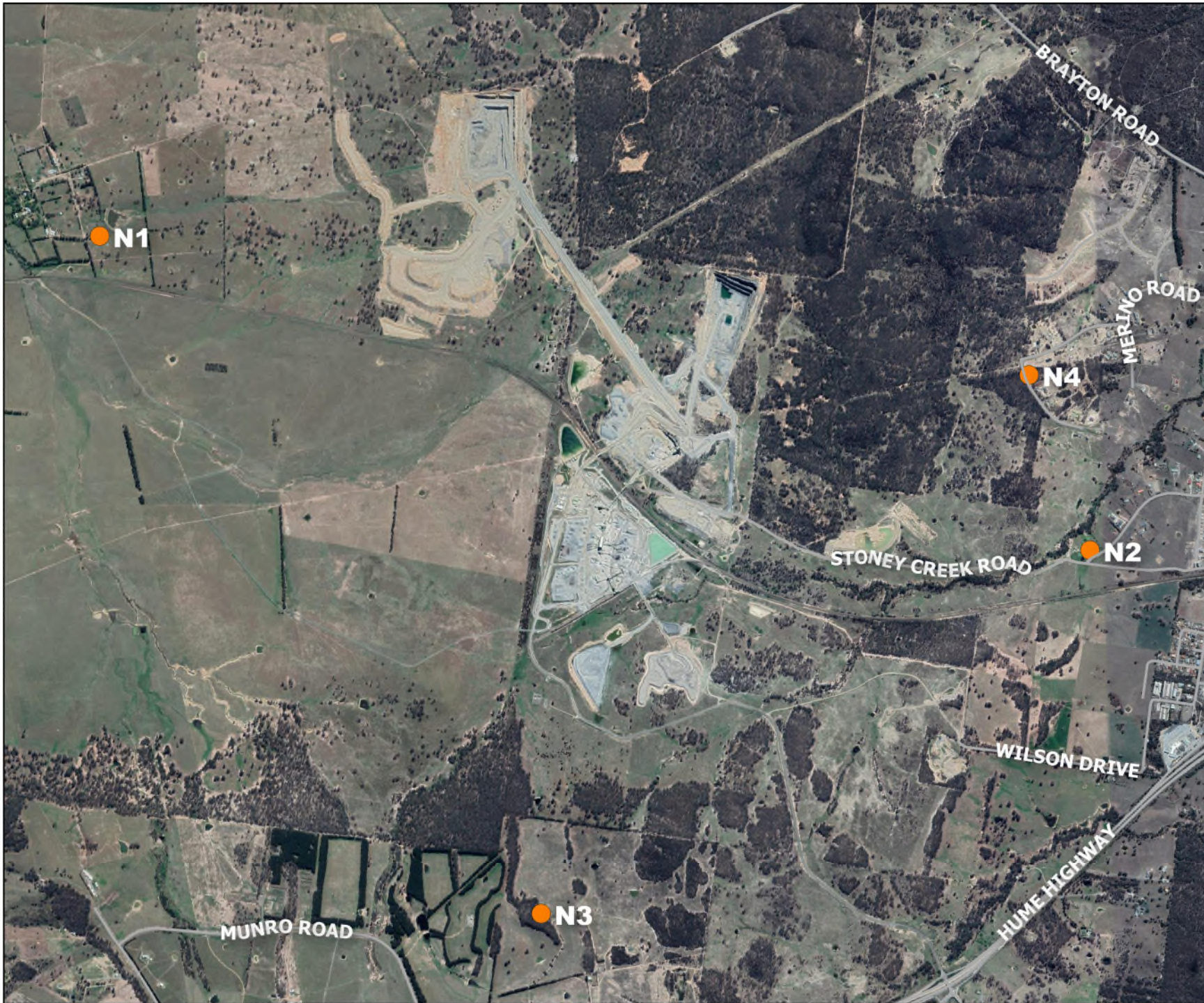


FIGURE 1
Site Locality
MAC180611-02
Holcim Lynwood Quarry

KEY

- Noise Monitoring Locations



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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/04/2022	15:32 (Day)	60	45	35	WD: SW	Insects 32-39
					WS: 1.0m/s	Birds 20-57
					Rain: Nil	Train 30-60
						Quarry inaudible
						Lynwood Quarry L _{Aeq} (15min) Contribution
						<35
21/04/2022	21:40 (Evening)	76	59	34	WD: SE	Insects 32-41
					WS: 1.0m/s	Distant traffic 30-41
					Rain: Nil	Train 35-76
						Quarry – reverse alarms <30 (Infrequent 3-5 second durations)
						Quarry – haul trucks <29-38 (Just audible <50% measurement)
						Lynwood Quarry L _{Aeq} (15min) Contribution
						<35
21/04/2022	22:05 (Night)	56	39	33	WD: SE	Insects 31-38
					WS: 1.5m/s	Wind 28-46
					Rain: Nil	Distant traffic 25-38
						MAC operator 56
						Quarry – reverse alarms <30 (Infrequent 3-5 second durations)
						Quarry – haul trucks <29-35 (Just audible <25% measurement)
						Lynwood Quarry L _{Aeq} (15min) Contribution
						<35
						Lynwood Quarry L _{A1} (1min) Contribution
						<45

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

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in **Table 4**.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/04/2022	14:26 (Day)	62	47	37	WD: SW WS: 1.0m/s Rain: Nil	Insects 35-39
						Traffic 32-41
						Birds 32-51
						Train 32-62
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
21/04/2022	20:35 (Evening)	64	48	44	WD: SE WS: 0.5m/s Rain: Nil	Traffic 41-54
						Train 38-64
						Quarry inaudible
						Lynwood Quarry L _{Aeq} (15min) Contribution
21/04/2022	23:09 (Night)	78	57	43	WD: SE WS: 1.0m/s Rain: Nil	Traffic 40-56
						Insects <37
						Train 40-78
						Quarry inaudible
						Lynwood Quarry L _{Aeq} (15min) Contribution
Lynwood Quarry L _{A1} (1min) Contribution						<46

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

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location N3						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/04/2022	13:50 (Day)	48	40	37	WD: SE WS: 1.0m/s Rain: Nil	Insects 35-41
						Traffic 32-41
						Birds 32-48
						Wind 32-46
Quarry - vehicles enter/exit <35 (2 movements, 10-20 seconds each)						
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
21/04/2022	19:57 (Evening)	51	42	40	WD: S WS: 0.5m/s Rain: Nil	Traffic 37-47
						MAC operator 51
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
21/04/2022	23:49 (Night)	51	42	39	WD: SW WS: 1.5m/s Rain: Nil	Traffic 33-43
						Wind 36-51
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
Lynwood Quarry L _{A1} (1min) Contribution						<47

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

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in **Table 6**.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
19/04/2022	14:49 (Day)	59	40	32	WD: SW WS: 1.0m/s Rain: Nil	Insects 27-38
						Traffic 30-59
						Birds 27-44
						Aircraft 30-41
						Quarry – machinery <27-38 (Just audible 50% measurement)
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
21/04/2022	20:59 (Evening)	52	42	38	WD: S WS: 1.0m/s Rain: Nil	Traffic 36-46
						Wind 33-38
						Aircraft 35-52
						Train 35-50
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<37
21/04/2022	22:45 (Night)	56	42	39	WD: SW WS: 1.5m/s Rain: Nil	Traffic 34-56
						Wind 37-46
						Quarry inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<36
Lynwood Quarry L _{A1} (1min) Contribution						<47

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

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was inaudible during daytime measurements and just audible during evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements and reverse alarms. Extraneous noise sources measured included wind, distant traffic, birds, insects, passing trains and MAC operator noise.

5.2 Discussion of Results - Location N2

Monitoring Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included birds, traffic, insects and passing trains.

5.3 Discussion of Results - Location N3

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site. Extraneous noise sources included wind, birds, traffic, insects and MAC operator noise.

5.4 Discussion of Results - Location N4

Monitoring on Tuesday 19 April 2022 and Thursday 21 April 2022 identified quarry noise was just audible during daytime measurements and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included general machinery noise, Extraneous noise sources included birds, traffic, insects, wind, aircraft and passing trains.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 2, ending June 2022.

Attended noise monitoring was undertaken on Tuesday 19 April 2022 and Thursday 21 April 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were generally just audible at three locations, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

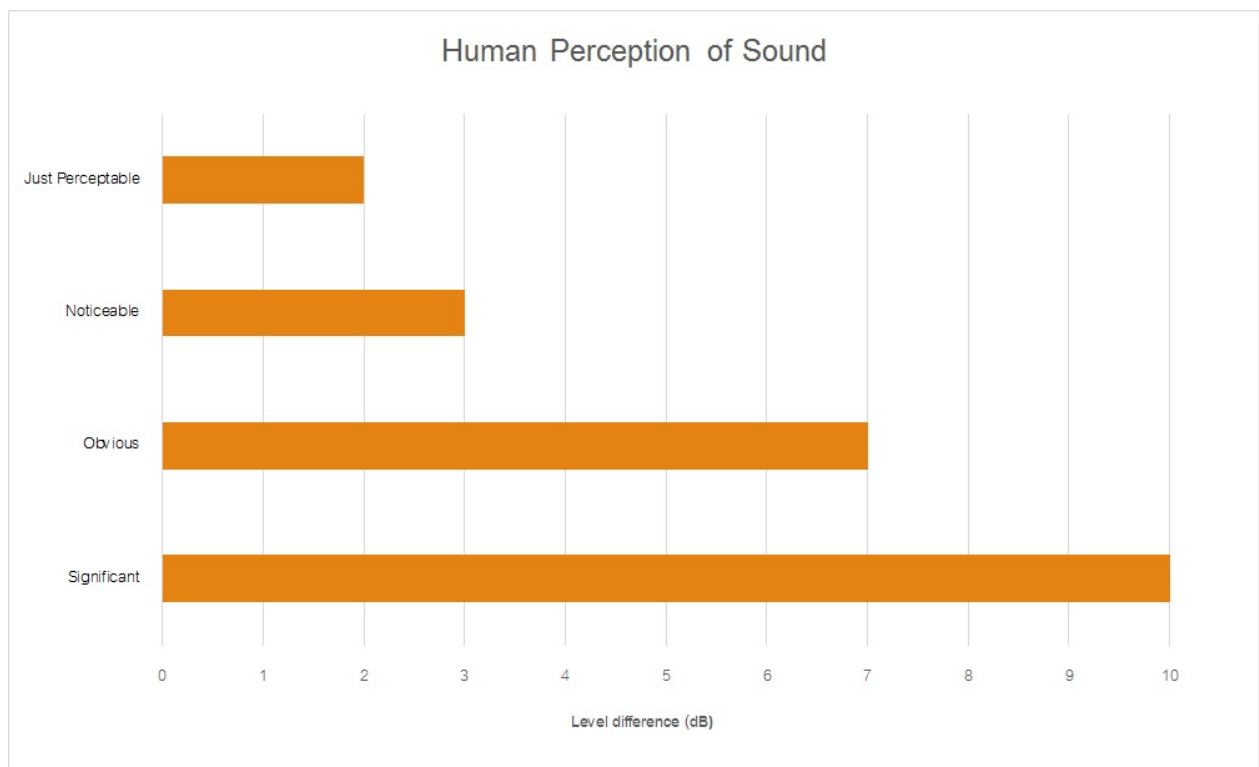
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAm _{ax}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : $= 10 \cdot \log_{10} (W/W_0)$ Where : W is the sound power in watts and W ₀ is the sound reference power at 10-12 watts.

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

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

Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW
Quarter 3 Ending September 2022.



Document Information

Noise Monitoring Assessment

Lynwood Quarry, Marulan, NSW

Quarter 3 Ending September 2022

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APPENDIX A - GLOSSARY OF TERMS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (the 'quarry'), Marulan, NSW.

