

Cleary Bros (Bombo) Pty Ltd

ABN: 28 000 157 808



**CLEARY BROS**

# Albion Park Quarry Extraction Area Stage 7 Extension

## Noise and Blasting Assessment

Prepared by

**SLR Consulting Australia Pty Ltd**



**February 2022**

**Specialist Consultant Studies Compendium  
Part 2a**

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ABN: 28 000 157 808

# Albion Park Quarry Extraction Area Stage 7 Extension

## Noise and Blasting Assessment

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**February 2022**

Addendum: The Noise and Blasting Assessment identifies that Cleary Bros were continuing discussions with the owners of “Figtree Hill” regarding Project-related impacts, and an agreement had not been reached at the time the assessment was finalised. As identified in Section 2.5 of the EIS, a negotiated agreement has since been finalised between Cleary Bros and the owners of “Figtree Hill”. As such, the “Figtree Hill” property is now considered Project-related for the purposes of this assessment. Under that agreement, the owners have agreed to accept Project-related impacts to the extent identified in the Noise and Blasting Assessment.

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- Appendix C Low-Frequency Noise Analysis
- Appendix D Historic Blast Emissions Levels
- Appendix E Blasting Site Laws



## **Executive Summary**

### **Overview**

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Cleary Bros (Bombo) Pty Ltd to undertake a noise and blasting impact assessment of the proposed Stage 7 Extension to the Albion Park Quarry Extraction Area. This assessment has been prepared to accompany the Environmental Impact Statement (EIS) for the Project.

This report summarises the results of ambient noise measurements undertaken in the area and assesses the potential operational noise and blasting impacts associated with the Project.

If approved, the Stage 7 Extension area would secure access to a long-term hard rock resource that would provide a range of high-quality aggregates, armour rock, and pavement products for use in the Illawarra and Greater Sydney Regions. The annual production rates of the Quarry are not proposed to change from those currently approved, and no changes to the existing production area and off site truck movements are proposed. Operating hours for extraction activities within the Project Area would be 7:00am to 5:30pm Monday to Friday, and 7:00am to 1:00pm Saturday, consistent with those of the existing approved extraction area.

The primary sources of noise within the Project Area include:

- trucks (articulated and non-articulated haul trucks, water truck);
- earthmoving equipment (excavators, front-end loaders, dozers, scrapers, grader);
- blasthole drill rig; and
- mobile crushing and screening equipment.

The nearest noise sensitive receivers are generally rural-residential properties located to the north and east of the Project Area. Suburban residential areas of Shell Cove West are located 1.1 km to the east and the Shellharbour Anglican College located 1.4 km to the east. Greenmeadows Estate residential area is located approximately 1.4km to the northwest of the Project Area, near the entrance to the Albion Park Quarry processing area (not part of the Project Area).

The nearest sensitive receivers are located on the "Figtree Hill" property and are between 250m to 320m to the northeast of the Project Area. Cleary Bros is continuing discussions with the owners of "Figtree Hill" regarding the predicted noise levels throughout the Project life and the impacts at the residences on the "Figtree Hill" property. An agreement has not yet been reached at the time of submitting the Development Application and EIS, however, Cleary Bros is continuing to discuss matters in good faith with the owners of "Figtree Hill" in order to reach a negotiated agreement.

## Noise

Unattended ambient noise monitoring was undertaken during October 2020 at five locations representative of the nearest receivers. Further noise monitoring was undertaken in the Shell Cove West area in March 2021. The existing noise environment at the nearest noise sensitive receivers is generally dominated by road traffic from the Princes Highway and East West Link. The measured noise levels have been used to determine the existing noise environment and to set Project Noise Trigger Levels (PNTLs) with reference to the Noise Policy for Industry (NPfI).

A Soundplan noise model of the Project Area has been developed to assess noise impacts from extraction in the remaining Stage 5/6 areas and proposed Stage 7a through to 7d. The modelled activity scenarios include typical extraction and processing operations plus the following short term activities.

- Amenity barrier works
- Vegetation mulching
- Soil stripping
- Drilling near surface

Model results from the Stage 5/6 extraction activity were compared against monitoring of current operations and historical noise compliance monitoring to verify the noise model is providing a representative estimate of the Project Area noise emissions.

Predicted noise levels during remaining extraction and processing operations would be compliant with the PNTLs at all receivers during Stage 5/6.

When implementing the standard noise mitigation and management measures, predicted noise levels during short term worst-case operation of the D11 dozer at the surface during amenity barrier works and soil stripping, and operation of the mulcher for vegetation mulching, would be less than the PNTLs at all receivers except the three "Figtree Hill" residence locations during Stages 7a through to 7d. Similarly, blast hole drilling near the surface would also be less than the PNTLs at all receivers except the three "Figtree Hill" residence locations during Stages 7a to 7d.

Results for extraction and processing during Stage 7 identified that for the "Figtree Hill" residences, when the mobile primary crusher and screen are positioned on the floor of the first bench below the natural surface, noise levels above the PNTL can occur when the crusher and screen are in line of sight to the "Figtree Hill" residences. This would occur in the southeastern corner of Stages 7a, 7b and 7c and northeastern corner of Stage 7d. In lieu of a negotiated agreement with the owners of "Figtree Hill", monitoring of noise levels would be undertaken when primary crushing is undertaken on the floor of the first bench below the natural surface to ensure the PNTLs are not exceeded. In the event an exceedance is identified, the primary crusher would be relocated to an area where compliance is achieved.

Noise management and mitigation measures include:

- Selection of quietest plant available and/or noise attenuation kits on surface operating plant (Dozer, Mulcher, Drill Rig) where practicable.

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- Noise monitoring of the primary crusher and screen when it is working on the first bench to ensure noise levels do not exceed the PNTL, and relocating the equipment, if required, to a lower bench or shielded location as required.

In lieu of a negotiated agreement with the owners of “Figtree Hill”, additional noise mitigation and management measures would be implemented when undertaking specific short term activities, including screening of the drill rig when drilling near the surface, and restricting amenity barrier works, vegetation mulching, and soil stripping activities to periods of favourable weather conditions. The residual impacts would be managed through the NSW Government’s Voluntary Land Acquisition and Mitigation Policy.

Noise levels with the implementation of these additional mitigation measures are predicted to fall within the range of day time impacts greater than 5dB(A) above the NPfI criteria but less than the NPfI amenity noise level of 50 dB(A) for rural residential receivers during the day time period. This characterises the impact as “moderate”.

Predicted residual noise impacts are less than the PNTLs for all other sensitive receptors, and as such the requirements of the VLAMP are not triggered for those properties.

**Blasting**

Cleary Bros has typically blasted between 12 and 35 times each year fragmenting between approximately 10,000 tonnes and 100,000 tonnes during each blast.

A detailed review of the historic blast designs and corresponding blast emissions (ground vibration and airblast) monitoring data during blasts initiated within Stages 1 to 4 and more recently Stages 5 and 6 has been undertaken to inform blast emissions site laws for the assessment of Stage 7.

Near-field ground vibration and airblast site laws have been specifically developed for the current extraction area to assist in designing the blasts so that the peak particle component velocity and airblast levels for blasting do not exceed 200mm/s or 135dB Linear at any point on the boundary of the “Figtree Hill” property. These limits were established based on a study of vibration impacts on dairy cattle and the 135dB Linear limit has been adopted in order to limit potential health impacts to persons.

Blast design procedures would be implemented with the objective of maintaining the levels of ground vibration at the closest residences below 5 mm/s and levels of airblast at the closest residences to below 115dB Linear and protecting people and/or stock at the external property boundaries.

Prediction of the far and near-field ground vibration and airblast levels would be conducted prior to each blast by the Blasting Engineer to ensure the blast design would achieve compliance with the relevant criteria at the closest receiver location. The ground vibration and airblast site laws would continue to be updated on a regular basis to reflect the blast results obtained.

Based on the current near-field airblast site law, conventional blasting during Stage 7 would be able to occur up to approximately 20m of the external property boundaries. This buffer would be reviewed in response to future near-field blast emission monitoring and blasting techniques, which may increase or decrease the required offset to achieve the nominated blast emissions criteria and safety limits. Non-explosive rock fracturing techniques may need to be used to allow extraction of the hard rock resource in closer proximity to external property boundaries, if the then current near-field site laws preclude the use of conventional explosive blasting techniques.

The impacts of vibration from blasting at the closest residential receivers and close to the external property boundaries would be mitigated in line with the control of the MIC associated with the control of airblast levels, based on the then current combined and near-field vibration site laws for the Stage 7 extension.

Flyrock management measures would continue to be implemented in accordance with the Blast Management Plan. The allowable MICs to comply with the nominated ground vibration and airblast safety limits at the "Figtree Hill" property boundary would progressively reduce as blasting approaches the external property boundaries, thereby further reducing the likelihood of flyrock.

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## 1. INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Cleary Bros (Bombo) Pty Ltd to undertake a noise and blasting impact assessment of the proposed Stage 7 Extension to the Albion Park Quarry Extraction Area (the Project). This assessment has been prepared to accompany the Environmental Impact Statement (EIS) for the Project.

This report summarises the results of ambient noise measurements undertaken in the area and assesses the potential operational noise and blasting impacts associated with the Project.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

### 1.1 PROJECT DESCRIPTION

The Albion Park Quarry is located in Croom, NSW. The Quarry is south of Albion Park Rail and the East West Link, and west of Flinders and Shell Cove West. The Holcim Quarry and Boral Dunmore Quarry are located to the west and south, respectively.

The Quarry location and surrounding land ownership is shown in **Figure 1**, and the proposed Stage 7 Extension Project Area is shown in **Figure 2**.

The Project Area covers Stages 1 to 6 of the current approved extraction area and the proposed Stage 7 extension area – see **Figure 2**. It is proposed that Stage 7 is developed in four general stages, namely Stages 7a to 7d. Stages 1 to 6 are included in the Project Area as a quantity of rock remains to be extracted in these stages and greater efficiencies would be achieved by extracting the rock remaining in Stages 4, 5 and 6 concurrently with the rock extracted in Stage 7. Some recoverable rock also remains to be extracted in Stage 2. Furthermore, some of the overburden and soil from Stages 7a and 7b would be used for the rehabilitation of sections of Stages 1 to 4.

It is noted that extraction in Stages 7c and 7d would initially be confined to the western side of both substages with extraction concluding in the area referred to as the “Eastern Rim” – see **Figure 3**. This would be the final area extracted in order to minimise views of extraction operations from the east, while still progressing this area generally from south to north to reduce visual and noise impacts to residences on “Figtree Hill”.

Stages 1 to 6 are located wholly within Lot 1 DP858245. Stage 7 is located immediately east of Stages 1 to 6 and extends onto the adjoining Lot 7 DP3709. Both lots covering the Project Area are owned by Bridon Pty Ltd, an associated entity of Cleary Bros (Bombo) Pty Ltd.