The monitoring has been conducted in accordance with the Lynwood Noise Management Plan (NMP) and in general accordance with the Noise Policy for Industry (NPI), at four representative monitoring locations. This assessment has been undertaken for the quarterly period ending September 2022, and forms part of the annual noise monitoring program to address conditions outlined in the Development Consent.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Lynwood Quarry Noise Management Plan (NMP), 2016;
- Lynwood Quarry Environmental Protection Licence (EPL), 2013 (12939);
- Lynwood Quarry, Development Consent, 2005 (DA128-5-2005); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

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2 Noise Criteria

The Lynwood Quarry Noise Management Plan (NMP) outlines the applicable noise criteria for residential receivers L1 – L16 surrounding the quarry, and are presented in **Table 1**.

Table 1 Noise Criteria ¹				
Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LA1(1min)
L1	35	35	35	45
L2	35	35	35	45
L3	35	35	35	45
L4	35	37	35	46
L5	35	35	35	46
L6	35	37	36	46
L7	38	38	35	55
L8	39	38	36	55
L9	39	39	37	56
L10	42	42	40	53
L11	35	35	35 ¹	47
L12	37	37	36	47
L13	40	38	37	47
L14	35	35	35	47
L15	35	35	35	47
L16	35	35	35	45

Note 1: Noise criteria adopted from the EPL.

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3 Methodology

3.1 Locality

The quarry is located near Marulan, NSW approximately 4km west of the town centre. Receivers in the locality surrounding the quarry are primarily rural and residential. The quarry is surrounded by rural properties to the west, with the Hume Highway situated to the east and south of the site. Highway traffic is a dominant noise source in the area along with rural noise. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1** and presented in **Table 2**.

Table 2 Monitoring Location Addresses

NMP ID	EPL ID	Address	Criteria dB			
			Day	Evening	Night	Night
			LAeq(15min)	LAeq(15min)	LAeq(15min)	LA1(1min)
N1	L1	1114 Carrick Road, Marulan	35	35	35	45
N2	L6	End of Maclura Drive, Marulan	35	37	36	46
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan ¹	35	35	35 ²	47
N4	L12	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47

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

Note 1: Intermediate noise monitoring point.

Note 2: Noise criteria adopted from the EPL.

3.2 Assessment Methodology

The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the Lynwood Quarry EPL. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 27 September 2022 and Thursday 29 September 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dBA.

Noise measurements were of 15-minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Measurements were conducted at four locations (N1-N4) on Tuesday 27 September 2022 and Thursday 29 September 2022 to satisfy the requirements of the NMP.

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

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

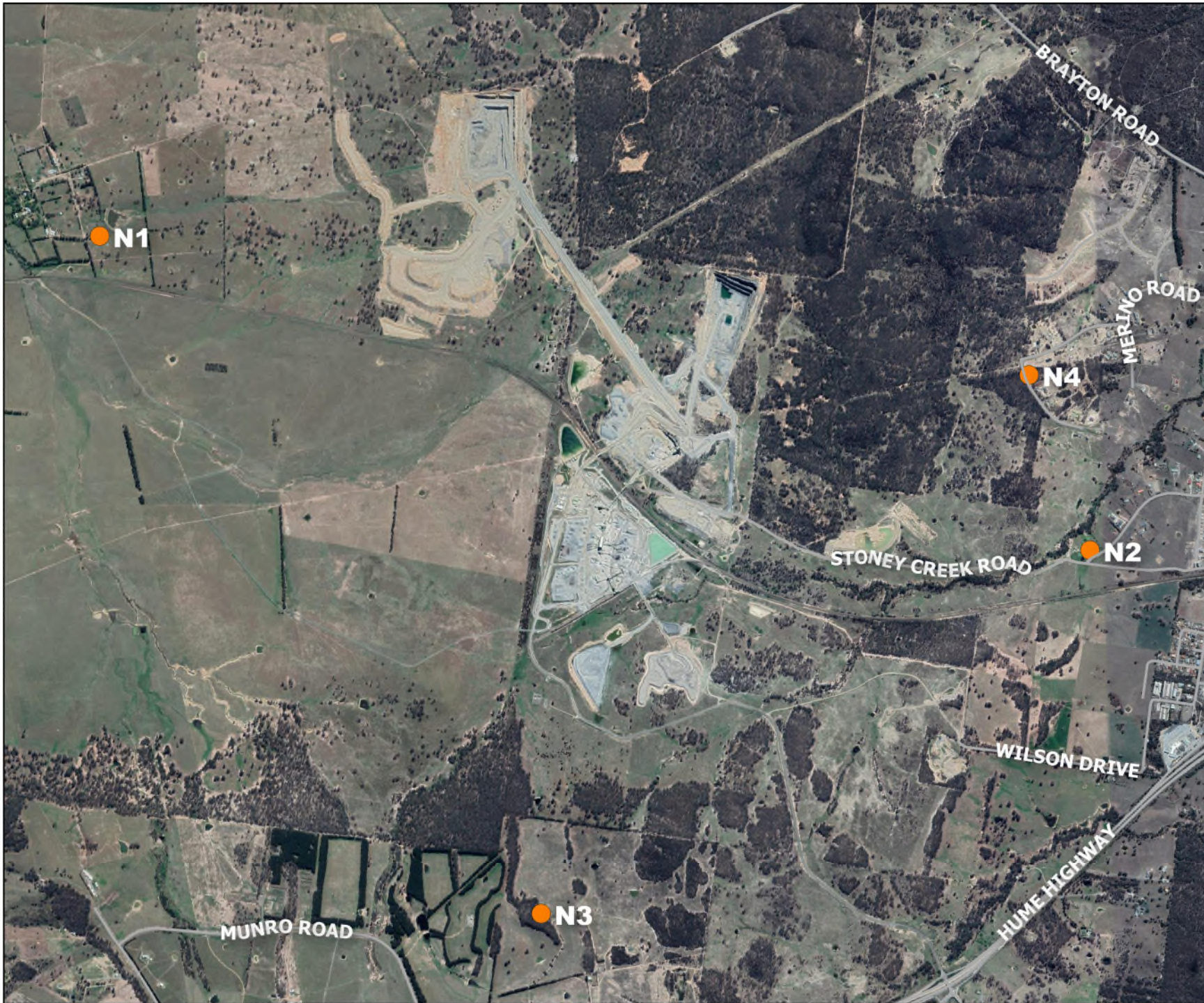


FIGURE 1
Site Locality
MAC180611-02
Holcim Lynwood Quarry

KEY

- Noise Monitoring Locations



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4 Results

4.1 Assessment Results - Location N1

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N1 for the NMA are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
27/09/2022	15:08 (Day)	61	39	29	WD: NW WS: 1.5m/s Rain: Nil	Wind 25-48
						Birds 25-55
						Insects 25-30
						Aircraft 30-43
						Distant Thunder 40-61
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
29/09/2022	21:37 (Evening)	55	39	36	WD: NW WS: 1.5m/s Rain: Nil	Insects 30-35
						Wind 30-48
						Distant Traffic 30-35
						Train Passby 35-55
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
29/09/2022	22:00 (Night)	53	38	36	WD: E WS: 1.5m/s Rain: Nil	Wind 30-46
						Insects 30-35
						Distant Traffic 30-35
						Aircraft 35-53
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
Lynwood Quarry L _{A1} (1min) Contribution						<45

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

4.2 Assessment Results - Location N2

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N2 for the NMA are presented in Table 4.

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
27/09/2022	14:11 (Day)	61	46	34	WD: W WS: 0.5m/s Rain: Nil	Birds 32-55
						Construction 35-46
						Train Passby 35-61
						Insects 32-36
						Traffic 30-35
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
29/09/2022	20:33 (Evening)	74	57	45	WD: W WS: 2.0m/s Rain: Nil	Insects <40-43
						Traffic 40-48
						Residential Noise 40-65
						Train Passby 45-74
						Wind 40-53
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<37
29/09/2022	22:58 (Night)	58	47	44	WD: SE WS: 1.5m/s Rain: Nil	Insects <40-45
						Traffic 40-53
						Residential Noise 40-58
						Wind 40-48
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<36
Lynwood Quarry L _{A1} (1min) Contribution						<46

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

4.3 Assessment Results - Location N3

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N3 for the NMA are presented in Table 5.

Table 5 Operator-Attended Noise Survey Results – Location N3							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA	
		L _{Amax}	L _{Aeq}	L _{A90}			
27/09/2022	13:33 (Day)	64	41	37	WD: W WS: 1.5m/s Rain: Nil	Insects 35-40 Birds 32-54 Distant Traffic <35 Wind 35-48 Quarry – Vehicles Enter/Exit 32-48 (3 movements, 10 -20 second each) Quarry – Blast 62-64 (1 instance, 2 second duration)	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
29/09/2022	19:55 (Evening)	56	47	45	WD: E WS: 1.5m/s Rain: Nil	Insects <40 Distant Traffic 40-48 Wind 43-56 Quarry Inaudible	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
29/09/2022	23:46 (Night)	53	46	44	WD: SE WS: 1.0m/s Rain: Nil	Insects 40-45 Distant Traffic 40-53 Wind <40 Quarry Inaudible	
						Lynwood Quarry L _{Aeq} (15min) Contribution	<35
						Lynwood Quarry L _{A1} (1min) Contribution	<47

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

4.4 Assessment Results - Location N4

The monitored noise level contributions and observed meteorological conditions for each assessment period at Location N4 for the NMA are presented in Table 6.

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
27/09/2022	14:34 (Day)	57	40	34	WD: W WS: 1.0m/s Rain: Nil	Birds 30-48
						Traffic 30-57
						Wind 31-52
						Distant Thunder 38-51
						Quarry – Haul Trucks 30-38 (barely to audible 50% measurement)
Lynwood Quarry L _{Aeq} (15min) Contribution						<35
29/09/2022	20:55 (Evening)	62	47	44	WD: E WS: 2.0m/s Rain: Nil	Wind 40-62
						Insects 40-43
						Traffic 40-57
						Train 45-53
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<37
29/09/2022	22:35 (Night)	55	45	44	WD: SE WS: 1.5m/s Rain: Nil	Insects 40-43
						Traffic 40-48
						Wind 40-55
						Quarry Inaudible
Lynwood Quarry L _{Aeq} (15min) Contribution						<36
Lynwood Quarry L _{A1} (1min) Contribution						<47

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

5 Discussion

5.1 Discussion of Results - Location N1

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was inaudible during daytime, evening and night measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources measured included wind, distant traffic, birds, insects, passing trains, aircraft, and distant thunder.

5.2 Discussion of Results - Location N2

Monitoring Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was inaudible during daytime, evening and night-time measurement with quarry noise contributions estimated to satisfy the relevant noise limits.

Extraneous noise sources included wind, birds, traffic, insects, passing trains, residential and construction noise.

5.3 Discussion of Results - Location N3

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified that quarry noise was audible during daytime and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources audible during the survey were trucks entering and exiting site and blasting noise. Extraneous noise sources included wind, birds, distant traffic, and insects.

5.4 Discussion of Results - Location N4

Monitoring on Tuesday 27 September 2022 and Thursday 29 September 2022 identified quarry noise was audible during daytime measurements and inaudible during evening and night-time measurements with quarry noise contributions estimated to satisfy the relevant noise limits.

Quarry noise sources measured included haul truck movements, Extraneous noise sources included birds, traffic, insects, wind, distant thunder and passing trains.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) for Holcim (Australia) Pty Ltd at the Lynwood Quarry, Marulan, NSW. The assessment was completed to assess the quarry's compliance with the relevant noise criteria during Quarter 3, ending September 2022.

Attended noise monitoring was undertaken on Tuesday 27 September 2022 and Thursday 29 September 2022 at four representative monitoring locations. The assessment has identified that noise emissions generated by Lynwood Quarry were generally audible at two locations during the day period, however quarry noise emissions were below the relevant noise criteria, satisfying the applicable noise criteria throughout the survey period.

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Appendix A - Glossary of Terms

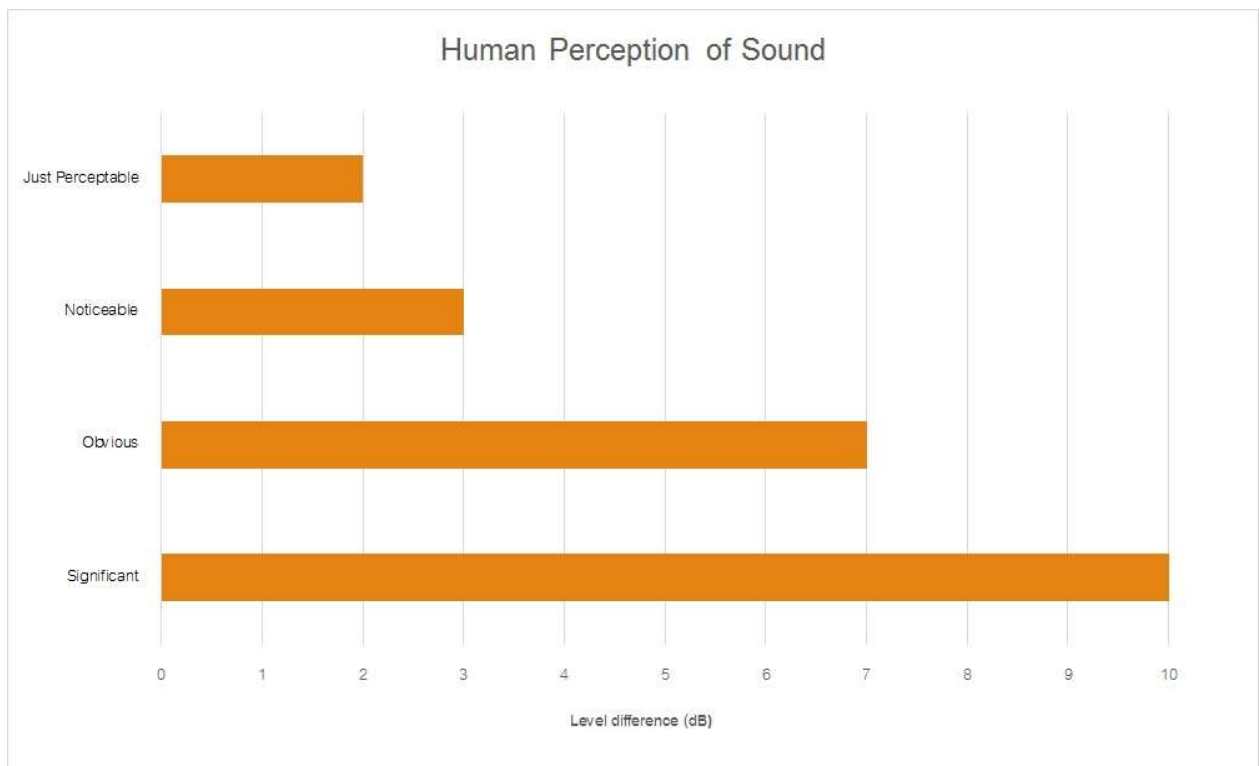
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAm _{ax}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.</p>

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

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

Figure A1 – Human Perception of Sound



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QUARTERLY NOISE MONITORING ASSESSMENT – QUARTER 4 2022 LYNWOOD QUARRY, MARULAN, NSW

**QUARTERLY NOISE MONITORING ASSESSMENT –
QUARTER 4 2022
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ABBREVIATIONS AND DEFINITIONS

Ambient Noise	The all-encompassing noise within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor (see below).
dB	Abbreviation for decibel, a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm of a given sound power to a reference power.
dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods. Normal daily traffic is not extraneous noise.
LA1	The noise level, measured in dB(A), which is exceeded for 1 per cent of the measurement period.
LA1(1min)	The noise level, measured in dB(A), which is exceeded for 1 per cent of the time over a 1-minute measurement period, i.e., is exceeded for 0.6 seconds. This measure can approximate to the maximum noise level but may be less if there is more than 1 noise event during this 0.6 second period.
LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
LAeq	The level of noise equivalent to the energy average of noise levels occurring over a defined measurement period.
LAeq (period)	The average equivalent noise level, measured in dB(A), during a measurement period (e.g., 15-minute, day, evening, or night).
LAm_{ax}	The A-weighted sound pressure level that represents the maximum noise level measured over the time that a given sound is measured.
NMA	Noise Monitoring Assessment
NMP	Noise Management Plan

Source: Noise Guide for Local Government (NSW EPA, 2013)

1. OVERVIEW

1.1 Project Driver

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry (“the quarry”) at Marulan, NSW.

This NMA was done in accordance with the following documents:

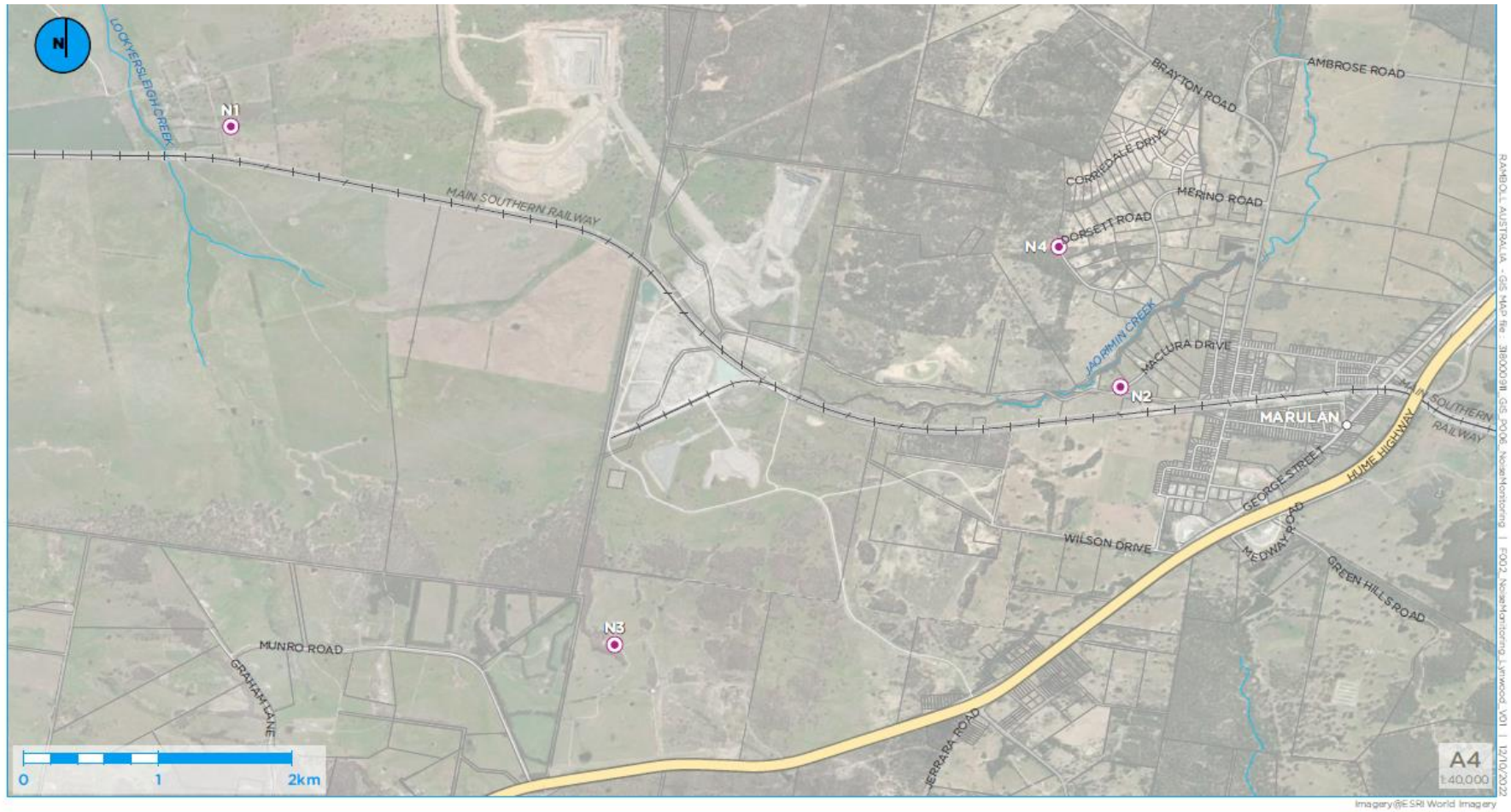
- Noise Policy for Industry (NPI) (NSW EPA, 2017).
- Lynwood Quarry Noise Management Plan (NMP) (Holcim Australia, 2019).
- Environment Protection Licence (EPL) number 12939 (NSW EPA, 2021).
- Development Consent DA 128-5-2005 (Minister for Planning, 2017).
- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018).
- IEC 60942 Ed. 3.0 b:2003 Electroacoustics - Sound calibrators (Standards Australia, 2003).

This NMA has been undertaken for the quarterly period October to December 2022, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1**.



Legend
● Noise monitoring location

Figure 1 : Noise monitoring locations at Lynwood Quarry

Confidential

2. NOISE CRITERIA

Table 2-1 includes the applicable noise criteria outlined in the Development Consent and the EPL for the 16 residential receivers surrounding the quarry (L1-L16), and the four monitoring locations adopted from the NMP that are deemed representative and applicable for this NMA (N1-N4). It should be noted that N3 was only accessible during the day and evening; night monitoring was completed at nearby location NM3 but on reflection the location within the quarry boundary to deemed unsuitable.

Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day ¹	Evening ²	Night ³	Night ³
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Northern Boundary, 16038 Hume Highway, Marulan	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

¹ 7 am-6 pm Monday to Saturday and 8 am-6 pm Sunday and public holidays
² 6 pm-10 pm Monday to Sunday
³ 10 pm-7 am Monday to Saturday and 10 pm-8 am Sunday and public holidays

3. METHODOLOGY

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 1. The measurements were carried out using a RION Sound Level Meter NL-52 on Tuesday 6 December and Wednesday 7 December 2022. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672-1:2013/2002 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2003. Drift in calibration did not exceed ± 0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening and night periods over two days. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source.

Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90, or estimated to be less than criteria value.

4. RESULTS AND DISCUSSION

4.1 Location N1

Noise monitoring at location N1 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the day, evening, and night. The results and observations taken during the monitoring events at Location N1 are presented in **Table 4-1**.

The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. Extraneous noise sources measured included birds, barking dogs, children yelling, wind, rustling leaves, vehicles and a passing freight train.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmx	LAeq	LA90						
06-12-22	7:31 (Day)	77	52	27	WD: n/a WS: 0 Rain: Nil	Birds Ute Dogs barking Children yelling Quarry inaudible	<35	35	n/a	n/a
06-12-22	19:52 (Evening)	73	54	40	WD: 270° WS: 3.6 m/s Rain: Nil	Dogs barking 49-70 Wind/rustling leaves 48-54 Quarry inaudible	<35	35	n/a	n/a
07-12-22	6:24 (Night)	77	61	32	WD: n/a WS: 0 Rain: Nil	Background 34 Birds 68 Freight train passing 65-76 Quarry inaudible	<35	35	<45	45

4.2 Location N2

Noise monitoring at location N2 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise at night, with audible noise measured during the day and evening. The results and observations taken during the monitoring events at Location N2 are presented in Table 4-1.