Figure 1 Quarry Location and Land Ownership

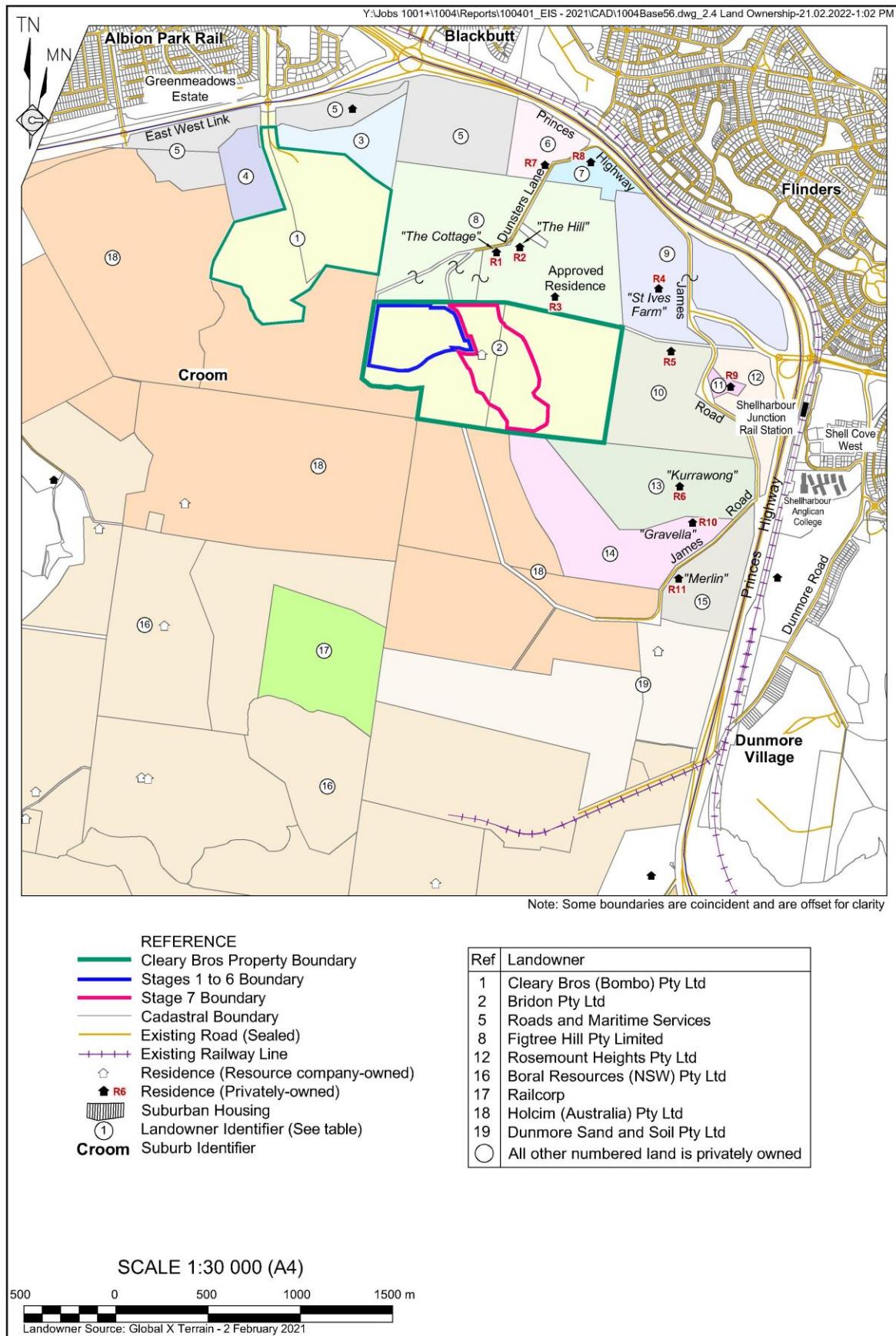
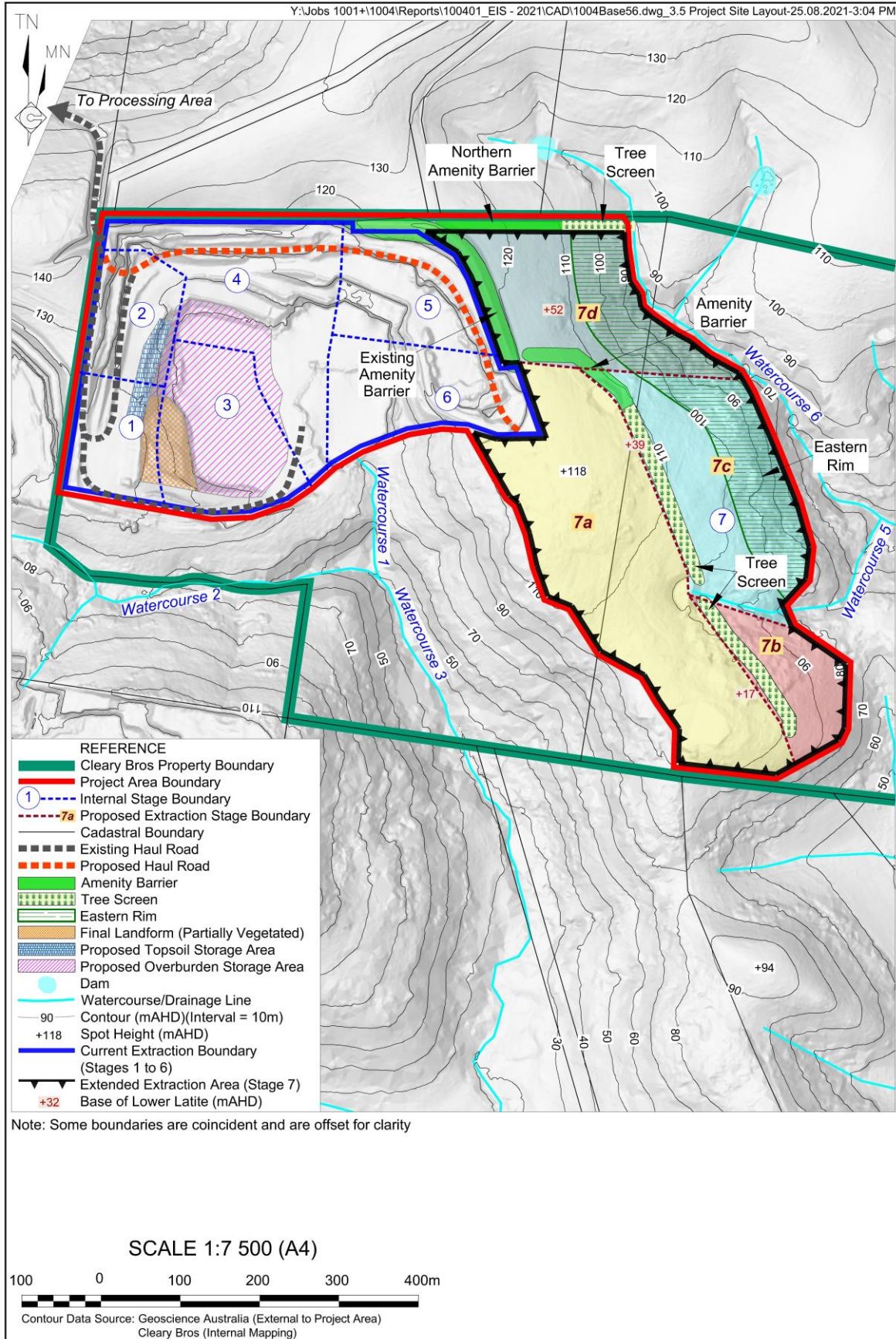


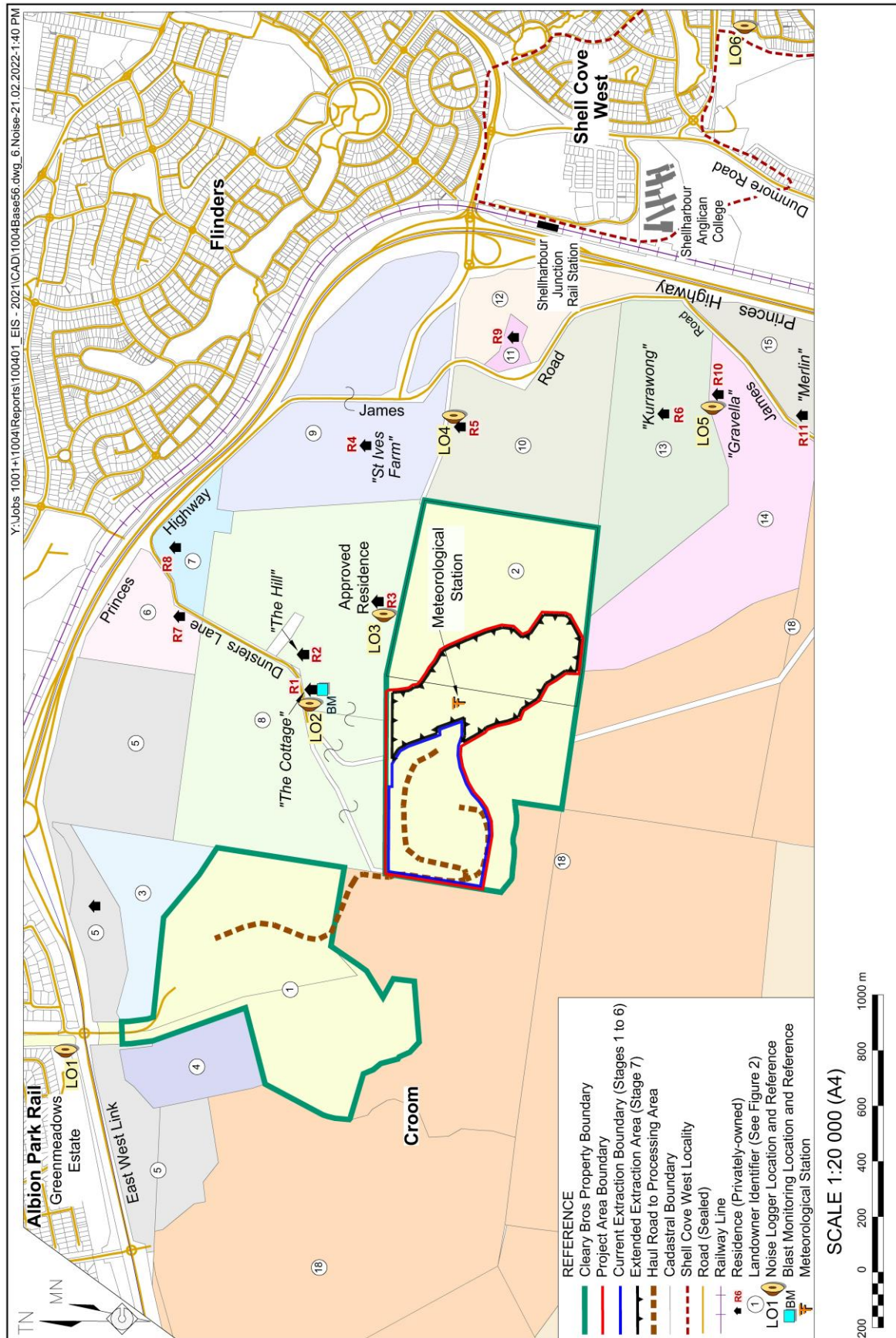
Figure 2 Stage 7 Extension Project Area





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 Albion Park Quarry Extraction Area Stage 7 Extension

Figure 3 Nearest Noise Sensitive Receivers and Ambient Noise Monitoring Locations



The western and northern boundaries of the Project Area are coincident with the boundary of Lot 1 DP 858245. The remaining boundaries are coincident with the currently approved southern boundary of Stages 1, 3 and 6 together with the proposed boundary of Stage 7. The boundaries of Stage 7 are aligned as follows.

- The eastern boundary of Stage 7 is generally coincident with the boundary of the RU1 zone boundary with the exclusion of a 250m section of a first and second order watercourse (covering 0.8ha) that traverses that zone.
- The southeastern boundary has been adjusted to exclude a 0.15ha area of higher biodiversity value.
- The southern boundary is set back 10m from the southern boundary of Lot 7 DP 3709.
- The western boundary of Stage 7 follows the RU1 Zone boundary except for:
  - the inclusion of a 350m section (covering 1.25ha) currently zoned C2 where remnant native vegetation is largely absent; and
  - the exclusion of a 200m section (covering 1ha) currently zoned RU1 in the southwestern corner of the extraction area due to its higher biodiversity value.

The 250m internal haul road between the Project Area and the processing area is located in the northern part of Lot 2 DP858245 (owned by Holcim (Australia) Pty Ltd) and is not within the Project Area.

The area of overall disturbance would be confined to the current approved extraction area (Stages 1 to 6) and the proposed Stage 7, as shown in **Figure 2**. Disturbance areas associated with the ongoing activities within Stages 1 to 6 cover approximately 16ha and 20ha within Stage 7.

The Stage 7 Extension area secures access to a long-term hard rock resource that would provide a range of high-quality aggregates, armour rock, and pavement products for use in the Illawarra and Greater Sydney Regions. The annual production rates of the Quarry are not proposed to change from those currently approved, and no changes to the existing production area and off site truck movements are proposed. Operating hours for extraction activities within the Project Area would be 7:00am to 5:30pm Monday to Friday, and 7:00am to 1:00pm Saturday, consistent with those of the existing approved extraction area.

The primary sources of noise within the Project Area include:

- trucks (articulated and non-articulated haul trucks, water truck);
- earthmoving equipment (excavators, front-end loaders, dozers, scrapers, grader);
- blasthole drill rig; and
- mobile crushing and screening equipment.

The main noise-generating activities assessed relate to the individual activities of amenity barrier construction or works (Stage 7a only), vegetation mulching and soil stripping and the combined activity of extraction and in-pit crushing and screening.

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The principal change to the current operations within the Project Area would be the introduction of a primary jaw crusher and screen which would operate full time within the extraction area within the proposed operating hours.

## 1.2 NEAREST RECEIVERS

The nearest noise sensitive receivers are generally rural residential properties located to the north and east of the Project Area. Suburban residential areas of Shell Cove West are located 1.1 km to the east and the Shellharbour Anglican College located 1.4 km to the east. Greenmeadows Estate residential area is located approximately 1.4km to the northwest of the Project Area, near the entrance to the Albion Park Quarry processing area (not part of the Project Area). The nearest noise sensitive receivers are shown in **Figure 3** and detailed in **Table 1** (with reference to **Figure 1**). Cleary Bros is continuing discussions with the owners of "Figtree Hill" regarding the predicted noise levels throughout the Project life and the impacts at the residences on the "Figtree Hill" property. An agreement has not yet been reached at the time of submitting the Development Application and EIS, however, Cleary Bros is continuing to discuss matters in good faith with the owners of "Figtree Hill" in order to reach a negotiated agreement.