The quarry was faintly audible during all periods. It was difficult to discern construction activities at this location from quarry activities during the day period. The quarry contribution was noted as below criteria when it was audible when construction activities ceased. The dominant noise source was motorway traffic. Extraneous noise sources measured included birds, earth moving construction, excavators, starting machinery, truck movement and motorway traffic.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmx	LAeq	LA90						
06-12-22	10:06 (Day)	72	49	40	WD: 90° WS: 1.2 m/s Rain: Nil	Birds 51 Construction earth moving 46 Truck 72 Excavator 49 Machine starting 45 Motorway 44 Quarry faintly audible	<41 ¹	35	n/a	n/a
06-12-22	18:33 (Evening)	55	44	41	WD: 90° WS: 1.9 m/s Rain: Nil	Birds 44-45 Motorway traffic 43-48 Wind/rustling leaves 42-47 Car turning around 48 Quarry faintly audible	<37	37	n/a	n/a
07-12-22	5:29 (Night)	71	55	41	WD: n/a WS: 0 Rain: Nil	2 x Freight train passing 50-69 Birds 48-50 Road Quarry inaudible	<36	36	<46	46

¹ Noted that construction works adjacent to monitoring location confounded ability to isolate quarry noise from construction noise

4.3 Location N3

Noise monitoring at location N3 conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the day and evening. The location was unable to be accessed during the night period due to a locked gate, so measurements were completed at an intermediate monitoring location approximately 550m closer to the quarry within the site boundary. The results and observations taken during the monitoring events at Location N3 are presented in **Table 4-13**.

The quarry was audible during the night period, above the noise criteria, but the monitoring location used within the quarry boundary was deemed unsuitable given distance from nearest sensitive receiver (approximately 500 m) when compared to the nominated location. For future monitoring, access will be sought through the locked gate or an alternative publicly accessible location on Munro Road will be used. Extraneous noise sources measured included birds, motorway traffic, wind, and rustling leaves.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAmx	LAeq	LA90						
06-12-22	17:18 (Day)	63	45	42	WD: 180° WS: 1.1 m/s Rain: Nil	Birds 48-51 Motorway traffic 50-63 Quarry inaudible	<35	<35	n/a	n/a
06-12-22	18:00 (Evening)	56	47	44	WD: 180° WS: 1.1 m/s Rain: Nil	Motorway traffic/road 46-51 Wind/rustling leaves 47-50 Quarry inaudible	<35	<35	n/a	n/a

Location unable to be accessed for night monitoring (i.e. unexpected locked gate)

4.4 Location N4

Noise monitoring at location N4 was conducted on Tuesday 6 December 2022 and Wednesday 7 December 2022 resulted in inaudible noise during the evening and night, with audible noise measured during the day. The results and observations taken during the monitoring events at location N2 are presented in **Table 4-1**.

These results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance, where quarry contribution was noted. Extraneous noise sources measured included birds, aircraft, passing cars, motorway traffic, wind, rustling leaves and a passing train.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LAm _{ax}	LA _{eq}	LA ₉₀						
06-12-22	9:34 (Day)	63	42	33	WD: 180° WS: 1.1 m/s Rain: Nil	Birds 55 Motorway traffic 35 Car passing 57 Quarry plant audible	<37	37	n/a	n/a
06-12-22	19:15 (Evening)	67	45	39	WD: 270° WS: 1.8 m/s Rain: Nil	Motorway traffic 43-45 Aircraft 54 Car on gravel road 44 Cars passing 56-58 Wind/rustling leaves 46 Birds 43-45 Quarry inaudible	<37	37	n/a	n/a
07-12-22	5:50 (Night)	63	44	37	WD: n/a WS: 0 Rain: Nil	Birds 53 Motorway traffic 42-47 Train 50 Quarry inaudible	<36	36	<47	47

5. CONCLUSION

Monitoring was carried out on Tuesday 6 December 2022 and Wednesday 7 December 2022 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry. No audible noise above the noise criteria from quarry operations was recorded at any of the four locations during the day, evening, and night periods. It was difficult to discern quarry noise from sub-division construction noise in location N2 during the day period.

This noise monitoring assessment completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP showed compliance to the relevant noise criteria.

6. REFERENCES

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APPENDIX 2

Environmental Monitoring Results

Date	EC	pH	Suspended Solids	Total Oil and Grease	Total Phosphorous	Total Nitrogen	Flow Observations
	µs/cm		mg/L	mg/L	mg/L	mg/L	
ANZECC Criteria	N/A	6.5 to 7.5	50	10	N/A	N/A	N/A
SW5							
1/07/2004	740	6.9	NS	NS	0.01	3	NS
3/08/2004	793	6.8	NS	NS	0.01	3.4	NS
3/09/2004	NS	NS	NS	NS			NS
8/10/2004	281	6.2	NS	NS	0.02	1.4	NS
2/11/2004	270	6.9	NS	NS	0.02	1.4	NS
30/11/2004	NS	NS	NS	NS	0.01	1.3	NS
6/01/2005	272	7	NS	NS	0.02	2	NS
2/02/2005	266	6.3	NS	NS	0.08	2	NS
2/03/2005	235	6.7	NS	NS	0.02	1.2	NS
8/04/2005	363	6.5	NS	NS	0.01	0.87	NS
5/05/2005	395	6.7	NS	NS	0.02	0.88	NS
2/06/2005	405	6.8	NS	NS	0.02	1.1	NS
6/07/2005	333	6.7	NS	NS	0.01	1	NS
3/08/2005	498	6.6	NS	NS	0.01	0.81	NS
8/09/2005	547	6.8	NS	NS	0.01	0.81	NS
13/10/2005	301	6.7	NS	NS	0.01	1	NS
2/11/2005	379	6.6	NS	NS	0.01	0.99	NS
1/12/2005	279	6.4	NS	NS	0.01	1.1	NS
5/01/2006	919	6.4	NS	NS	0.02	1.6	NS
2/02/2006	574	6.7	NS	NS	0.04	1.6	NS
2/03/2006	708	7	NS	NS	0.07	2	NS
7/04/2006	828	7.3	NS	NS	0.01	1.6	NS
3/05/2006	910	7.1	NS	NS	0.01	2.1	NS
8/06/2006	287	6	NS	NS	0.03	1.8	NS
6/07/2006	399	6.4	NS	NS	0.01	0.75	NS
3/08/2006	566	6.6	NS	NS	0.01	0.95	NS
7/09/2006	635	6.8	NS	NS	0.01	1.3	NS
5/10/2006	732	6.5	NS	NS	0.01	1.3	NS
2/11/2006	946	6.8	NS	NS	0.03	2	NS
4/12/2006	1362	6.8	NS	NS	0.05	2.6	NS
11/01/2007	310	6.4	NS	NS	0.02	2.2	NS
9/02/2007	416	6.8	NS	NS	0.02	2.8	NS
2/03/2007	468	6.3	NS	NS	0.01	1.6	NS
13/04/2007	469	6.3	NS	NS	0.02	1.4	NS
2/05/2007	491	6.6	NS	NS	0.01	1.4	NS
6/06/2007	506	6.6	NS	NS	0.02	1.9	NS
9/07/2007	326	7.3	NS	NS	0.01	1.4	NS
15/08/2007	748	6.5	NS	NS	0.02	0.88	NS
6/09/2007	845	6.9	NS	NS	0.01	0.88	NS
12/10/2007	1049	6.6	NS	NS	0.02	1.1	NS
8/11/2007	272	6.2	NS	NS	0.03	1.3	NS
6/12/2007	530	6.2	NS	NS	0.03	1.1	NS
10/01/2008	398	6.4	NS	NS	0.02	1.4	NS
7/02/2008	386	6.3	NS	NS	0.01	1.2	NS
6/03/2008	445	6.6	NS	NS	0.03	1.3	NS
11/04/2008	414	6.5	NS	NS	0.01	1.3	NS
8/05/2008	441	6.7	NS	NS	0.12	1.1	NS
4/06/2008	442	6.7	NS	NS	0.01	1.2	NS
3/07/2008	454	7.3	NS	NS	0.03	1.2	NS
20/02/2009	404	6.5	NS	NS	0.01	1.8	NS
30/07/2009	319	6.5	NS	NS	0.02	0.99	NS
8/01/2010	378	5.8	NS	NS	0.02	2.3	NS
1/07/2010	333	6.2	NA	NA	0.05	0.96	
19/07/2010	333	6.2	NS	NS	0.01	0.96	NS
1/12/2010	464	6.3	9	1	0.07	1.6	Moderate
15/12/2010	464	6.3	NS	NS	0	1.6	Moderate
1/01/2011	778	6.2	4	1	0.05	1.2	Moderate
12/01/2011	778	6.2	NS	NS	0	1.2	Moderate
1/02/2011	618	6.1	14	1	0.13	1.4	Low
10/02/2011	618	6.1	NS	NS	0	1.4	Low
1/03/2011	569	6.2	7	1	0.05	1.2	Low
10/03/2011	569	6.2	NS	NS	0	1.2	Low
1/04/2011	944	6	5	1	0.03	0.8	Low
6/04/2011	944	6	NS	NS	0	0.8	NS
1/05/2011	1000	6.7	10	1	0.03	0.74	Low
1/06/2011	932	6.8	13	1	0.03	0.73	Low
13/07/2011	865	6.6	7	1	0.03	0.75	Low
12/08/2011	820	6.6	17	1	0.04	0.79	Moderate
8/09/2011	603	6.6	40	1	0.07	1.1	Moderate
6/10/2011	674	6.2	33	1	0.07	1.1	Low
7/11/2011	725	6.7	9	1	0.05	0.98	Low
9/12/2011	736	7.2	29	1	0.06	1	Moderate
10/01/2012	766	6.6	25	1	0.07	1.1	Moderate
13/02/2012	448	6.8	810	1	0.24	2.7	Moderate
16/03/2012	208	7.5	140	1	0.1	1.3	Flood
16/04/2012	146	6	530	1	0.13	1.5	Moderate
14/05/2012	335	7.1	97	1	0.08	1.2	Moderate
13/06/2012	380	6.2	34	1	0.06	1.3	Moderate
12/07/2012	1137	6.5	52	1	0.04	1.1	Moderate
24/08/2012	760	6.8	22	1	0.04	1	Low
18/09/2012	795	6.3	18	1	0.04	1.1	Low
30/10/2012	141.5	6.6	36	5	0.05	0.9	Very Low
27/11/2012	1461	6.1	10	5	0.05	5.6	Very Low

17/12/2012	968	5.3	15	5	0.05	2.6	No Flow
29/01/2013	202.8	5.6	140	5	0.07	2.5	Fast Flow
28/02/2013	202.3	6.4	76	5	0.09	2	Med to Fast
21/03/2013	480	6.1	17	5	0.09	2.1	No Flow
18/04/2013	402.1	6.7	17	5	0.09	2.5	No Flow
22/05/2013	518	7.3	7	5	0.07	2.5	No Flow
19/06/2013	1137	6.5	52	1	0.04	1.1	Moderate
19/07/2013	447	7.34	100	5	0.05	1.4	NS
19/08/2013	504	7.43	15	5	0.05	0.4	NS
24/09/2013	442	6.62	25	5	0.05	1.2	NS
26/11/2013	283	6.59	71	5	0.08	2.7	NS
21/01/2014	235	6	28	1	0.12	2.2	NS
18/02/2014	265	6	48	1	0.11	1.7	NS
20/03/2014	361	6	56	1	0.11	1.4	NS
29/04/2014	600	6	20	1	0.08	1.8	NS
21/05/2014	622	6	23	1	0.1	1.6	NS
16/06/2014	875	6	43	1	0.04	0.86	NS
18/07/2014	75	7	11	1	0.04	0.83	NS
22/08/2014	355	6	39	1	0.07	1.4	NS
19/09/2014	356	6.7	25	1	0.06	1.4	NS
24/10/2014	199	6	21	1	0.08	1.4	NS
20/11/2014	330	6.4	39	1	0.11	1.9	NS
17/12/2014	273	6.2	62	1	0.09	1.7	NS
20/01/2015	340	6.4	14	1	0.08	1.8	NS
20/02/2015	308	6.7	29	1	0.1	1.4	NS
20/03/2015	383	6.9	7	1	0.09	1.3	NS
20/04/2015	319	6.3	130	1	0.1	2.1	NS
18/05/2015	533	6.9	13	1	0.05	1.1	NS
21/07/2015	326	6	11	1	0.04	1.29	NS
27/08/2015	172	6.2	44	1	0.08	2.02	NS
16/09/2015	224	5.9	34	1	0.1	1.15	NS
19/10/2015	261	6.5	15	1	0.08	1.46	NS
20/11/2015	986	6.4	4	1	0.02	0.75	NS
17/12/2015	NS	NS	NS	NS	NS	NS	NS
20/01/2016	1360	6.2	7	1	0.06	1.17	NS
23/02/2016	556	7.1	12	1	0.08	1.65	NS
20/04/2016	NS	NS	NS	NS	NS	NS	NS
24/05/2016	NS	NS	NS	NS	NS	NS	NS
23/06/2016	354	6.4	18	1	0.04	1.98	NS
21/07/2016	501	6.8	23	1	0.07	2.78	Flood
22/08/2016	603	7.1	6	1	0.03	1.14	Low
27/09/2016	477	7.4	8	1	0.09	2.27	Moderate
24/10/2016	905	7	7	1	0.02	1	Low
21/11/2016	NS	NS	NS	NS	NS	NS	ponding no flow no sample
15/12/2016	NS	NS	NS	NS	NS	NS	pooling no flow
20/03/2017	908	7.5	23	1	0.05	2.59	Moderate
20/04/2017	1200	7.7	4	1	0.02	1.22	Low
25/05/2017	1040	7.62	20	1	0.03	1.34	Low
19/06/2017	1080	7.6	13	1	0.03	2.66	Low
25/07/2017	1280	7.89	4	1	0.02	0.74	Low
24/08/2017	1240	7.69	5	1	0.02	1.18	Low
22/09/2017	1340	7.66	6	1	0.02	0.92	No flow. Pooling
19/01/2018	ND	ND	ND	ND	ND	ND	No flow
14/02/2018	ND	ND	ND	ND	ND	ND	No flow
15/03/2018	707	7.54	5	1	0.05	1.33	Low
20/04/2018	818	6.98	95	1	0.51	4.34	Low
18/05/2018	871	7.63	3	1	0.03	1.4	Low
14/06/2018	846	7.66	3	1	0.03	1.36	Low
16/07/2018	NS	NS	NS	NS	NS	NS	Low
13/08/2018	1110	7.73	13	1	0.07	1.74	Low
17/09/2018	ND	ND	ND	ND	ND	ND	Dry
23/10/2018	ND	ND	ND	ND	ND	ND	Dry
15/11/2018	ND	ND	ND	ND	ND	ND	Dry
17/12/2018	892	7.05	13	NS	0.03	3.18	Low
21/01/2019	NS	NS	NS	NS	NS	NS	NF
20/02/2019	NS	NS	NS	NS	NS	NS	NF
18/03/2019	NS	NS	NS	NS	NS	NS	NF
29/04/2019	NS	NS	NS	NS	NS	NS	NF
30/05/2019	NS	NS	NS	NS	NS	NS	NF
14/06/2019	536	7	9	1	0.04	0.86	F
11/07/2019	1000	7.44	5	1	0.02	0.71	F
20/08/2019	NS	NS	NS	NS	NS	NS	NF
18/09/2019	684	6.81	17	1	0.63	1.32	F
15/10/2019	902	7.48	5	1	0.04	NF	
13/11/2019	ND	ND	ND	ND	ND	ND	NF
12/12/2019	ND	ND	ND	ND	ND	ND	NF
3/04/2020	*597	*7.12	*5	*10	*0.05	*1.6	NT
20/05/2020	512	7.12	4	5	0.13	3.4	F
11/06/2020	748	7.64	34	7	0.15	3.6	F
30/07/2020	554	7.01	11	5	0.02	0.86	F
25/08/2020	489.3	7.58	5.8	5	0.02	1.11	F
3/09/2020	557	7.49	45	5	0.02	1.1	F
30/10/2020	561	7.26	13	5	0.06	1.1	F
19/11/2020	542	6.82	17	5	0.05	1	F
14/12/2020	645	7.41	12	5	0.03	0.2	F
20/01/2021	901	7.06	8.8	5	0.07	1.5	F
23/02/2021	1020	7.5	6.6	5	0.03	0.5	F
10/03/2021	1050	7.6	9.2	5	0.03	0.96	F
9/04/2021	771	7.4	7.9	5	0.5	0.2	F

7/05/2021	111	7.4	27	5	0.03	0.5	F
2/06/2021	912	7.3	3.4	5	0.01	0.8	NF
1/07/2021	896	7.6	4.4	5	0.02	0.84	NF
2/08/2021	1410	7.3	12	5	0.02	0.2	F
1/09/2021	379	7.5	11	5	0.03	2.37	NF
6/10/2021	475	8	2.7	13	0.01	0.2	F
3/11/2021	609	7.9	13	5	0.03	0.9	F
9/12/2021	506	7	10	5	0.02	2.2	NF
6/01/2022	758	7.2	14	12	0.03	2.9	NF
0/01/1900	326	7.1	7	5	0.11	0.3	NF
0/01/1900	NA	7	10	5	0.04	1	F
0/01/1900	441	7.3	6	6.4	0.03	3.7	NF
0/01/1900	418	7.7	11	5	0.03	0.88	NF
0/01/1900	384	8	8	5	0.02	0.85	F
0/01/1900	181	8.2	8	5	0.17	1	F
0/01/1900	311	8.6	7	6	0.03	1.18	F
0/01/1900	421	8.4	5	5	0.04	0.2	NF
0/01/1900	390	7.4	5	5	0.02	0.2	NF
0/01/1900	310	8.2	12	25	0.05	49	NF
0/01/1900	434	8.1	8	5	0.05	1.3	F
Average	587.54	6.81	34.55	2.92	0.05	1.73	-
Minimum	75.00	5.30	2.70	1.00	0.00	0.20	-
Maximum	1461.00	8.60	810.00	25.00	0.63	49.00	-
SW6							
1/07/2004	2316	7.1	NS	NS	0.01	0.95	NS
3/08/2004	2268	7.1	NS	NS	0.01	0.41	NS
3/09/2004	3255	9.7	NS	NS	0.01	0.47	NS
8/10/2004	488	6.9	NS	NS	0.01	1.1	More water than previous samples
2/11/2004	277	7	NS	NS	0.01	1.2	NS
30/11/2004	NS	NS	NS	NS	0.01	0.89	NS
6/01/2005	575	7	NS	NS	0.01	1	NS
2/02/2005	248	6.4	NS	NS	0.05	1.9	NS
2/03/2005	588	6.5	NS	NS	0.01	0.88	NS
8/04/2005	682	7.2	NS	NS	0.01	0.79	NS
5/05/2005	887	6.9	NS	NS	0.02	0.59	NS
2/06/2005	1290	7.1	NS	NS	0.01	0.95	NS
6/07/2005	352	6.8	NS	NS	0.01	1	NS
3/08/2005	632	6.9	NS	NS	0.01	0.68	NS
8/09/2005	860	7.5	NS	NS	0.01	0.54	NS
13/10/2005	529	7	NS	NS	0.01	0.73	NS
2/11/2005	821	7.2	NS	NS	0.01	0.66	NS
1/12/2005	323	6.7	NS	NS	0.01	1.1	NS
5/01/2006	1052	6.6	NS	NS	0.02	0.84	NS
2/02/2006	667	7	NS	NS	0.02	1.2	NS
2/03/2006	1176	6.9	NS	NS	0.04	0.97	Brown oil film on surface.
7/04/2006	1730	7.3	NS	NS	0.01	0.67	NS
3/05/2006	1910	7	NS	NS	0.01	0.61	NS
8/06/2006	2091	6.9	NS	NS	0.01	0.44	NS
6/07/2006	425	6.2	NS	NS	0.02	0.43	NS
3/08/2006	576	6.7	NS	NS	0.01	0.86	NS
7/09/2006	818	6.9	NS	NS	0.01	0.86	NS
5/10/2006	934	6.9	NS	NS	0.01	0.88	NS
2/11/2006	1055	7.2	NS	NS	0.02	1	NS
4/12/2006	1303	7.2	NS	NS	0.03	1	NS
11/01/2007	412	6.6	NS	NS	0.01	1.4	NS
9/02/2007	890	6.9	NS	NS	0.02	1	NS
2/03/2007	309	6.7	NS	NS	0.01	1.3	NS
13/04/2007	612	6.7	NS	NS	0.02	1	NS
2/05/2007	697	6.9	NS	NS	0.01	0.99	NS
6/06/2007	984	6.7	NS	NS	0.02	0.75	NS
9/07/2007	485	7.3	NS	NS	0.01	1.2	NS
15/08/2007	644	7	NS	NS	0.02	0.77	NS
6/09/2007	1260	6.9	NS	NS	0.01	0.66	NS
12/10/2007	1557	7	NS	NS	0.03	0.75	NS
8/11/2007	414	6.4	NS	NS	0.02	1	NS
6/12/2007	351	6.7	NS	NS	0.02	0.97	NS
10/01/2008	307	6.6	NS	NS	0.02	0.91	NS
7/02/2008	378	6.9	NS	NS	0.01	1	NS
6/03/2008	644	6.5	NS	NS	0.02	0.73	NS
11/04/2008	886	7	NS	NS	0.01	0.72	NS
8/05/2008	1017	6.9	NS	NS	0.03	0.63	NS
4/06/2008	970	7.2	NS	NS	0.01	0.66	NS
3/07/2008	971	7.4	NS	NS	0.02	0.71	NS
20/02/2009	1197	6.9	NS	NS	0.01	0.85	NS
30/07/2009	1174	7.1	NS	NS	0.02	0.57	NS
8/01/2010	1149	6.5	NS	NS	0.01	1	NS
1/07/2010	1000	7	NA	NA	0.01	0.62	NS
19/07/2010	1000	7	NS	NS	0.01	0.62	NS
1/12/2010	459	6.5	11	1	0.06	1.6	NS
15/12/2010	459	6.5	NS	NS	0	1.6	Moderate
1/01/2011	943	6.9	3	1	0.02	0.98	Moderate
1/02/2011	1182	6.7	4	1	0.07	0.97	Low
1/03/2011	1143	6.7	3	1	0.02	0.89	Low
1/04/2011	973	6.7	3	1	0.02	0.82	Low
1/05/2011	929	7.1	3	1	0.02	0.69	Low
1/06/2011	999	7	2	1	0.01	0.6	Low
13/07/2011	952	7	2	1	0.01	0.55	Low
12/08/2011	1053	7	4	1	0.02	0.58	Moderate
8/09/2011	634	7.3	21	1	0.05	0.91	Moderate