**Table 1 Nearest Noise Sensitive Receivers**

Receiver	Details	Distance from Project Area Boundary (m)	Direction relative to the Project Area
"Figtree Hill" "The Cottage" – R1	Rural residential dwelling off Dunsters Lane on Property 8 owned by Figtree Hill Pty Ltd	260	North
"Figtree Hill" "The Hill" – R2	Rural residential dwelling off Dunsters Lane on Property 8 owned by Figtree Hill Pty Ltd	320	Northeast
"Figtree Hill" "Approved Residence" – R3	Location of approved rural residential dwelling off Dunsters Lane on Property 8 owned by Figtree Hill Pty Ltd	250	Northeast
R4	Rural residential dwelling "St Ives Farm" off James Road on Property 9	780	East
R5	Rural residential dwelling "Deer Farm" off James Road on Property 10	710	East
R6	Rural residential dwelling "Kurrawong" off James Road on Property 13	790	Southeast
R7	Rural residential dwelling off Dunsters Lane on Property 6	770	Northeast
R8	Rural residential dwelling off Dunsters Lane on Property 7	900	Northeast
R9	Rural residential dwelling off James Road on Property 11	980	East
R10	Rural residential dwelling "Gravella" off James Road on Property 14	950	Southeast
R11	Rural residential dwelling "Merlin" off James Road on Property 15	1 080	Southeast
Shell Cove West	This receiver area includes the southwestern part of the suburb of Shell Cove, as well as the recent subdivisions in the north of the suburb of Dunmore.	1 100+	East
Shellharbour Anglican College	Anglican school at 1 Piper Drive, Dunmore	1 400	East
Greenmeadows Estate	Residential area to the north of East West Link in Albion Park Rail	1 370+	Northwest

### 1.3 EXISTING OPERATIONS

Cleary Bros have been operating the current extraction area, i.e. Stages 1 to 6, since 2007 with the remaining resources likely to be depleted within the next 3 to 5 years. The noise assessment for Stages 1 to 6 and the relevant noise limits in the current development consent (LEC Consent No. 10639012005-MOD 3) were established in accordance with the Industrial Noise Policy. **Table 2** presents the current noise limits set out in Schedule 4, Condition 4 of the current development consent.

**Table 2 Current Noise Limits -Stages 1 to 6**

Receiver Locations	Noise Limits dB(A) $L_{Aeq}$ (15 minute)		
	<b>Stages 1-2</b>	<b>Stages 3-4</b>	<b>Stages 5-6</b>
'The Hill' residence (Dunster premises)	35	38	35
'The Cottage' residence (Dunster premises)	35	38	35
Approved rural workers dwelling (Dunster premises)	35	38	35
Greenmeadows Residential Estate	41	41	41

Source: Schedule 4, Condition 4 of Development Consent No. 10639 of 2005-MOD 3

## 2. EXISTING ENVIRONMENT

The existing noise environment at the nearest noise sensitive receivers is generally dominated by road traffic from the Princes Highway and East West Link. The Albion Park Rail Bypass opened in 2021 and runs parallel to the East West Link past Greenmeadows Estate and the Albion Park Quarry entrance.

### 2.1 EXISTING AMBIENT NOISE MONITORING

Unattended ambient noise monitoring was undertaken during October 2020 (L01 to L05) and March 2021 (L06) at locations representative of the nearest receivers. The measured noise levels have been used to determine the existing noise environment and to set the criteria used to assess the potential impacts from the Project.

The monitoring equipment was positioned to measure existing noise levels that are representative of receivers potentially most affected by the Project, within constraints such as accessibility, security and landowner permission.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and equipment calibration was confirmed before and after each measurement.

The measured data has been processed to exclude noise from extraneous events and periods affected by adverse weather conditions, such as strong wind or rain, to establish representative existing noise levels at the nearest noise sensitive receivers.

The noise monitoring locations are shown in **Figure 3** and the results are summarised in **Table 3**. Details of each monitoring location together with graphs of the measured daily noise levels are provided in **Appendix B**.

**Table 3 Summary of Unattended Ambient Noise Monitoring Results**

ID	Location	Measured Noise Levels dB(A)					
		Background Noise (RBL)			Average Noise (LAeq)		
		Day	Evening	Night	Day	Evening	Night
L01	Noise logger located adjacent to the Greenmeadows Estate on Cleary Bros property	40	36	30	51	47	43
L02	Noise logger located adjacent to "Figtree Hill" "The Cottage" – R1	36	35	28	48	43	44
L03	Noise logger located in a paddock at the approximate location of the "Figtree Hill" "Approved Residence" – R3	36	34	27	49	46	46
L04	Noise logger located adjacent to residence R5	45	40	30	52	49	47
L05	Noise logger located adjacent to residence R9	48	44	34	56	53	51
L06	Noise logger located adjacent to residence at 5 Moonah Way, Shell Cove West	37	38	33	49	46	47

Note 1: The assessment periods are the daytime which is 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm on Sundays and public holidays, the evening which is 6:00 pm to 10:00 pm, and the night-time which is 10:00 pm to 7:00 am on Monday to Saturday and 10:00 pm to 8:00 am on Sunday and public holidays. See the Noise Policy for Industry (EPA, 2017).

## 2.2 ATTENDED NOISE MEASUREMENTS

Short-term attended noise monitoring was also completed at each monitoring location. The attended measurements allow the contributions of the various noise sources at each location to be determined. The attended observations are summarised in **Table 4**. Detailed observations from the attended measurements are provided in **Appendix B**.

**Table 4 Summary of Attended Observations**

Measurement Location	Summary of Observations
L01 – Greenmeadows	Background noise during the measurement was a combination of road traffic noise from the East West Link and equipment noise from Albion Park Rail Bypass construction. Birds, aircraft and a helicopter also contributed to the LAeq at this location during the measurement. The Albion Park Quarry was not audible at this location during the period of measurement.
L02 – “Figtree Hill” “The Cottage” – R1	Background noise during the measurement was primarily road traffic noise from the Princes Highway and East West Link. Birds, livestock, aircraft and wind noise in vegetation also contributed to the LAeq at this location during the measurement. The existing Albion Park Quarry extraction area equipment was intermittently audible during the period of measurement.
L03 – “Figtree Hill” “Approved Residence” – R3	Background noise during the measurement was primarily road traffic noise from the Princes Highway. Birds, livestock and wind noise in vegetation also contributed to the LAeq at this location during the measurement. The existing Albion Park Quarry extraction area equipment was intermittently audible during the period of measurement.
L04 –Residence R5	Background noise during the measurement was road traffic noise from the Princes Highway. Birds, livestock and wind noise in vegetation also contributed to the LAeq at this location during the measurement. The Albion Park Quarry was not audible at this location during the period of measurement.
L05 – Residence R9	Background noise during the measurement was road traffic noise from the Princes Highway. Birds, livestock and wind noise in vegetation also contributed to the LAeq at this location during the measurement. The Albion Park Quarry was not audible at this location during the period of measurement.
L06 – Shell Cove West	Background noise during the measurement was road traffic noise from Princes Highway. Road traffic on Dunmore Road and Bass Point Quarry Road, along with residential noise also contributed to the LAeq at this location during the measurement. The Albion Park Quarry was not audible at this location during the measurement.

The attended measurements were generally found to be consistent with the results of the unattended noise monitoring and show that existing noise levels are typically dominated by road traffic noise from the surrounding road network.

## 2.3 WEATHER CONDITIONS

Certain weather conditions can increase noise levels by focusing noise at receivers. Noise-enhancing weather conditions can occur where wind blows from a noise source to the receiver, or when temperature inversions occur. Conversely, winds blowing from a receiver towards a noise source can reduce noise levels.

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The Noise Policy for Industry (NPfI) (EPA, 2017) defines ‘standard’ and ‘noise-enhancing’ weather conditions as shown in **Table 5**. Noise-enhancing weather should be included in the assessment where they occur for more than 30% of the daytime, evening or night-time period in any season.

**Table 5 Standard and Noise-Enhancing Weather Conditions**

Weather Conditions	Meteorological Parameters
Standard	Daytime/evening/night-time: stability categories A–D with wind speed up to 0.5m/s
Noise-enhancing	Daytime/evening: stability categories A–D with light winds up to 3m/s Night-time: stability categories A–D with light winds up to 3m/s and/or stability category F with winds up to 2m/s

To determine the occurrence of noise-enhancing weather conditions, an analysis of meteorological data collected at the Bureau of Meteorology weather station at Albion Park (site # 68241) between 2016 and 2020 was undertaken utilising the NSW EPA Noise enhancing wind analysis program (NEWA). Results of the analysis for the daytime period relevant to extraction area operations are presented in **Figure 4** and **Table 6**.

**Table 6 Occurrence of Noise Enhancing Winds for Daytime Period**

Wind Direction	Percentage of Occurrence of Noise-Enhancing Winds (0.5-3m/s) (Winds Blowing From)							
	North	North East	East	South East	South	South West	West	North West
Summer	4.2	6.9	7.9	5.3	3.7	4.1	4	3.4
Autumn	6.9	8.9	10.3	7.1	6.8	10.3	9.5	6.2
Winter	5.8	7.9	8.1	5.5	6	11.7	12.1	6.9
Spring	4.5	6.3	7	4.4	3.2	4.2	3.9	3.4

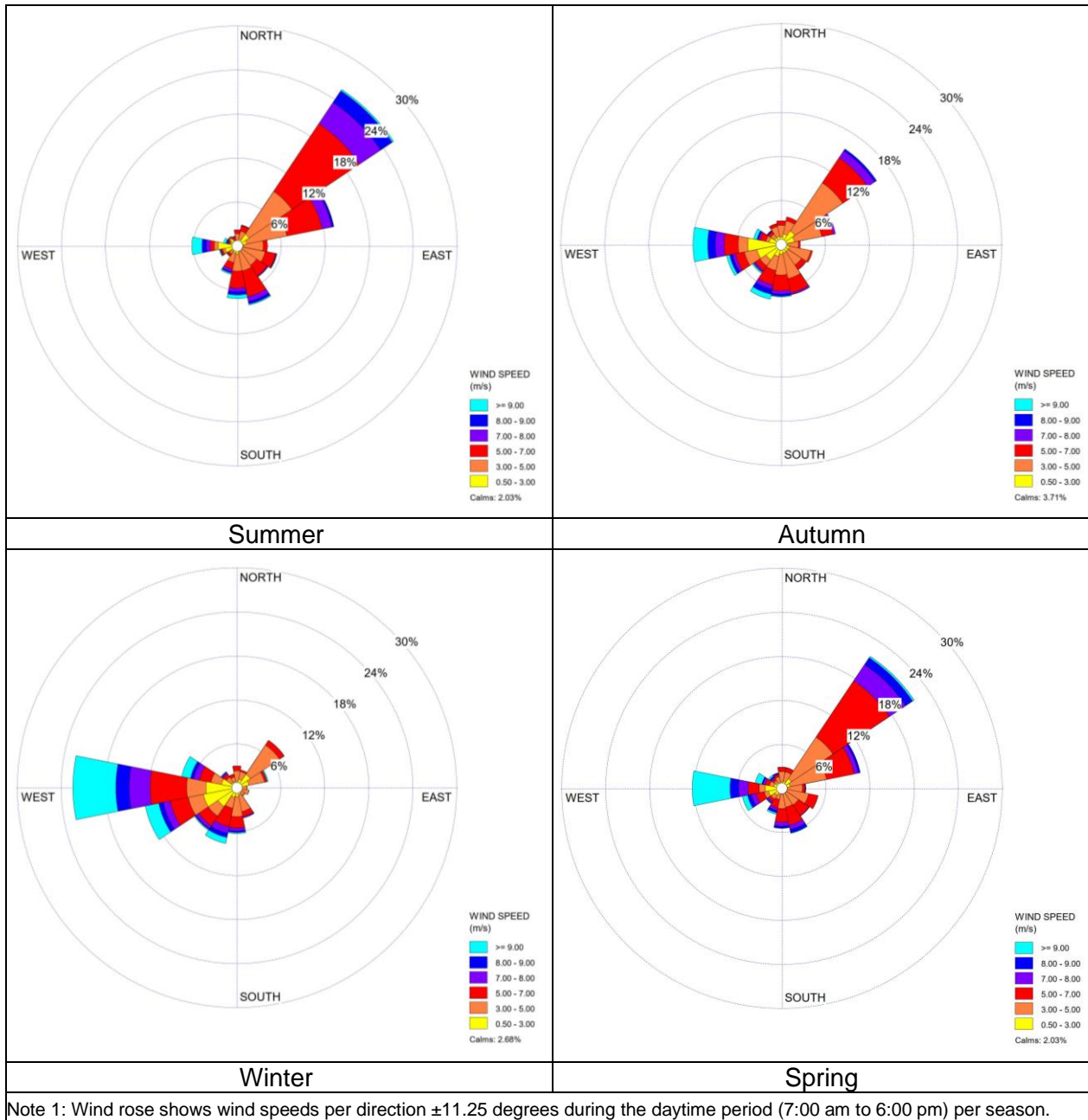
Note 1: Noise-enhancing winds (0.5-3m/s) were calculated per direction  $\pm 45$  degrees during the daytime period (7:00 am to 6:00 pm) for each season.

The weather analysis shows that noise-enhancing winds (0.5-3m/s) are not a significant feature (>30% occurrence) of the Project Area during the daytime period when extraction operations occur.

Winds stronger than 3m/s occur regularly in the Project Area, however these are not considered to be noise-enhancing under the NPfI as these stronger winds typically increase ambient noise from wind in trees and vegetation, and the wind noise itself, typically masking any increase in industrial noise levels due to the wind.

Of note are strong northeast winds which have the potential to reduce potential noise impacts at the nearest receivers (“Figtree Hill” residences R1, R2, R3) to the northeast of the Project Area during summer, autumn and spring.

Figure 4 Wind Rose (Winds Blowing From) – Daytime Period





### 3. APPROVED NOISE LIMITS

The current Development Consent for the Albion Park Quarry (10639/2005-Mod 3) was most recently modified in 2017 and includes noise limits for the operation of the Quarry. The consented noise limits are reproduced in **Table 7** and were developed based on the now superseded Industrial Noise Policy (EPA, 2000) using noise monitoring results from 2001.

**Table 7 Development Consent Noise Limits**

Receiver Location	Noise Limits dB(A) LAeq (15minute)		
	Stage 1-2	Stage 3-4	Stage 5-6
'The Cottage' residence ("Figtree Hill" premises)	35	38	35
'The Hill' residence ("Figtree Hill" premises)	35	38	35
Approved rural workers dwelling ("Figtree Hill" premises)	35	38	35
Greenmeadows Residential Estate	41	41	41

The following Notes were also applicable with these conditions:

1. *Staging as depicted in Figure 3.5 of the EIS prepared by Perram and Partners, dated October 2003.*
2. *Receiver locations nominated in Table 5.12 of the report prepared by Richard Heggie and Associates Report No. 30-1079R1 titled 'Noise and Blasting Impact Assessment – Cleary Bros Albion Park Quarry' (13 December 2002). At the time of the DA the above were the nearest affected residences.*
3. *The receiver locations and noise limits in the above table may be varied in the instance that negotiated agreements are entered into by the licensee and affected residents/occupiers or if existing agreements become void, or the nearest receiver location changes due to urban encroachment. These limits may be subject to change with an EPL variation.*
4. *Noise from the premises is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in Table 1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise level where applicable.*
5. *The noise emission limits in Table 1 apply under meteorological conditions of:*
  - *Wind speed up to 0.5m/s in any direction at 10 metres above ground level; or*
  - *Temperature gradient (environmental lapse rate) conditions of less than or equal to 0°C/100m (lapse).*

## 4. SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project (SSD 10369) in relation to noise and blasting are reproduced in **Table 8** together with the sections of this report where each requirement is addressed.

**Table 8 Project SEARs (SSD-10369) Relevant to Noise and Blasting**

Key Issue	Requirement	Where Addressed in this Report
Noise and Blasting	A detailed assessment of the likely construction, operational and off- site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy	Operational noise criteria is discussed in Section 5 with modelling methodology in Section 6, and operational noise assessment in Section 7 Off-site transport noise is discussed in Section 5.2. Construction noise and vibration is discussed in Section 5.4 The Voluntary Land Acquisition and Mitigation Policy is discussed in Sections 5.3 and 7.6
Noise and Blasting	Proposed blasting hours, frequency and methods	Blast emissions limits and management are discussed in Section 8.1 and 8.2
Noise and Blasting	Detailed assessment of the likely blasting impacts of the development (including ground vibrations, overpressure, flyrock, visual and fumes/odour) on people, animals, buildings/structures, infrastructure and significant natural features, having regard to the relevant ANZEC guidelines	Blast emissions assessment, limits and management are discussed in Section 8

## 5. ASSESSMENT CRITERIA

### 5.1 INTRODUCTION

The Noise Policy for Industry (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW. The noise limits arising from the NPfI, referred to as “project noise trigger levels” (PNTLs), would be applicable for the entire Project Area, i.e. Stages 1 to 7. In lieu of an agreement with the owners of “Figtree Hill”, the VLAMP outlines the mechanism for the implementation of appropriate mitigation measures in the event the predicted noise levels exceed the PNTLs. Processes for the management of noise levels at the residences on “Figtree Hill” are discussed in Section 5.1.2.

#### 5.1.1 Industrial Noise Trigger Levels

The NPfI defines how to determine ‘trigger levels’ for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – one to account for ‘intrusive’ noise impacts and one to protect the ‘amenity’ of particular land uses:

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the  $L_{Aeq}$  noise level of the source, measured over a period of 15-minutes, does not exceed the representative background noise level by more than 5dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

For this assessment, the receivers surrounding the Project Area considered to be ‘rural’ as per the NPfI definitions, with the exception of the Greenmeadows Estate and Shell Cove West, which are considered to be ‘suburban’. The **amenity level** for rural and suburban receivers are the objective noise levels for total industrial noise at a receiver location. This level is also referred to in the Voluntary Land Acquisition and Mitigation Policy (refer Section 5.3) as the cumulative industrial noise level.

#### 5.1.2 Project Noise Trigger Levels

The trigger levels for industrial noise from the Project are summarised in **Table 9**. The PNTLs are the most stringent of the intrusiveness and amenity trigger level for each receiver and are highlighted in **Table 9**.

**Table 9 Project Noise Trigger Levels**

Receivers	Representative Noise Logger	Period	Amenity Noise Level	Measured Noise Level dB(A)		Project Noise Trigger Levels LAeq(15minute) dB(A)	
			LAeq (period)	RBL <sup>1</sup>	LAeq(period)	Intrusiveness	Amenity <sup>2,3</sup>
Greenmeadows Estate	L01	Daytime	55	40	51	<b>45</b>	53
"Figtree Hill" "The Cottage" (R1) & "The Hill" (R2)	L02	Daytime	50	36	48	<b>41</b>	48
"Figtree Hill" "Approved Residence" (R3)	L03	Daytime	50	36	49	<b>41</b>	48
R4, R5, R7, R8, R9	L04	Daytime	50	45	52	50	<b>48</b>
R6, R10, R11	L05	Daytime	50	48	56	53	<b>48</b>
Shell Cove West	L06	Daytime	55	37	49	<b>42</b>	53
Shellharbour Anglican College	n/a	When in use	45 <sup>4</sup>	n/a	n/a	n/a	<b>43<sup>4</sup></b>

Notes: Most stringent of the intrusiveness and amenity trigger level for each receiver are highlighted in **Bold**.

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have been reduced by 5dB, where appropriate, to give the Project amenity noise levels due to other sources of industrial noise being present in the area.

Note 3: The Project amenity noise levels have been converted to a 15-minute level by adding 3dB, in accordance with the NPfl.

Note 4: The criterion for educational receivers is specified as an internal noise level. As the noise model predicts external noise levels, it has been conservatively assumed that all school buildings have openable windows and external noise levels are therefore 10dB higher than the corresponding internal level, which is generally considered representative of windows being partially open for ventilation.

Where the predicted noise levels are less than or equal to the PNTLs shown in bold in **Table 9**, it is envisaged the PNTLs would become the approved noise limits in the development consent for the Project. Where the predicted noise levels are greater than the PNTLs shown in bold in **Table 9**, it is envisaged the NSW Government's Voluntary Land Acquisition and Mitigation Policy (VLAMP) would determine the approved noise limits in the development consent for the Project.

### 5.1.3 Modifying Factors

Sources of industrial noise can cause greater annoyance when they contain certain characteristics, such as tonality, intermittency or dominant low-frequency content. The NPfl applies modifying factors for the assessment of noise impacts. Tonal, low-frequency and intermittent noise modifying factors were considered in this assessment as shown in **Table 10**.

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Table 10 NPfl Modifying Factors

Factor	Assessment/Measurement	When to Apply	Correction <sup>1</sup>
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by the levels defined in the NPfl.	5dB <sup>2</sup>
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements	Measure/assess source contribution C and A weighted Leq,t levels over same time period. Correction to be applied where the C minus A level is 15dB or more and the level to which the thresholds defined in the NPfl are exceeded.	2 or 5dB <sup>2</sup>
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level	The source noise heard at the receiver varies by more than 5dB and the intermittent nature of the noise is clearly audible.	5dB <sup>3</sup>
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated.	Maximum correction of 10dB <sup>2</sup> (excluding duration correction)
Note 1: Corrections to be added to the measured or predicted levels.			
Note 2: Where a source emits tonal and low-frequency noise, only one 5dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160Hz.			
Note 3: Adjustment to be applied to night-time only.			

## 5.2 TRAFFIC ON SURROUNDING ROADS

The Project would not result in any additional traffic generation to and from the Quarry. As such, no increase in traffic noise on surrounding roads is expected.

Traffic noise has not been considered further in this assessment.

## 5.3 VOLUNTARY LAND ACQUISITION AND MITIGATION POLICY

The NSW Government's Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Department of Planning and Environment, 2018) provides guidance on the assessment of impacts from state significant extractive industry developments such as the Project. The policy provides a process under which mitigation or voluntary acquisition rights are applied.

The policy includes the NSW Government's interpretation of the significance of potential exceedances, presented in **Table 11**.

**Table 11 Voluntary Land Acquisition and Mitigation Policy**

Predicted Noise Exceeds NPfl Criteria By	And the Total Cumulative Industrial Noise Level is	Characterisation of Impacts	Potential Treatment
0-2dB(A) at all times	Not applicable.	Impacts are considered to be <b>negligible</b> .	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3-5dB(A) at all times	≤ NPfl amenity noise level, or greater than amenity noise level, but cumulative increase is ≤1dB.	Impacts are considered to be <b>marginal</b> .	Provide mechanical ventilation/ comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
3-5dB(A) at all times	Greater than NPfl amenity noise level, and cumulative increase is greater than 1dB.	Impacts are considered to be <b>moderate</b> .	As for marginal impacts but also upgraded facade elements like windows doors or roof insulation.
Day and evening >5dB(A)	≤ NPfl amenity noise level.	Impacts are considered to be <b>moderate</b> .	As for marginal impacts but also upgraded facade elements like windows doors or roof insulation.
Day and evening >5dB(A)	Greater than NPfl amenity noise level.	Impacts are considered to be <b>significant</b> .	Provide mitigation as for moderate impacts and triggers voluntary land acquisition provisions
Night >5dB(A)	Not Applicable	Impacts are considered to be <b>significant</b> .	Provide mitigation as for moderate impacts and triggers voluntary land acquisition provisions

Voluntary Land Acquisition rights are triggered when, even with the implementation of best practice management, the noise generated by the development would result in a significant impact as defined in **Table 11** at any residence on privately owned land. Additionally, if the noise generated would contribute to exceedance of the acceptable noise level plus 5dB(A) in Table 2.2 of the NPfl on more than 25% of any privately-owned land where there is an existing dwelling or an approved dwelling.

## 5.4 CONSTRUCTION NOISE AND VIBRATION

Construction noise and vibration is assessed and managed in accordance with the Interim Construction Noise Guideline (ICNG).

However, the ICNG states that noise from industrial sources (including quarrying, mining, and construction associated with quarrying and mining) is not covered by the ICNG, and is assessed in accordance with the Industrial Noise Policy (INP), which has since been superseded by the Noise Policy for Industry (NPfl).

As such, all works associated with the Project, including construction of the amenity barriers, are considered to be operational quarry works.

Therefore, no assessment of construction noise and vibration is required.

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## 6. OPERATIONAL NOISE MODELLING METHODOLOGY

The potential operational noise levels from the Project have been predicted to the surrounding receivers using CONCAWE industrial noise algorithm in SoundPLAN V8. The three-dimensional model includes ground topography, receiver locations, and representative noise sources within the Project Area.

The potential impacts have been determined by comparing the predicted noise levels to the PNTLs in a 15-minute assessment period.

### 6.1 OPERATIONAL NOISE SOURCES

A summary of the significant noise sources associated with the operation of the Project is provided in **Table 12**. The sound power levels sourced are from a combination of on-site measurements conducted in January 2021 in the existing extraction area, historical measurements from the Quarry, and SLR's noise measurement database.

**Table 12 Project Plant and Equipment**

Equipment Type <sup>1</sup>	Make & Model	Fleet Quantity	Utilisation within Project Area <sup>2</sup>	Main Function/Location	Sound Power Level (dB(A))
Excavator	Hitachi EX-1200-6 <sup>3</sup>	1	75%	In-pit material extraction	113
Dump truck	CAT 777D <sup>3</sup>	1	50%	Material haulage	115
Dump truck	CAT 773D & 773E <sup>3</sup>	4	50%	Material haulage	114
Water truck	CAT 773B <sup>3</sup>	1	25%	Dust suppression	114
Excavator and hammer	CAT 330 <sup>3</sup>	1	50%	In-pit material extraction and reduction of oversize fragmented rock	115
Front-end loader	CAT 992K <sup>3</sup>	1	75%	In-pit material movement	115
Front-end loader	CAT 980C <sup>3</sup>	1	75%	In-pit feeding mobile crusher	108
Blasthole drill rig	Furukawa HCR1500-EDII <sup>3</sup>	1	75%	Blasthole drilling	118
Grader	CAT 16G <sup>3</sup>	1	25%	Road maintenance	113
Excavator	Komatsu PC800 <sup>3</sup>	1	75%	Material extraction	113
Dewatering Pump	8" pump <sup>3</sup>	1	25%	Water pumping	109
Excavator	Kobelco 260B <sup>3</sup>	1	75%	In-pit loading mobile crusher	105
Primary Mobile crusher/screen	Premiertrak 600 <sup>3</sup>	1	100%	In-pit material crushing and screening (continuous)	121
Secondary Mobile crusher/screen	Maxtrack/Warrior <sup>3</sup>	1	100%	In-pit material crushing and screening (campaign)	120
Scraper	CAT 637E <sup>4</sup>	2	25%	Soil/overburden stripping	111
Dozer	CAT D11 <sup>4</sup>	1	75%	In-pit material movement and soil/overburden stripping	120
Dozer	CAT D8 <sup>4</sup>	1	(typically only one dozer in use)	In-pit material movement and soil/overburden stripping	118
Mulching Unit	Vermeer BC 1800XL <sup>4</sup>	1	75%	Mulching vegetation	120
Articulated haul trucks	CAT 740 Moxy <sup>4</sup>	2	50%	Soil/overburden stripping	113

Note 1: Other equipment used in the extraction area that is not a significant noise source (such as light vehicles) has not been included.  
 Note 2: Utilisation refers to the percentage of a 15-minute assessment period that the equipment typically operates at full capacity.  
 Note 3: Noise emission data measured by SLR in 2021.  
 Note 4: Noise emission data referenced from previous SLR measurements and source database.