6/10/2011	1003	6.4	4	1	0.01	0.58	Low
7/11/2011	1001	7.3	3	1	0.02	0.76	Low
9/12/2011	1102	7.7	6	1	0.02	0.7	Moderate
10/01/2012	1146	7.1	3	1	0.02	0.72	Low
13/02/2012	916	7.1	9	1	0.06	1	Moderate
16/03/2012	435	7.2	27	1	0.07	1.4	Flood
16/04/2012	2110	6.6	320	1	0.11	1.3	Moderate
14/05/2012	574	7	28	1	0.05	1.1	Moderate
13/06/2012	349	6.5	34	1	0.07	1.2	Moderate
12/07/2012	647	6.5	20	1	0.04	0.91	Moderate
24/08/2012	940	6.6	6	1	0.02	0.78	Low
18/09/2012	1215	6.9	6	1	0.02	0.8	Low
30/10/2012	943	6.3	5	5	0.05	0.8	Med - Low
27/11/2012	1631	6.4	5	5	0.05	1.1	Med-Low
17/12/2012	1096	6.9	7	5	0.05	0.6	Low Flow
29/01/2013	259	5.8	51	5	0.07	1.9	Low Flow
28/02/2013	180	6.4	69	5	0.09	1.4	Low to No Flow
21/03/2013	752	6.5	6	5	0.05	1.5	No to Low Flow
18/04/2013	832	5.5	5	5	0.05	1.9	No to Low Flow
22/05/2013	1048	7.1	5	5	0.05	1.2	No to Low Flow
19/06/2013	1129	7.3	5	5	0.05	0.9	Low to Medium
19/07/2013	634	7.13	46	5	0.05	1.2	NS
19/08/2013	849	7.37	5	5	0.05	0.4	NS
24/09/2013	573	6.89	16	5	0.05	1	NS
15/10/2013	766	7.19	5	5	0.05	0.8	NS
26/11/2013	551	6.74	26	5	0.05	1.8	NS
21/01/2014	666	6	4	1	0.04	1.2	NS
18/02/2014	1007	7	4	1	0.02	0.99	NS
20/03/2014	655	6.7	18	1	0.05	1	NS
29/04/2014	702	6.9	9	1	0.04	1.2	NS
21/05/2014	905	6.5	3	1	0.06	0.82	NS
16/06/2014	1029	6.4	4	1	0.01	0.68	NS
18/07/2014	951	6.8	2	1	0.02	0.69	NS
22/08/2014	372	7.3	40	1	0.07	1.4	NS
19/09/2014	244	6.9	10	1	0.03	1	NS
20/11/2014	981	6.6	3	1	0.02	0.92	NS
17/12/2014	404	6.4	80	1	0.08	1.5	NS
20/01/2015	383	6.5	20	1	0.08	1.6	NS
20/02/2015	419	6.8	14	1	0.06	1.1	NS
20/03/2015	816	6.7	3	1	0.03	0.79	NS
20/04/2015	523	6.3	71	1	0.08	1.1	NS
18/05/2015	687	7.2	8	1	0.03	0.92	NS
21/07/2015	332	6.3	16	1	0.06	1.37	Low
27/08/2015	180	6.2	31	1	0.1	1.89	Moderate
16/09/2015	660	6.5	12	1	0.04	1.13	Moderate
19/10/2015	907	6.3	8	1	0.04	0.97	Moderate
20/11/2015	1050	6.7	3	1	0.02	0.78	Low
17/12/2015	1740	6.7	4	1	0.02	0.8	Moderate
20/01/2016	2300	6.6	4	1	0.01	0.61	Low
23/02/2016	678	6.8	6	1	0.04	1.09	Low
20/04/2016	1140	6.9	3	1	0.01	0.82	Low
24/05/2016	935	6.9	2	1	0.01	0.76	Moderate
23/06/2016	361	6.6	16	1	0.05	1.68	Low
21/07/2016	427	6.2	59	1	0.06	2.12	Moderate
22/08/2016	686	6.8	9	1	0.03	0.93	Low
27/09/2016	541	7.2	7	1	0.05	1.95	Moderate
24/10/2016	710	6.8	5	1	0.02	0.83	Low
21/11/2016	710	7	2	1	0.02	0.87	Low
15/12/2016	768	7.1	3	1	0.02	0.9	Low
19/01/2017	859	7.31	3	1	0.02	1.01	Low
17/02/2017	723	7.47	4	1	0.03	1.11	Low
20/03/2017	838	7.27	7	1	0.04	0.98	Low
20/04/2017	1240	7.59	3	1	0.02	0.92	No flow detectable
25/05/2017	1240	7.28	5	1	0.02	0.75	Pooling with no flow
19/06/2017	1120	7.41	2	1	0.02	0.67	Low
25/07/2017	1190	7.67	154	1	0.05	0.9	Low
24/08/2017	1150	7.69	2	1	0.02	0.72	Low
22/09/2017	1270	7.79	3	1	0.02	0.71	Low
25/10/2017	1390	7.8	3	1	0.02	0.76	Low
24/11/2017	821	7.59	4	1	0.03	0.92	No Flow Detectable
19/01/2018	1060	7.38	4	1	0.02	0.94	Low
14/02/2018	1200	7.6	5	1	0.02	0.88	Low
15/03/2018	637	7.35	5	1	0.04	0.94	Low
20/04/2018	1030	7.34	4	1	0.02	0.71	Low
18/05/2018	1060	7.78	2	1	0.01	0.72	Low
14/06/2018	1020	7.86	4	1	0.01	0.7	Low
16/07/2018	1020	8	2	1	0.01	0.68	Low
13/08/2018	987	7.9	2	1	0.02	0.55	Low
17/09/2018	1040	7.83	2	1	0.01	0.7	Low
23/10/2018	1100	6.82	6	1	0.03	0.79	Low
15/11/2018	1230	7.66	7	1	0.03	0.8	Low
17/12/2018	NS	NS	NS	NS	NS	NS	Low
21/01/2019	897	7.6	6	1	0.12	1.47	F
20/02/2019	1450	7.5	36	0.9	0.03	0.96	F
18/03/2019	1810	7.6	7	1	0.03	0.88	F
29/04/2019	1510	6.7	5	<1	0.02	0.82	F
30/05/2019	1120	7.4	5	<1	0.89	0.04	F
14/06/2019	533	7	43	<1	0.1	1.21	F
11/07/2019	688	7.18	9	<1	0.04	0.84	F

20/08/2019	746	7.67	5	<1	0.02	0.66	F
18/09/2019	532	7.01	21	<1	0.16	1.52	F
15/10/2019	707	7.26	2	1	0.03	0.74	F
13/11/2019	954	7.79	4	1	0.02	0.67	F
12/12/2019	163	7.58	11	1	0.02	0.69	F
3/04/2020	*906	*6.88	*7.3	*10	*0.13	*2	NT
20/05/2020	498.5	7.19	5.8	5	0.07	1.2	F
11/06/2020	666.9	7.55	25	5	0.04	1.7	F
30/07/2020	325.9	7.4	17	6.8	0.06	12.14	F
25/08/2020	465.9	7.6	2.3	5.6	0.03	0.9	F
3/09/2020	713	7.54	7.7	5	0.03	0.9	F
30/10/2020	657	7.45	5.3	5	0.03	1.2	F
19/11/2020	561	6.97	19	5	0.05	0.4	F
14/12/2020	698	7.93	9.9	5	0.03	0.7	F
20/01/2021	594	7.1	6.5	5	0.08	0.4	F
23/02/2021	652	7.3	11	5	0.05	0.6	F
10/03/2021	753	7.4	6.6	5	0.03	0.8	F
9/04/2021	746	7.1	14	5	0.5	0.2	F
7/05/2021	169	6.9	18	7.9	0.18	1.02	F
2/06/2021	681	7.6	5.7	5	0.03	6.9	NF
1/07/2021	980	7.1	6.8	7.6	0.03	1.22	NF
2/08/2021	1050	6.8	5.5	8.7	0.02	0.2	F
1/09/2021	368	8.06	5.9	12	0.04	1.4	F
6/10/2021	503	7.2	2.2	6.7	0.01	0.2	NF
3/11/2021	599	8.7	21	5	0.03	1.7	NF
9/12/2021	596	7.1	5.6	5	0.08	2.7	NF
1/09/2021	379	7.5	11	5	0.03	2.37	NF
6/10/2021	475	8	2.7	13	0.01	0.2	F
3/11/2021	609	7.9	13	5	0.03	0.9	F
9/12/2021	506	7	10	5	0.02	2.2	NF
6/01/2022	758	7.2	14	12	0.03	2.9	NF
1/02/2022	326	7.1	7	5	0.11	0.3	NF
9/03/2022	NS	7	10	5	0.04	1.0	F
5/04/2022	441	7.3	6	6.4	0.03	3.7	NF
3/05/2022	418	7.7	11	5	0.03	0.9	NF
2/06/2022	384	8	8	5	0.02	0.9	F
6/07/2022	181	8.2	8	5	0.17	1.0	F
3/08/2022	311	8.6	7	6	0.03	1.2	F
7/09/2022	421	8.4	5	5	0.04	0.2	NF
5/10/2022	390	7.4	5	5	0.02	0.2	NF
9/11/2022	310	8.2	12	25	0.05	49.0	NF
6/12/2022	434	8.1	8	5	0.05	1.3	F
Average	831.60	7.08	14.29	2.94	0.04	1.31	-
Minimum	163.00	5.50	2.00	0.90	0.00	0.04	-
Maximum	3255.00	9.70	320.00	25.00	0.89	49.00	-
SW8							
19/01/2018	NS	NS	NS	NS	NS	NS	Dry
14/02/2018	NS	NS	NS	NS	NS	NS	NF
15/03/2018	NS	NS	NS	NS	NS	NS	Dry
20/04/2018	NS	NS	NS	NS	NS	NS	Dry
18/05/2018	NS	NS	NS	NS	NS	NS	Dry
14/06/2018	NS	NS	NS	NS	NS	NS	Dry
16/07/2018	NS	NS	NS	NS	NS	NS	Dry
13/08/2018	NS	NS	NS	NS	NS	NS	Dry
17/09/2018	NS	NS	NS	NS	NS	NS	Dry
23/10/2018	NS	NS	NS	NS	NS	NS	Dry
15/11/2018	NS	NS	NS	NS	NS	NS	Dry
17/12/2018	NS	NS	NS	NS	NS	NS	Dry
21/01/2019	NS	NS	NS	NS	NS	NS	NF
20/02/2019	NS	NS	NS	NS	NS	NS	NF
18/03/2019	NS	NS	NS	NS	NS	NS	NF
29/04/2019	NS	NS	NS	NS	NS	NS	NF
30/05/2019	NS	NS	NS	NS	NS	NS	NF
14/06/2019	NS	NS	NS	NS	NS	NS	NF
11/07/2019	380	7.84	16	1	0.08	1.89	F
20/08/2019	NS	NS	NS	NS	NS	NS	NF
18/09/2019	NS	NS	NS	NS	NS	NS	NF
15/10/2019	NS	NS	NS	NS	NS	NS	NF
13/11/2019	NS	NS	NS	NS	NS	NS	NF
12/12/2019	NS	NS	NS	NS	NS	NS	NF
3/04/2020	293	7.86	630	14	0.05	2.9	NF
20/05/2020	208.9	7.47	540	5	0.51	3.3	NF
11/06/2020	296.6	8.7	270	5.4	0.55	4.6	NF
30/07/2020	202.5	7.84	330	5	0.38	2.7	NF
25/08/2020	215.4	8.34	830	7.3	0.39	4.6	NF
3/09/2020	308.2	8.11	170	5	0.08	5.6	NF
30/10/2020	384.1	7.7	79	5	0.08	5	NF
19/11/2020	477.1	8.3	22	5	0.05	5.2	NF
14/12/2020	477.6	7.85	32	5	0.03	5.6	NF
2/08/2021	NS	NS	NS	NS	NS	NS	Dry
1/09/2021	NS	NS	NS	NS	NS	NS	Dry
6/10/2021	NS	NS	NS	NS	NS	NS	Dry
3/11/2021	NS	NS	NS	NS	NS	NS	Dry
9/12/2021	NS	NS	NS	NS	NS	NS	Dry
6/01/2022	NS	NS	NS	NS	NS	NS	Dry
1/02/2022	NS	NS	NS	NS	NS	NS	Dry
9/03/2022	NS	NS	NS	NS	NS	NS	Dry
5/04/2022	NS	NS	NS	NS	NS	NS	Dry
3/05/2022	NS	NS	NS	NS	NS	NS	Dry