## 6.2 OPERATIONAL NOISE ACTIVITY SCENARIOS

Extraction activities within the Project Area would progress throughout the Project life. Activities would progress from the Stage 6 area into the 7a area and move south towards Stage 7b (refer to **Figure 2**). This would allow the Stage 7b, 7c and 7d works to be undertaken in northerly and easterly directions, with the working faces directed away from the nearest receivers to maximise the visual and acoustic shielding provided by the landform. The modelled stages are listed below:

- Stage 5/6 existing extraction and processing operations, representative of current activity in 2021. This stage is also used for noise model verification. Proposed processing would include primary crushing and screening on the floor of the uppermost bench remaining to be blasted with secondary crushing on the pit floor.
- Stage 7a – the 7a area is typically located on the western side of the ridgeline within the Stage 7 area facing away from the nearest receivers.
- Stage 7b – the 7b area is the southernmost area to the east of the ridgeline. This area is closest to the receivers to the southeast of the Project Area.
- Stage 7c/7d – the 7c and 7d areas are east of the ridgeline and are closest to the three receivers locations on “Figtree Hill” and other receivers to the north and east of the Project Area.

Within each of the stages, several operating activity scenarios have been modelled in order to determine the potential noise impacts of the various aspects of the Project. The modelled activity scenarios are set out below:

- Typical extraction operations – this scenario reflects the general day-to-day operations within the Project Area, with noise sources representative of the typical equipment locations within each stage (operating on the benches and extraction area floor).
- Amenity barrier works – this scenario reflects worst-case use of the D11 dozer on the surface for construction of the amenity barriers along the eastern boundary of Stage 7a and northern boundary of Stage 7d. This would be undertaken early in the Project and would likely last around 3 months.
- Vegetation mulching – this scenario reflects worst-case use of the mulching unit on the surface, typically in line of sight of the most-affected receivers. This would be required intermittently throughout the Project when vegetation removal is required prior to soil stripping.
- Soil stripping – this scenario reflects worst-case use of the D11 dozer on the surface for stripping of soil in each stage, typically in line of sight of the most-affected receivers. This would be required intermittently throughout the Project prior to blasthole drilling.
- Drilling near surface – this scenario reflects worst-case use of the drill rig for drilling blastholes near the surface, typically in line of sight of the most-affected receivers. Blasthole drilling would typically only occur near the surface where overburden is too hard to extract with an excavator and the material is required to be blasted.
- Crushing of blasted rock with a mobile primary jaw crusher and screen would be undertaken on the floor of each recently blasted bench. The crusher and screen would be progressively moved following each successive production blast.



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The modelled source locations for the above scenarios are shown in **Figure 5** to **Figure 8**. Activities which may occur anywhere within the Stage 7 areas, including vegetation mulching, soil stripping, near surface drilling and bench one primary crushing, have been modelled as such. These areas are shown as shaded in the Stage 7 scenario figures.

**Figure 5 Modelled Source Locations – Current Operations, Stage 5/6**

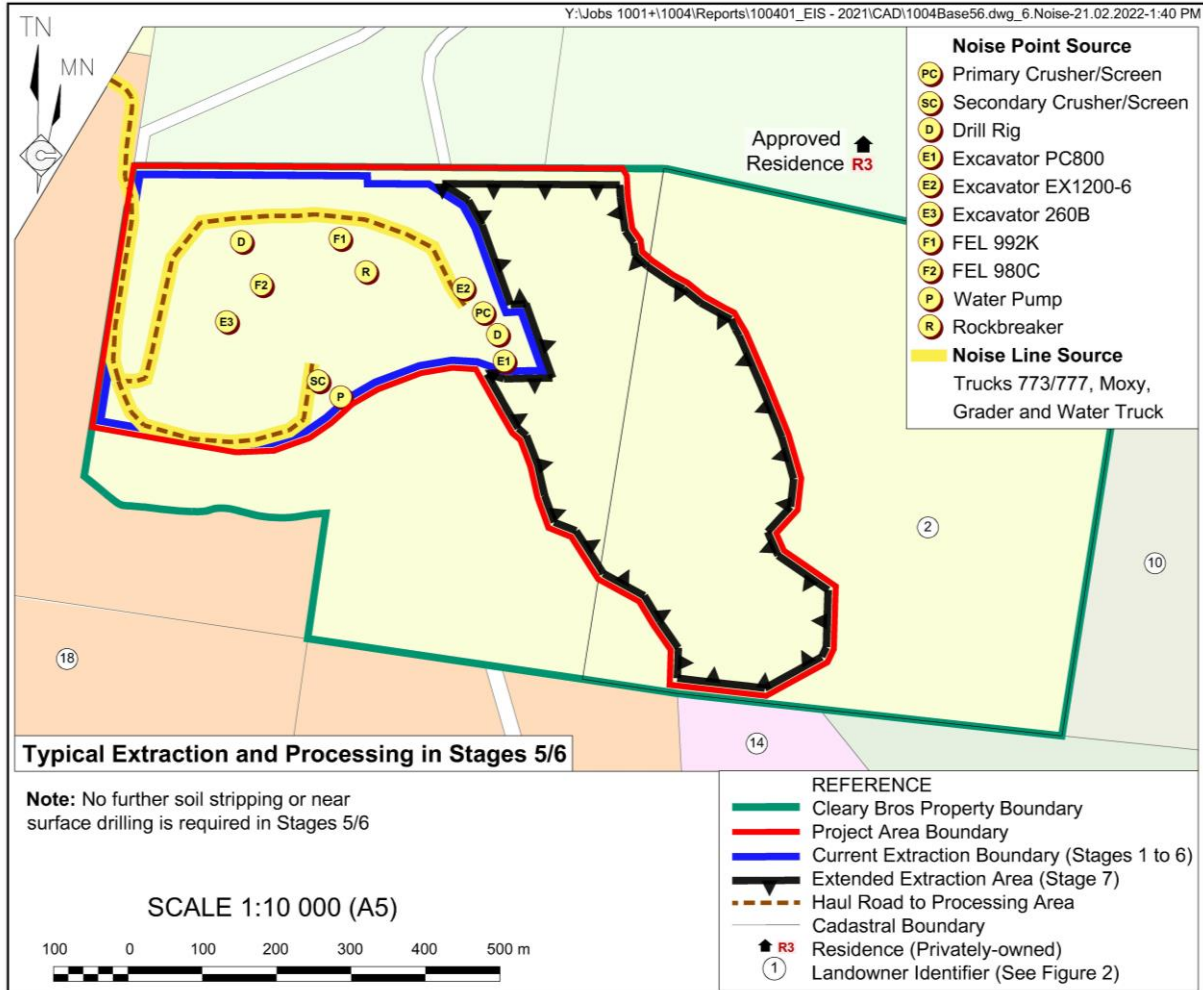


Figure 6 Modelled Source Locations – Stage 7a

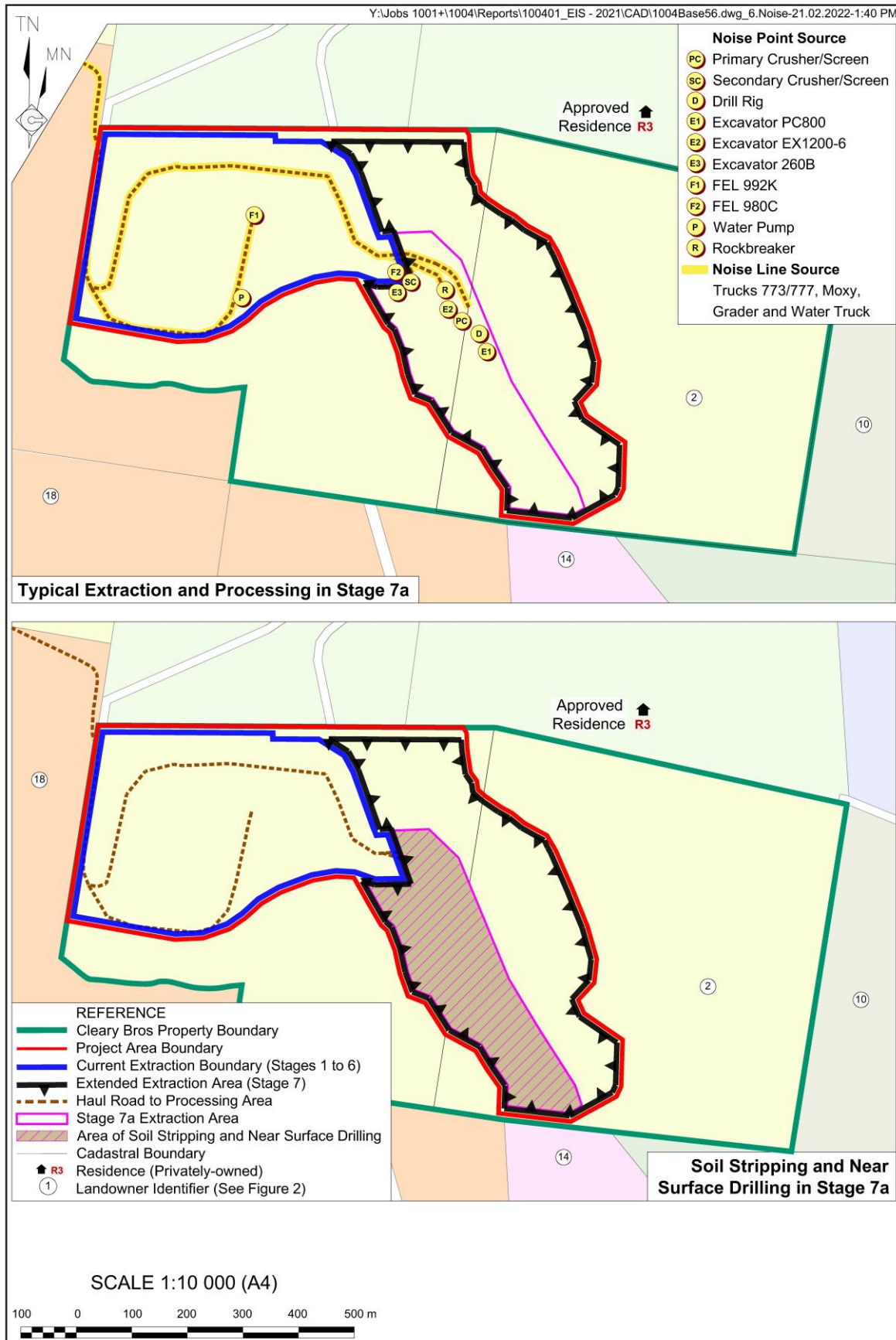


Figure 7 Modelled Source Locations – Stage 7b

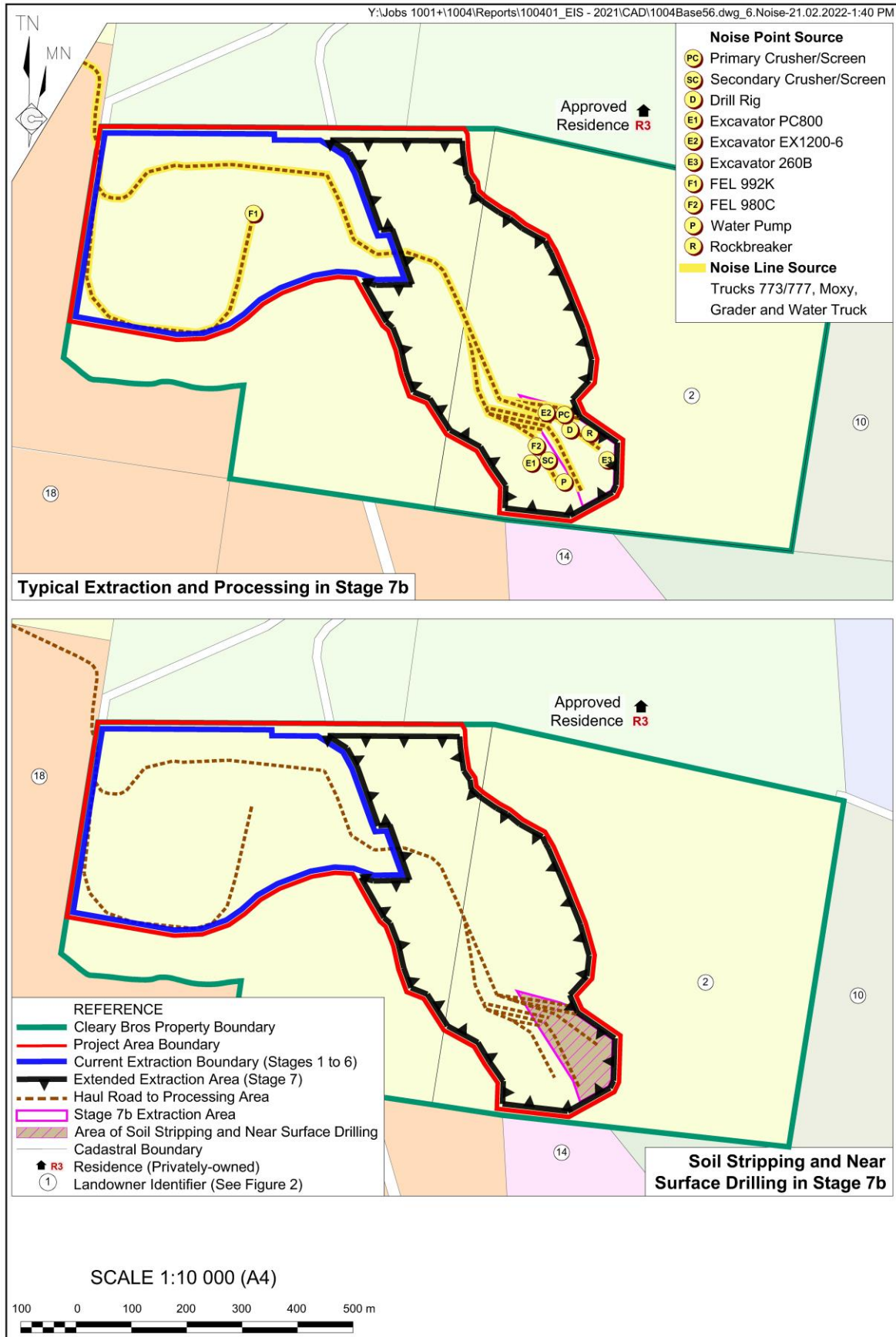
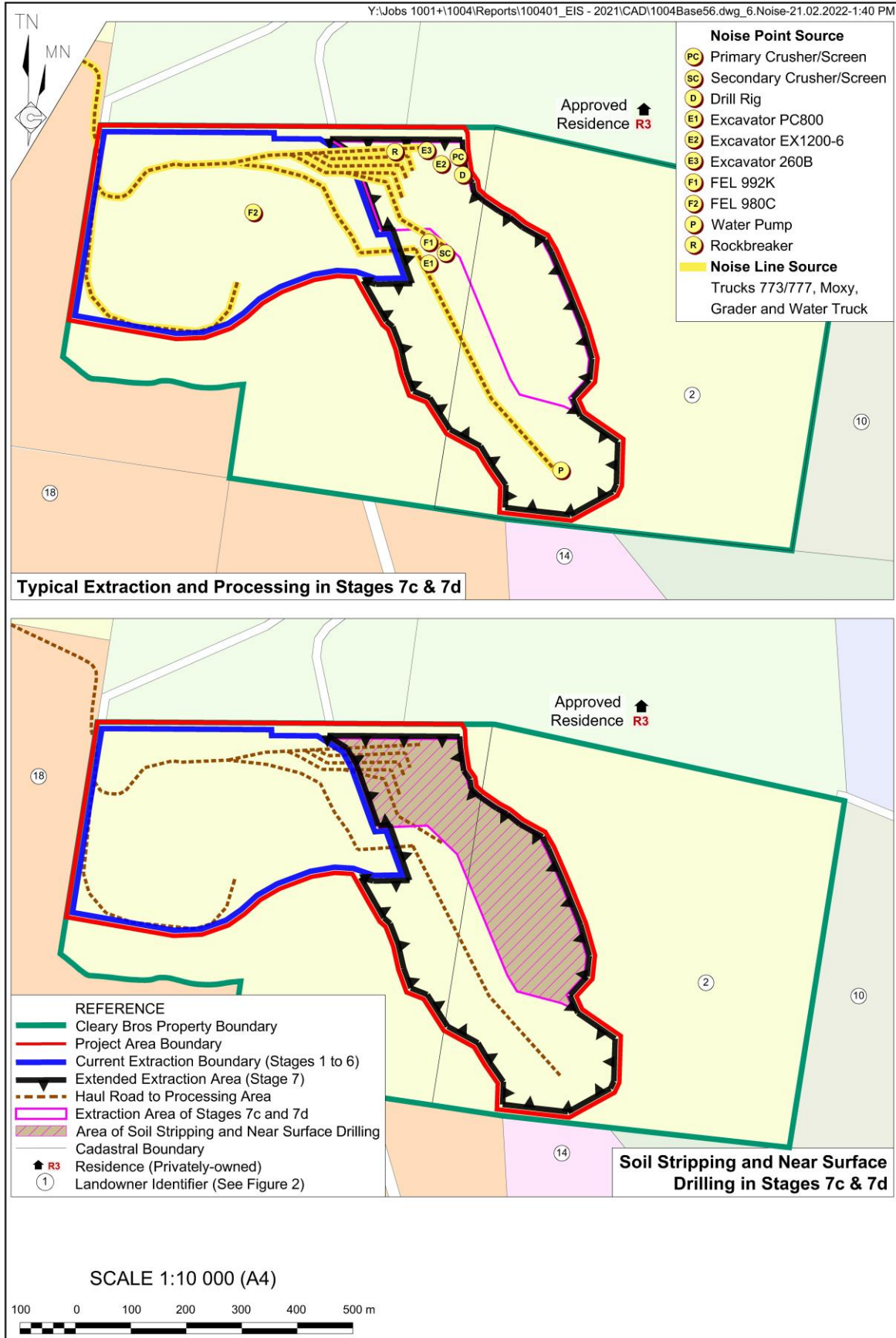


Figure 8 Modelled Source Locations – Stage 7c/7d



### 6.3 MODEL VERIFICATION

In order to assist in verifying that the noise model, relied upon for this assessment, provides an acceptable estimate of noise propagation from the future Stage 7 scenarios to potentially impacted receivers, a validation model was developed representative of the existing extraction operations in Stages 1 to 6. The validation model included the operation of equipment listed in **Table 12**, and topographic data from a recent survey of the extraction area undertaken in January 2021.

Utilisation factors were applied to plant usage in Stages 1 to 6 based on observations of typical activity. Due to the nature of operations, staffing, and the available fleet, not all plant operate at once and tend to be rotated in and out of service depending on extraction activities underway, hence the utilisation applied in **Table 12**.

The existing approved fixed processing plant and product stockpile areas were included in the validation model to estimate existing noise levels at the nearest receivers. A summary of the significant noise sources associated with the existing approved processing area is provided in **Table 13**. The sound power levels are a combination of on-site measurements conducted in January 2021 in these areas, historical measurements from the Quarry, and SLR's noise measurement database.

**Table 13 Existing Stage 1- 6 Equipment Operating within the Fixed Processing Plant and Product Stockpile Area**

<b>Plant &amp; Equipment</b>	<b>Utilisation<sup>1</sup></b>	<b>Main Function/ Location</b>	<b>Sound Power Level dB(A)</b>
Batching plant <sup>3</sup>	100%	Concrete batching plant – loading concrete trucks	110
Concrete trucks <sup>3</sup>	100%	Being loaded with concrete	103
Highway trucks <sup>3</sup>	100%	Being loaded with material	103
Front-end loader CAT 980C <sup>2</sup>	50%	Feeding material into crushers	108
Front-end loaders CAT 980K <sup>2</sup>	75%	Loading highway trucks and moving stockpiled material	108
Primary crusher <sup>2</sup>	50%	Crushing material	113
Secondary crusher <sup>2</sup>	50%	Crushing material	113
Main screens <sup>2</sup>	50%	Screening material	108
Pug mill <sup>3</sup>	50%	Preparation of pre coat material	108
Note 1: Utilisation refers to the percentage of a 15-minute assessment period that the equipment typically operates at full capacity. Note 2: Noise emission data measured by SLR in 2021. Note 3: Noise emission data referenced from previous SLR measurements and source database.			

## 7. OPERATIONAL NOISE ASSESSMENT

### 7.1 MODEL VERIFICATION

The results of the Stage 6 validation model were compared with noise measurements undertaken in October 2020 and historical noise monitoring results. A summary of model verification results is presented in **Table 14**.

**Table 14 Stage 5- 6 Extraction, Processing and Model Verification**

Location	Predicted Noise Level – Current operations (Validation Model) dB(A)	Measured Noise Level October 2020 dB(A)	Historical Noise Levels (Annual Monitoring) dB(A)					Stage 3-4 Approved Noise Limits dB(A)	Stage 5-6 Approved Noise Limits dB(A)
			2016	2017	2018	2019	2020		
"Figtree Hill" "The Cottage" – R1	36	<36 (extraction area intermittently audible during measurement)	38	35	30	33	35	38	35
"Figtree Hill" "The Hill" – R2	34	n/a (no measurement undertaken at this location)	32	35	27	31	34	38	35
"Figtree Hill" "Approved Residence" – R3	33	<36 (extraction area intermittently audible during measurement)	Not applicable (no dwelling at this location)					38	35
Receiver R4-R11	<30	N/A	N/A					N/A	N/A
Shell Cove West	<30	N/A	N/A					N/A	N/A
Shellharbour Anglican College	<30	N/A	N/A					N/A	N/A
Greenmeadows Estate	41	<43 (quarry not audible during measurement)	39	37	36	41	41	41	41
Notes: Validation model results were compared with monitoring undertaken for Stage 3-4 and Stage 5-6 approved noise limits and monitoring data. Noise monitoring was not previously required at Locations 4-11, Shell Cove West and Shellharbour Anglican College.									

The results of the model verification indicates the model provides an acceptable estimate of potential noise impacts with slightly conservative impact prediction.

The following general model settings were applied as implemented in the CONCAWE industrial noise algorithm in SoundPLAN V8.

- Ground absorption set to 0.5 in extraction areas and 0.9 in the surrounding rural landscape, where 0 is fully reflective.
- Temperature 20 degrees Celsius, Humidity 70%.
- Calm wind and Class D stability conditions.

## 7.2 PREDICTED NOISE LEVELS STAGE 5/6

A summary of the noise assessment at the receivers surrounding the Project Area is shown for Stage 5/6 in **Table 15**. The predicted levels are compared to the PNTLs to determine the potential impact from the Project. No exceedances of the PNTLs are predicted. Predicted noise contours for typical extraction operations with equipment positions as indicated in **Figure 5** is shown in **Figure 9**.

**Table 15 Stage 5/6 Noise Assessment**

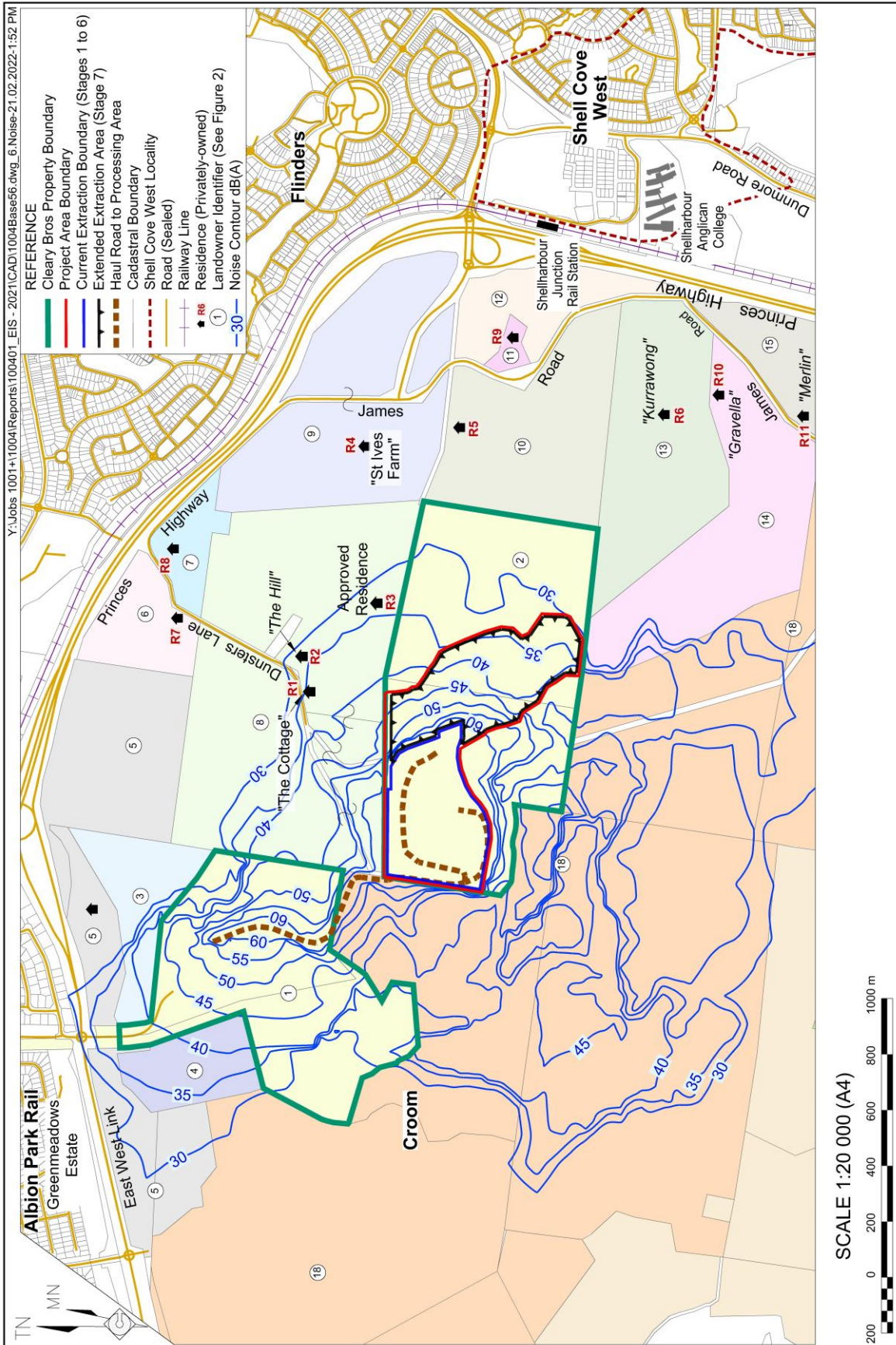
Stage	Receiver Location	Project Noise Trigger Level dB(A)	Predicted Noise Level LAeq(15minute) dB(A)	
			Typical Extraction, Mobile Primary Crushing at upper level <sup>1</sup>	Typical Extraction, Mobile Primary Crushing at lower levels
Stage 5/6	"Figtree Hill" "The Cottage" – R1	41	38	37
	"Figtree Hill" "The Hill" – R2	41	36	35
	"Figtree Hill" "Approved Residence" – R3	41	35	34
	R4	48	<30	<30
	R5	48	<30	<30
	R6	48	<30	<30
	R7	48	<30	<30
	R8	48	<30	<30
	R9	48	<30	<30
	R10	48	<30	<30
	R11	48	<30	<30
	Shell Cove West	42	<30	<30
	Shellharbour Anglican College	43	<30	<30
	Greenmeadows Estate	45	<30	<30

Note 1: Mobile primary crushing results are presented for second bench below natural ground level (uppermost bench remaining).