18/03/2019	NS	NS	NS	NS	NS	NS	NS	NF
29/04/2019	NS	NS	NS	NS	NS	NS	NS	NF
30/05/2019	NS	NS	NS	NS	NS	NS	NS	NF
14/06/2019	NS	NS	NS	NS	NS	NS	NS	NF
11/07/2019	NS	NS	NS	NS	NS	NS	NS	NF
20/08/2019	NS	NS	NS	NS	NS	NS	NS	NF
18/09/2019	NS	NS	NS	NS	NS	NS	NS	NF
15/10/2019	NS	NS	NS	NS	NS	NS	NS	NF
13/11/2019	NS	NS	NS	NS	NS	NS	NS	NF
12/12/2019	NS	NS	NS	NS	NS	NS	NS	NF
28/02/2020	1720	7.21	82	1	0.21	2.7	2.7	F
3/04/2020	2530	7.04	160	10	0.24	0.7	0.7	NF
20/05/2020	2206	6.62	900	5	2.5	2.4	2.4	NF
11/06/2020	3553	7.12	170	5	0.15	0.7	0.7	F
30/07/2020	1873	7.58	4.5	6.8	0.03	1.2	6.8	F
25/08/2020	1090	7.53	1.2	5	0.02	0.7	0.7	F
3/09/2020	2101	7.4	39	5	0.04	0.7	0.7	F
30/10/2020	2292	7.48	6.9	5	0.02	1.3	1.3	F
19/11/2020	1673	6.94	160	5	0.05	0.5	0.5	NF
14/12/2020	1914	7.32	1900	8.4	14	70	70	NF
20/01/2021	NS	NS	NS	NS	NS	NS	NS	NF
23/02/2021	3390	7.4	37	5	0.06	1.8	1.8	F
10/03/2021	6510	7	190	5	0.37	0.2	0.2	NF
9/04/2021	1880	7.5	41	5	0.5	0.2	0.2	F
7/05/2021	369	7.5	15	8.7	0.32	0.49	0.49	F
2/06/2021	2270	7.6	4.6	5	0.02	0.5	0.5	NF
1/07/2021	3930	7.7	2.8	5	0.02	0.6	0.6	NF
2/08/2021	4110	7.1	6.2	5	0.01	0.2	0.2	F
1/09/2021	1180	7.5	74	10	0.04	1.5	1.5	F
6/10/2021	2160	7.8	1.2	7.3	0.01	0.2	0.2	NF
3/11/2021	2530	7.5	21	5	0.16	0.9	0.9	NF
9/12/2021	1560	7.5	7.8	6.7	0.14	4.8	4.8	NF
6/01/2022	2150	7.3	30.0	5.0	0.07	3.2	3.2	NF
1/02/2022	806	7.1	5.0	5.0	0.34	2.2	2.2	NF
9/03/2022	NA	7.2	7.8	10.0	0.29	2.1	2.1	F
5/04/2022	1260	7.5	5.0	23.0	0.02	1.6	1.6	NF
3/05/2022	1240	7.6	5.0	5.0	0.02	0.9	0.9	NF
2/06/2022	1270	7.6	5.0	5.0	0.02	0.6	0.6	NF
6/07/2022	325	7.6	9.4	5.0	0.07	1.2	1.2	F
3/08/2022	951	7.9	5.0	15.0	0.03	1.1	1.1	NF
7/09/2022	991	8.3	5.0	5.0	0.03	0.2	0.2	NF
5/10/2022	1290	7.1	5.0	12.0	0.22	2.9	2.9	NF
9/11/2022	726	7.5	5.3	11.0	0.04	0.2	0.2	NF
6/12/2022	1160	7.5	5.0	9.2	0.02	0.6	0.6	NF
Average	2061.43	7.44	109.27	6.59	0.56	3.08	3.08	-
Minimum	325.00	6.62	1.20	1.00	0.01	0.20	0.20	-
Maximum	6510.00	7.80	1900.00	23.00	14.00	70.00	70.00	-

Location	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Depth to Water Level					
MP1	m	1.82	1.53	1.37	1.27
MP2		16.52	15.53	15.00	14.89
MP4		18.62	17.57	17.31	17.27
MP5		20	18.88	18.34	16.43
MP7		17.74	17.62	17.77	17.36
MP10		4.40	4.22	3.97	3.86
MP11		10.60	9.53	9.48	9.06
GPZ1		11.71	11.05	10.37	10.20
GPZ5		8.71	8.52	8.35	8.27
GPZ6		4.99	4.43	4.13	3.81
GPZ8		7.71	7.65	7.16	7.08
pH					
MP1	pH Units	6.5	6.8	7.4	6.70
MP2		6.3	6.6	7.9	7.40
MP4		6.0	6.2	6.9	6.20
MP5		6.6	6.7	7.4	6.20
MP7		6.6	6.7	7.7	7.10
MP10		7.1	7.1	8.1	7.20
MP11		7.2	7.5	8.0	7.30
GPZ1		7.7	8.0	8.5	7.60
GPZ5		7.7	8.0	8.6	7.90
GPZ6		7.0	7.2	8.0	7.30
GPZ8		7.1	7.4	8.1	7.00
EC					
MP1	µS/cm	1050	877	696	812.00
MP2		321	228	183	231.00
MP4		430	320	289	300.00
MP5		704	549	439	300.00
MP7		704	5600	4780	4370.00
MP10		6740	6570	6150	5980.00
MP11		661	575	414	486.00
GPZ1		884	771	771	692.00
GPZ5		3540	3340	3250	3180.00
GPZ6		662	484	457	411.00
GPZ8		2360	2190	1960	1930.00
Sulphate					
MP1		19.0	24.0	20.0	22.00
MP2		2.0	5.0	11.0	50.00
MP4		2.0	5.0	4.1	50.00

MP5		2.0	5.0	10.0	50.00
MP7		31.0	31.0	44.0	37.00
MP10	mg/L	23.0	26.0	140.0	24.00
MP11		6.2	5.0	2.0	5.00
GPZ1		7.3	9.5	7.6	10.00
GPZ5		3.0	5.0	4.2	5.00
GPZ6		42.0	25.0	23.0	19.00
GPZ8		2.0	5.0	37.0	5.00
Kjeldahl Nitrogen					
MP1		1.30	-	-	-
MP2		2.00	-	-	-
MP4		2.70	-	-	-
MP5		2.80	-	-	-
MP7		3.40	-	-	-
MP10	mg/L	1.60	-	-	-
MP11		3.50	-	-	-
GPZ1		0.05	-	-	-
GPZ5		1.05	-	-	-
GPZ6		2.80	-	-	-
GPZ8		1.05	-	-	-
Total Phosphate					
MP1		0.29	-	-	-
MP2		2.00	-	-	-
MP4		2.70	-	-	-
MP5		2.80	-	-	-
MP7		3.40	-	-	-
MP10	mg/L	0.01	-	-	-
MP11		0.01	-	-	-
GPZ1		0.24	-	-	-
GPZ5		0.15	-	-	-
GPZ6		0.14	-	-	-
GPZ8		0.05	-	-	-
TDS					
MP1		675	561	445	520
MP2		209	148	119	150
MP4		280	208	188	195
MP5		451	352	285	195
MP7		3890	3530	3060	2800
MP10	mg/L	4250	4140	3870	3770
MP11		423	368	269	316
GPZ1		565	493	368	443
GPZ5		2270	2130	2080	2030
GPZ6		423	314	297	267
GPZ8		1510	1400	1250	1240
Hardness as CaCO3					
MP1		240	160	96	580
MP2		52	41	15	35
MP4		84	67	34	200
MP5		210	180	170	350
MP7		2100	1900	960	2100
MP10	mg/L	1800	2100	660	3500
MP11		270	270	120	350
GPZ1		310	290	180	470
GPZ5		120	120	44	3100
GPZ6		97	64	44	430
GPZ8		850	710	280	960
Sodium-Filtered					
MP1		120	120	130	120
MP2		630	800	690	670
MP4		30	33	34	34
MP5		35	33	34	32
MP7		55	50	46	43
MP10	mg/L	58	60	58	56
MP11		390	480	420	350
GPZ1		74	75	78	77
GPZ5		660	730	780	750
GPZ6		100	99	120	99
GPZ8		140	140	140	140
Pottasium - Filtered					
MP1		4	4	3.1	3.0
MP2		3	2.8	2.8	2.7
MP4		2	1.9	1.7	1.7
MP5		4.6	4.6	4.5	4.2
MP7		4.6	5.8	4.9	4.5
MP10	mg/L	10	13.0	10.0	9.1
MP11		2	2.1	2.0	3.8
GPZ1		5.0	5.2	5.0	4.5
GPZ5		8.5	9.7	9.4	8.4
GPZ6		1	1.1	1.1	1.9
GPZ8		9.1	11.0	13	12.0
Sulphate					
MP1		19	24.0	20.0	22.0
MP2		2	5.0	11.0	50.0
MP4		2	5.0	4.1	50.0
MP5		2	5.0	10.0	50.0
MP7		31	31.0	44.0	37.0
MP10	mg/L	23	26.0	140.0	24.0
MP11		6	5.0	2.0	5.0

GPZ1		7.3	9.5	7.6	10.0
GPZ5		3.0	5.0	4.2	5.0
GPZ6		42.0	25.0	23.0	19.0
GPZ8		2.0	5.0	37.0	5.0
Chloride					
MP1	mg/L	310	230	250	210.0
MP2		68	63	57	50.0
MP4		110	78	65	66.0
MP5		120	120	100	110.0
MP7		1900	1800	1800	1400.0
MP10		2100	2200	2400	2200.0
MP11		39	28	24	30.0
GPZ1		94	97	89	93.0
GPZ5		750	750	110	730.0
GPZ6		100	53	78	53.0
GPZ8		650.0	570	570	560.0
Silver - Filtered					
MP1	ug/L	0.000005	-	-	-
MP2		0.000005	-	-	-
MP4		0.000005	-	-	-
MP5		0.000005	-	-	-
MP7		0.000005	-	-	-
MP10		0.000005	-	-	-
MP11		0.000005	-	-	-
GPZ1		0.000005	-	-	-
GPZ5		0.000005	-	-	-
GPZ6		0.000005	-	-	-
GPZ8		0.000005	-	-	-
Aluminium					
MP1	ug/L	0.05	-	-	-
MP2		0.25	-	-	-
MP4		0.13	-	-	-
MP5		0.13	-	-	-
MP7		0.18	-	-	-
MP10		0.06	-	-	-
MP11		0.05	-	-	-
GPZ1		0.10	-	-	-
GPZ5		0.06	-	-	-
GPZ6		1.20	-	-	-
GPZ8		0.11	-	-	-
Antimony					
MP1	ug/L	0.00005	-	-	-
MP2		0.00005	-	-	-
MP4		0.00005	-	-	-
MP5		0.00005	-	-	-
MP7		0.00005	-	-	-
MP10		0.00005	-	-	-
MP11		0.00005	-	-	-
GPZ1		0.00005	-	-	-
GPZ5		0.000005	-	-	-
GPZ6		0.000005	-	-	-
GPZ8		0.000005	-	-	-
Barium					
MP1	ug/L	0.31	-	-	-
MP2		0.05	-	-	-
MP4		0.09	-	-	-
MP5		0.20	-	-	-
MP7		0.50	-	-	-
MP10		0.45	-	-	-
MP11		0.75	-	-	-
GPZ1		0.20	-	-	-
GPZ5		0.35	-	-	-
GPZ6		0.20	-	-	-
GPZ8		2.60	-	-	-
Beryllium					
MP1	ug/L	0.003	-	-	-
MP2		0.001	-	-	-
MP4		0.001	-	-	-
MP5		0.001	-	-	-
MP7		0.001	-	-	-
MP10		0.001	-	-	-
MP11		0.001	-	-	-
GPZ1		0.001	-	-	-
GPZ5		0.001	-	-	-
GPZ6		0.001	-	-	-
GPZ8		0.001	-	-	-
Boron					
MP1	ug/L	0.05	-	-	-
MP2		0.05	-	-	-
MP4		0.05	-	-	-
MP5		0.05	-	-	-
MP7		0.05	-	-	-
MP10		0.05	-	-	-
MP11		0.05	-	-	-
GPZ1		0.05	-	-	-
GPZ5		0.05	-	-	-
GPZ6		0.05	-	-	-
GPZ8		0.05	-	-	-
Cadmium					