### 7.2.1 Remaining Extraction Operations – Stage 5/6

- Measured and predicted noise levels during remaining extraction and processing operations would be compliant with the PNTLs at all receivers during Stage 5/6.
- Mobile primary crushing and screening on the second bench is expected to contribute up to 1 dB(A) to extraction and processing operations at the nearest residences on "Figtree Hill".

Figure 9 Predicted Noise Levels Stage 5/6 Typical Extraction and Processing Scenario





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## **7.3 OPERATIONAL NOISE MITIGATION AND MANAGEMENT MEASURES**

### **7.3.1 Introduction**

Cleary Bros proposes to adopt a range of standard noise mitigation measures for the extraction and processing activities within the extraction area – expanded upon in Section 7.3.2.

Cleary Bros has identified a range of additional control measures that the Company could adopt in the event that they are unable to finalise a negotiated agreement with the owners of “Figtree Hill” – expanded upon Section 7.3.3. An agreement has not yet been reached at the time of submitting the Development Application and EIS, however, Cleary Bros is continuing to discuss matters in good faith with the owners of “Figtree Hill” in order to reach a negotiated agreement. In the event a negotiated agreement is reached with the owners of “Figtree Hill”, these additional measures would not apply.

### **7.3.2 Standard Noise Mitigation and Management Measures**

Cleary Bros proposes to undertake the extraction and processing activities with the adoption of the following mitigation measures which are referred to as “standard” measures.

1. The design of the Stage 7 extraction area and the direction and sequence of extraction would maximise the use of extraction faces to attenuate noise from the mobile equipment operating within the extraction area. This includes the use of ramps with gradients not exceeding 1:10 (V:H) and located predominantly on the eastern and northern sides of the extraction area, thereby maximising noise attenuation from haul trucks within the extraction area.
2. The crushing and screening plants would be positioned in locations that achieve maximum topographic protection from residences to the north and east. In the event that the measured noise level from the primary crushing and screening plant is greater than 41dB(A), the plant would be relocated to another position on the existing bench until noise levels are no greater than 41dB(A), or otherwise the plant would be relocated to a lower bench and the fragmented rock pushed by bulldozer to the bench below for processing.
3. All mobile equipment would be fitted with standard noise suppression equipment such as engine cowling and mufflers as fitted by the original equipment manufacturer.
4. All extraction and processing activities within the extraction area would be undertaken during the day within the hours of 7:00am to 5:30pm (Monday to Friday) and 7:00am to 1:00pm (Saturday),
5. All mobile equipment would be regularly maintained and serviced within the Company’s Albion Park workshop to ensure the original equipment manufacturer’s specifications are maintained.
6. The amenity barriers constructed on the surface at strategic locations within the extraction area would assist to attenuate noise from the mobile equipment.

### 7.3.3 Additional Noise Mitigation and Management Measures

The following additional noise mitigation and management measures would be adopted in order to reduce the noise impacts arising from the amenity barrier works, vegetation mulching, soil stripping and blasthole drilling when near the surface in the event a negotiated agreement with the owners of “Figtree Hill” is not reached.

1. Noise attenuation kits on surface operating plant, specifically dozers and the drill rig (typically 2-4dB(A) reduction can be achieved with hush kits).
2. Amenity barrier works, vegetation mulching, and soil stripping would only be undertaken when the wind direction is between 330° and 90° and at speeds of greater than 3m/s, i.e. from the “Figtree Hill” residences towards the Project Area.
3. An acoustic screen would be erected when undertaking drilling near the surface. This screen would be situated directly adjacent to the drill rig to minimise the transmission of noise towards the “Figtree Hill” residences.
4. The Quarry’s noise management plan (NMP) would be updated for the Project and would include the noise mitigation and management measures to be adopted throughout the Project life.

## 7.4 PREDICTED NOISE LEVELS STAGE 7

### 7.4.1 Assessment with Standard Mitigation and Management Measures

This subsection presents the results of the noise assessment undertaken assuming the adoption of the standard noise mitigation and management measures set out in Section 7.3.1.

#### 7.4.1.1 Predicted Noise Level Summary

A summary of the predicted noise levels at the receivers surrounding the Project Area is shown for Stage 7a in **Table 16**, Stage 7b in **Table 17**, and Stage 7c/7d in **Table 18**. The predicted levels are compared to the PNTLs to determine the potential impact from the Project. Exceedances of the PNTLs are highlighted in **bold**. The predicted noise contours for the worst-case scenario (soil stripping, vegetation mulching and amenity barrier works) across all stages are shown in **Figure 10**. Predicted noise contours for typical extraction operations with equipment positions as indicated in **Figure 6** to **Figure 8** are shown in **Figure 11** to **Figure 13**.

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**Table 16 Stage 7a Noise Assessment**

Stage	Receiver Location	Project Noise Trigger Level dB(A)	Predicted Noise Level LAeq(15minute) dB(A)					
			Short term activities				Typical Extraction	
			Amenity Barrier Works	Vegetation Mulching	Soil Stripping	Drilling near Surface	Mobile Primary Crushing upper level <sup>1</sup>	Mobile Primary Crushing at lower levels <sup>2</sup>
Stage 7a	"Figtree Hill" "The Cottage" – R1	41	48	48	48	45	39	36
	"Figtree Hill" "The Hill" – R2	41	46	46	46	43	38	34
	"Figtree Hill" "Approved Residence" – R3	41	50	50	50	47	41	36
	R4	48	38	38	38	34	33	<30
	R5	48	40	40	40	36	35	<30
	R6	48	39	39	39	36	32	<30
	R7	48	<30	<30	<30	<30	<30	<30
	R8	48	<30	<30	<30	<30	<30	<30
	R9	48	37	37	37	33	31	<30
	R10	48	37	37	37	33	<30	<30
	R11	48	35	35	35	31	<30	<30
	Shell Cove West	42	31	31	31	<30	<30	<30
	Shellharbour Anglican College	43	31	31	31	<30	<30	<30
Greenmeadows Estate	45	<30	<30	<30	<30	30	30	

Note 1: Typical extraction including mobile primary crushing and screening on uppermost bench i.e. one bench below natural ground level.

Note 2: Typical extraction including mobile primary crushing and screening on second bench and lower.

**Table 17 Stage 7b Noise Assessment**

Stage	Receiver Location	Project Noise Trigger Level dB(A)	Predicted Noise Level LAeq(15minute) dB(A)					
			Short term activities				Typical Extraction	
			Amenity Barrier Works	Vegetation Mulching	Soil Stripping	Drilling near Surface	Mobile Primary Crushing upper level <sup>1</sup>	Mobile Primary Crushing at lower levels <sup>2</sup>
Stage 7b	"Figtree Hill" "The Cottage" – R1	41	n/a	41	41	37	41	34
	"Figtree Hill" "The Hill" – R2	41	n/a	40	40	37	41	33
	"Figtree Hill" "Approved Residence" – R3	41	n/a	<b>46</b>	<b>46</b>	<b>43</b>	41	37
	R4	48	n/a	37	37	33	31	<30
	R5	48	n/a	42	42	38	36	<30
	R6	48	n/a	39	39	36	32	<30
	R7	48	n/a	<30	<30	<30	<30	<30
	R8	48	n/a	<30	<30	<30	<30	<30
	R9	48	n/a	38	38	34	<30	<30
	R10	48	n/a	37	37	33	<30	<30
	R11	48	n/a	36	36	31	<30	<30
	Shell Cove West	42	n/a	31	31	<30	<30	<30
	Shellharbour Anglican College	43	n/a	31	31	<30	<30	<30
	Greenmeadows Estate	45	n/a	<30	<30	<30	<30	<30

Note 1: Typical extraction including mobile primary crushing and screening on uppermost bench i.e.. one bench below natural ground level.

Note 2: Typical extraction including mobile primary crushing and screening on second bench and lower.

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Table 18 Stage 7c/7d Noise Assessment

Stage	Receiver Location	Project Noise Trigger Level dB(A)	Predicted Noise Level LAeq(15minute) dB(A)					
			Short term activities				Typical Extraction	
			Amenity Barrier Works <sup>1</sup>	Vegetation Mulching	Soil Stripping	Drilling near Surface	Mobile Primary Crushing upper level <sup>2</sup>	Mobile Primary Crushing at lower levels <sup>3</sup>
Stage 7c/d	"Figtree Hill" "The Cottage" – R1	41	55	55	55	52	41	40
	"Figtree Hill" "The Hill" – R2	41	52	52	52	50	41	38
	"Figtree Hill" "Approved Residence" – R3	41	54	54	54	52	41	41
	R4	48	<30	<30	<30	<30	<30	<30
	R5	48	42	42	42	38	39	31
	R6	48	38	38	38	34	38	38
	R7	48	<30	<30	<30	<30	<30	<30
	R8	48	<30	<30	<30	<30	<30	<30
	R9	48	37	37	37	33	36	<30
	R10	48	31	31	31	<30	33	<30
	R11	48	34	34	34	<30	34	34
	Shell Cove West	42	30	30	30	<30	<30	<30
	Shellharbour Anglican College	43	30	30	30	<30	<30	<30
Greenmeadows Estate	45	<30	<30	<30	<30	31	31	

Note 1: Amenity barrier works for Stage 7c/7d would be undertaken at the same time as the Stage 7a amenity barrier works.

Note 2: Typical extraction including mobile primary crushing and screening on uppermost bench i.e.. one bench below natural ground level.

Note 3: Typical extraction including mobile primary crushing and screening on second bench and lower.





Figure 12 Predicted Noise Levels Stage 7b Typical Extraction and Processing Scenario