MP1	mg/L	0.0002	-	-	-	
MP2		0.0002	-	-	-	
MP4		0.0002	-	-	-	
MP5		0.0002	-	-	-	
MP7		0.0002	-	-	-	
MP10		0.0002	-	-	-	
MP11		0.0002	-	-	-	
GPZ1		0.0002	-	-	-	
GPZ5		0.0002	-	-	-	
GPZ6		0.0002	-	-	-	
GPZ8		0.0002	-	-	-	
Chromium						
MP1		mg/L	0.001	-	-	-
MP2	0.002		-	-	-	
MP4	0.002		-	-	-	
MP5	0.003		-	-	-	
MP7	0.004		-	-	-	
MP10	0.002		-	-	-	
MP11	0.001		-	-	-	
GPZ1	0.002		-	-	-	
GPZ5	0.001		-	-	-	
GPZ6	0.002		-	-	-	
GPZ8	0.001		-	-	-	
Cobalt						
MP1	ug/L		0.001	-	-	-
MP2		0.002	-	-	-	
MP4		0.002	-	-	-	
MP5		0.003	-	-	-	
MP7		0.004	-	-	-	
MP10		0.001	-	-	-	
MP11		0.001	-	-	-	
GPZ1		0.001	-	-	-	
GPZ5		0.001	-	-	-	
GPZ6		0.001	-	-	-	
GPZ8		0.001	-	-	-	
Manganese						
MP1		ug/L	0.69	-	-	-
MP2	0.59		-	-	-	
MP4	0.71		-	-	-	
MP5	1.10		-	-	-	
MP7	3.40		-	-	-	
MP10	0.10		-	-	-	
MP11	1.30		-	-	-	
GPZ1	0.69		-	-	-	
GPZ5	0.65		-	-	-	
GPZ6	0.05		-	-	-	
GPZ8	5.70		-	-	-	
Molybdenum						
MP1	ug/L		0.005	-	-	-
MP2		0.005	-	-	-	
MP4		0.005	-	-	-	
MP5		0.013	-	-	-	
MP7		0.005	-	-	-	
MP10		0.008	-	-	-	
MP11		0.005	-	-	-	
GPZ1		0.022	-	-	-	
GPZ5		0.53	-	-	-	
GPZ6		0.017	-	-	-	
GPZ8		0.014	-	-	-	
Nickel						
MP1		ug/L	0.001	-	-	-
MP2	0.006		-	-	-	
MP4	0.008		-	-	-	
MP5	0.003		-	-	-	
MP7	0.002		-	-	-	
MP10	0.007		-	-	-	
MP11	0.001		-	-	-	
GPZ1	0.001		-	-	-	
GPZ5	0.001		-	-	-	
GPZ6	0.001		-	-	-	
GPZ8	0.007		-	-	-	
Lead						
MP1	ug/L		0.001	-	-	-
MP2		0.002	-	-	-	
MP4		0.003	-	-	-	
MP5		0.004	-	-	-	
MP7		0.004	-	-	-	
MP10		0.001	-	-	-	
MP11		0.001	-	-	-	
GPZ1		0.001	-	-	-	
GPZ5		0.001	-	-	-	
GPZ6		0.003	-	-	-	
GPZ8		0.001	-	-	-	
Selenium						
MP1			0.001	-	-	-
MP2	0.001		-	-	-	
MP4	0.001		-	-	-	
MP5	0.001		-	-	-	
MP7	0.001		-	-	-	

MP10	ug/L	0.001	-	-	-
MP11		0.001	-	-	-
GPZ1		0.001	-	-	-
GPZ5		0.001	-	-	-
GPZ6		0.001	-	-	-
GPZ8		0.001	-	-	-
Zinc					
MP1	ug/L	0.005	-	-	-
MP2		0.017	-	-	-
MP4		0.017	-	-	-
MP5		0.017	-	-	-
MP7		0.032	-	-	-
MP10		0.120	-	-	-
MP11		0.008	-	-	-
GPZ1		0.008	-	-	-
GPZ5		0.005	-	-	-
GPZ6		0.009	-	-	-
GPZ8		0.014	-	-	-
Mercury					
MP1	ug/L	0.0001	-	-	-
MP2		0.0001	-	-	-
MP4		0.0001	-	-	-
MP5		0.0003	-	-	-
MP7		0.0001	-	-	-
MP10		0.0001	-	-	-
MP11		0.0001	-	-	-
GPZ1		0.0001	-	-	-
GPZ5		0.0001	-	-	-
GPZ6		0.0001	-	-	-
GPZ8		0.0001	-	-	-
WAD Cyanide					
MP1	ug/L	-	0.005	-	-
MP2		-	0.005	-	-
MP4		-	0.005	-	-
MP5		-	0.005	-	-
MP7		-	0.0005	-	-
MP10		0.0005	-	-	-
MP11		0.0005	-	-	-
GPZ1		-	0.005	-	-
GPZ5		0.0005	-	-	-
GPZ6		-	0.005	-	-
GPZ8		-	0.005	-	-
Calcium					
MP1	mg/L	35	24	37	-
MP2		7.4	6.4	6.1	-
MP4		13	12.0	12.0	-
MP5		58	56	58	-
MP7		430	460	400	-
MP10		300	380	320	-
MP11		92	84	98	-
GPZ1		65	75	68	-
GPZ5		19	24	19	-
GPZ6		16	13	15	-
GPZ8		160	140	160	-
Magnesium					
MP1	mg/L	32	25	37	-
MP2		6.4	6.1	5.8	-
MP4		9	9.2	9.5	-
MP5		10	10	10.0	-
MP7		170	200	160	-
MP10		220	270	230	-
MP11		6.1	15.0	7.5	-
GPZ1		29	25	33	-
GPZ5		16	15	19	-
GPZ6		12	8	13	-
GPZ8		92	89	91	-
Ammonia as N					
MP1	mg/L	0.01	-	-	-
MP2		0.02	-	-	-
MP4		0.01	-	-	-
MP5		0.18	-	-	-
MP7		0.05	-	-	-
MP10		0.01	-	-	-
MP11		0.14	-	-	-
GPZ1		0.08	-	-	-
GPZ5		0.19	-	-	-
GPZ6		0.02	-	-	-
GPZ8		0.84	-	-	-
Nitrate as N					
MP1	mg/L	0.05	-	-	-
MP2		0.05	-	-	-
MP4		0.05	-	-	-
MP5		0.05	-	-	-
MP7		0.05	-	-	-
MP10		0.08	-	-	-
MP11		0.05	-	-	-
GPZ1		0.05	-	-	-
GPZ5		0.05	-	-	-
GPZ6		2.8	-	-	-

GPZ8		0.05		-	-
Phosphorus as P					
MP1	mg/L	0.05	-	-	-
MP2		0.05	-	-	-
MP4		0.05	-	-	-
MP5		0.05	-	-	-
MP7		0.05	-	-	-
MP10		0.06	-	-	-
MP11		0.05	-	-	-
GPZ1		0.82	-	-	-
GPZ5		0.19	-	-	-
GPZ6		0.40	-	-	-
GPZ8		0.05	-	-	-

APPENDIX 3

Approved CIF-Funded Projects since CIF Inception

Project Name	Total Approved
Bungonia: Sustaining the present through the past	\$8,000
Marulan Community Hall Upgrade	\$2,500
Marulan School Projects Room	\$15,000
Restoration of historical culvert	\$12,010
Computer hardware for archiving and cataloguing	\$2,500
Meridian mosaic installation	\$2,000
Tallong Memorial Hall Refurbishment	\$13,318
Marulan Road Safety	\$1,770
Towrang Hall Floor Refurbishment	\$14,230
Extension to GMC Road Safety Day	\$2,000
Insectivorous Bat Flight Centre	\$15,912
Increase in funds for GMC project - Road Safety	\$2,000
Thermal Imaging Camera	\$1,890
Tallong Community Memorial Walk	\$8,323
Tallong Hall project	\$5,133
Toilet Block for RFS	\$15,790
Community Sign at Towrang	\$11,923
Local Schools Co creating a sustainable future	\$4,000
Bungonia Community Engagement Program	\$4,500
Marulan Highway Signage	\$8,190
Promotions for Australia Day Committee	\$2,613
Muulii Murra (beautiful place)	\$2,800
MHS Archive & Research Facility	\$15,862
Marulan Public School Playground Upgrade	\$ 15,000 (funded in 2019, in progress as of October 2020)
Tallong Public School Playground Upgrade	\$ 15,000 (funded in 2019)
Marulan RFS - Training Room Extension	\$ 10,000 (funded in 2019)
Big Hill RFS - Thermal Imaging Camera	\$ 2,403 (funded in 2019)

Project Name	Total Approved
Tallong Community Focus Group – Defibrillator	\$ 2,572 (funded in 2019)
Marulan Kite Festival	\$3,000 (funded in 2020, however the event was cancelled)
Marulan Pony Club	\$1,500 (funded in 2020)
Goulburn & District Show Jumping Club	\$500 (funded in 2020)
Tallong Apple Festival	\$2,000 (funded in 2020)
Marulan Christmas Carols	\$3,500 (funded in 2020)
Goulburn Hockey Club	\$3,000 (funded in 2020)
Goulburn Cricket	\$3,000 (funded in 2020)
Marulan Soccer Club	\$5,000 (funded in 2020)
Goulburn Rugby	\$3,000 (funded in 2020)
Mayoral Charity Golf Day	\$5,000 (funded in 2020)
Goulburn Australia Day BBQ	\$1,000 (funded in 2020)
Tallong Public School Father’s Day	\$600 (funded in 2020)
Lion’s Club BBQ	\$500 (funded in 2020)
Marulan Australia Day BBQ	\$1,500 (funded in 2020)
Goulburn Mulwaree Council Australia Day BBQ	\$500 (funded in 2021)
Gunning Campdraft	\$500 (funded in 2021)
Towrang Valley Progress Assoc Australia Day BBQ	\$500 (funded in 2021)
Goulburn Agriculture, Pastoral and Horticultural Society	\$2,000 (funded in 2021)
Marulan Football Club	\$3,500 (funded in 2021)
Goulburn & District Showjumping Competition	\$1,000 (funded in 2021)
Tallong Apple Day Festival	\$900 (funded in 2022)
Marulan Football Club	\$500 (funded in 2022)
Tallong Public School P&C	\$900 (funded in 2022)
Cystic Fibrosis Goulburn	\$2000 (funded in 2022)
Goulburn and District Show jumping Competition	\$1000 (funded in 2022)
Convoy for Kids	\$500 (funded in 2022)
Goulburn Mayoral Charity Golf Day	\$5000 (funded in 2022)