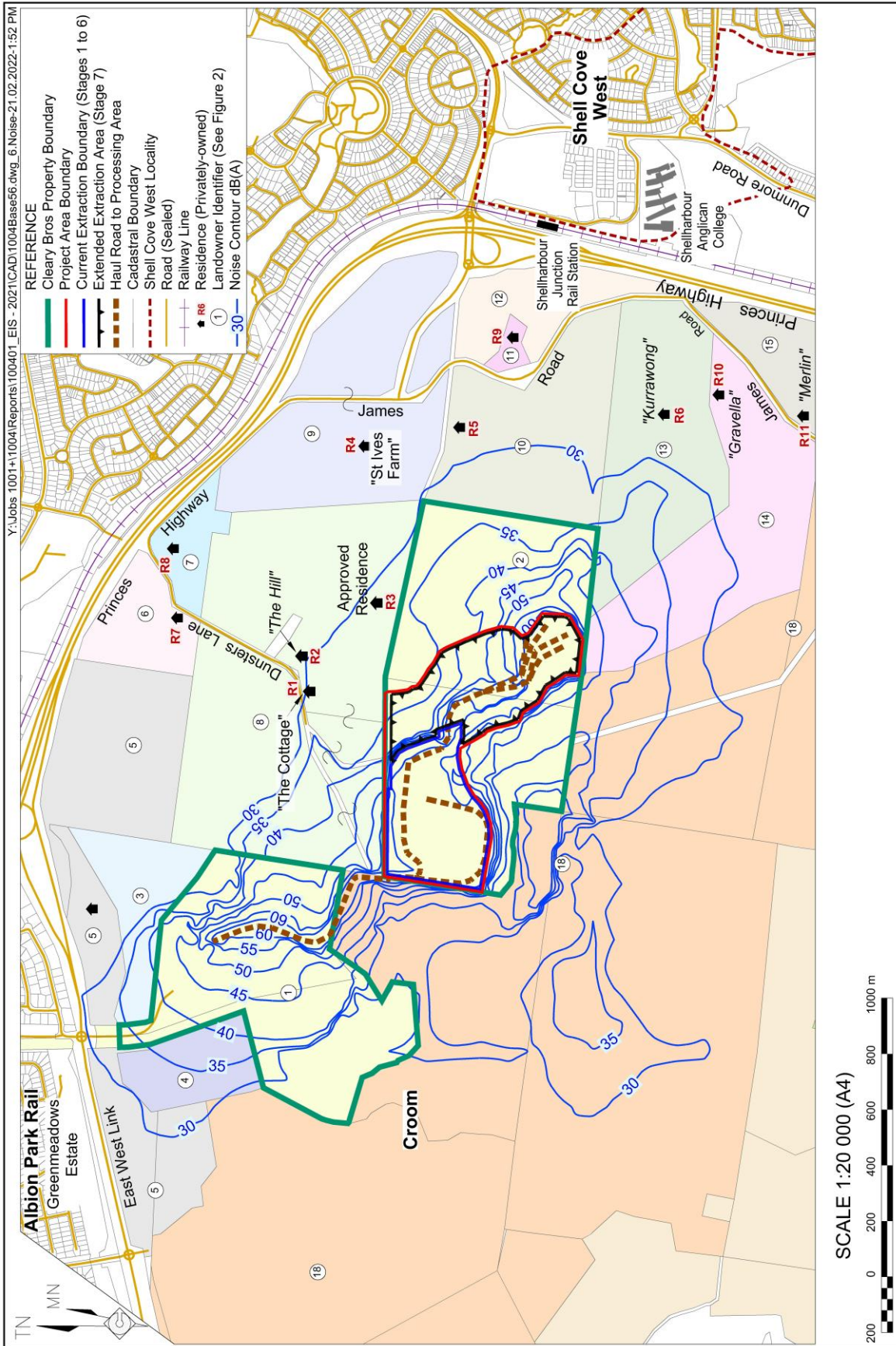
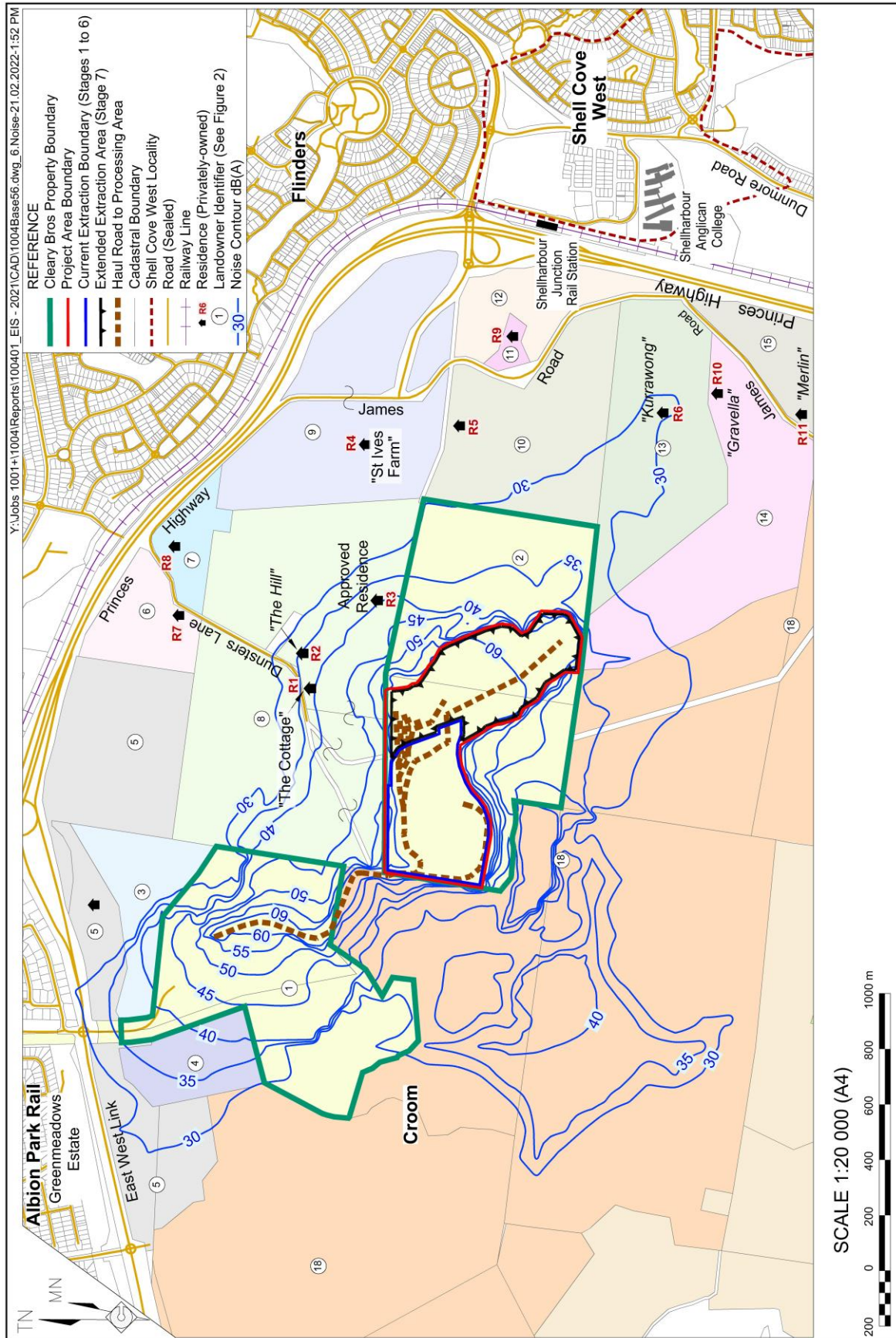




Figure 13 Predicted Noise Levels Stage 7c/d Typical Extraction and Processing Scenario



### 7.4.1.2 Assessment of Short Term Activities Stage 7

#### Amenity Barrier Works / Vegetation Mulching / Soil Stripping

- Predicted noise levels during worst-case operation of the D11 dozer at the surface during amenity barrier works and soil stripping, and operation of the mulcher for vegetation mulching, would be less than the PNTLs at all receivers except the three “Figtree Hill” residence locations during all stages.
- Noise levels of up to 7dB(A) above the PNTL at the existing “Figtree Hill” residences (R1 and R2) and up to 9dB(A) at the approved “Figtree Hill” residence R3 are predicted during amenity barrier works, vegetation mulching, and soil stripping in Stage 7a.
- Noise levels of up to 5dB(A) above the PNTL at the approved “Figtree Hill” residence R3 are predicted during vegetation mulching, and soil stripping in Stage 7b. Noise levels less than or equal to the PNTL are predicted at the existing “Figtree Hill” residences R1 and R2 during these activities in Stage 7b.
- Noise levels of up to 14dB(A) above the PNTL at the existing “Figtree Hill” residences R1 and R2 and up to 13dB(A) at the approved “Figtree Hill” residence R3 are predicted during amenity barrier works, vegetation mulching, and soil stripping in Stage 7c/7d.
- The noise levels presented are worst case and lower noise levels are expected when these activities are further from the receiver and/or are hidden from sight. When quieter equipment is used for these activities (such as the D8 dozer or the scraper), or equipment is not in line of sight of the “Figtree Hill” residences, predicted noise levels would be lower than the above.

#### Drilling near the Surface

- Predicted noise levels during worst-case operation of the blasthole drill rig near the surface would be less than the PNTLs at all receivers except the three “Figtree Hill” residence locations during all stages.
- Noise levels of up to 4dB(A) above the PNTL at the existing “Figtree Hill” residences R1 and R2 and up to 6dB(A) at the approved “Figtree Hill” residence R3 are predicted during near-surface drilling in Stage 7a.
- Noise levels of up to 2dB(A) above the PNTL at the approved “Figtree Hill” residence R3 are predicted during near-surface drilling in Stage 7b. Noise levels less than or equal to the PNTL are predicted at the existing “Figtree Hill” residences R1 and R2.
- Noise levels of up to 11dB(A) above the PNTL at the existing and approved “Figtree Hill” residences are predicted during near-surface drilling in Stage 7c/7d.
- The noise levels presented are worst case and lower noise levels are expected when the activity is further from the receiver and/or is hidden from sight.

### 7.4.1.3 Continuous Extraction Operations Stage 7

#### Typical Extraction and Mobile Primary Crushing and Screening at Upper Levels

- Predicted noise levels during typical extraction operations with the mobile primary crushing and screening occurring on the floor of the first bench below the natural surface indicate that noise levels would be less than the PNTLs at all receivers except the three “Figtree Hill” residence locations during all stages.

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- At the “Figtree Hill” residences, when the mobile crusher and screen are positioned on the floor of the first bench below the natural surface, noise levels above the PNTL can occur when the crusher and screen are in line of sight to “Figtree Hill” residences. This is at specific points in the pit progression including the southeastern corner of Stages 7a, 7b and 7c and northeastern corner of Stage 7d.
- Noise monitoring specific to these activities is provided in Section 7.7.

**Typical Extraction and Mobile Primary Crushing and Screening at Lower Levels**

- Extraction operations with primary crushing and screening on the second bench and below provides shielding to “Figtree Hill” residences with predicted noise levels no greater than the PNTLs for all stages.

**7.4.2 Assessment with Additional Mitigation and Management Measures**

This subsection presents the results of the noise assessment undertaken assuming the adoption of the additional noise mitigation and management measures set out in Section 7.3.2 in the event a negotiated agreement with the owners of “Figtree Hill” is not reached.

A summary of the predicted noise levels at the three residences on “Figtree Hill” is presented in **Table 19**. The predicted levels are compared to the PNTLs to determine the potential impact from the Project. Exceedances of the PNTLs are highlighted in **bold**.

**Table 19 Stage 7 Noise Assessment with Additional Mitigation and Management Measures**

Stage	Receiver Location	Project Noise Trigger Level dB(A)	Predicted Noise Level LAeq(15minute) dB(A)			
			Short term activities			
			Amenity Barrier Works <sup>1</sup>	Vegetation Mulching	Soil Stripping	Drilling near Surface
Stage 7a	“Figtree Hill” “The Cottage” – R1	41	37	<b>42</b>	37	<b>42</b>
	“Figtree Hill” “The Hill” – R2	41	35	40	35	40
	“Figtree Hill” “Approved Residence” – R3	41	39	<b>44</b>	39	<b>44</b>
Stage 7b	“Figtree Hill” “The Cottage” – R1	41	30	35	30	41
	“Figtree Hill” “The Hill” – R2	41	<30	34	<30	41
	“Figtree Hill” “Approved Residence” – R3	41	35	40	35	<b>42</b>
Stage 7c/d	“Figtree Hill” “The Cottage” – R1	41	<b>44</b>	<b>49</b>	<b>44</b>	<b>46</b>
	“Figtree Hill” “The Hill” – R2	41	41	<b>46</b>	41	<b>45</b>
	“Figtree Hill” “Approved Residence” – R3	41	<b>43</b>	<b>48</b>	<b>43</b>	<b>46</b>

Note 1: Amenity barrier works for Stage 7c/7d would be undertaken at the same time as the Stage 7a amenity barrier works.

#### 7.4.2.1 Assessment of Short Term Activities Stage 7 with Additional Mitigation and Management Measures

##### Amenity Barrier Works / Vegetation Mulching / Soil Stripping

- Predicted noise levels during worst-case operation of the D11 dozer at the surface during amenity barrier works and soil stripping, and operation of the mulcher for vegetation mulching, would be less than the PNTLs at all receivers except the three “Figtree Hill” residence locations during all stages.
- Noise levels of up to 1dB(A) above the PNTL at the existing “Figtree Hill” residence (R1) and up to 3dB(A) at the approved “Figtree Hill” residence R3 are predicted during vegetation mulching, in Stage 7a. Noise levels less than the PNTL are predicted at all “Figtree Hill” residences during all other short term activities in Stage 7a.
- Noise levels less than the PNTL are predicted at the existing “Figtree Hill” residences R1 and R2 and at the approved “Figtree Hill” residence R3 in Stage 7b.
- Noise levels of up to 8dB(A) above the PNTL at the existing “Figtree Hill” residences R1 and R2 and up to 7dB(A) at the approved “Figtree Hill” residence R3 are predicted during amenity barrier works, vegetation mulching, and soil stripping in Stage 7c/7d.

The noise levels presented are worst case and lower noise levels are expected when these activities are further from the receiver and/or are hidden from sight. When quieter equipment is used for these activities (such as the D8 dozer or the scraper), or equipment is not in line of sight of the “Figtree Hill” residences, predicted noise levels would be lower than the above.

##### Drilling near the Surface

- Predicted noise levels during worst-case operation of the blasthole drill rig near the surface would be less than the PNTLs at all receivers except the three “Figtree Hill” residence locations during all stages.
- Noise levels up to 1dB(A) above the PNTL are predicted at the existing “Figtree Hill” residence R1 and 3dB(A) above the PNTL are predicted at the approved “Figtree Hill” residence R3 during near-surface drilling in Stage 7a.
- Noise levels up to 1dB(A) above the PNTL are predicted at the approved “Figtree Hill” residence R3 during near-surface drilling in Stage 7b.
- Noise levels of up to 5dB(A) above the PNTL are predicted at the existing and approved “Figtree Hill” residences during near-surface drilling in Stage 7c/7d.

The noise levels presented are worst case and lower noise levels are expected when the activity is further from the receiver and/or is hidden from sight.

### 7.4.3 Modifying factors

An assessment of the potential for low-frequency noise was undertaken utilising the following methodology:

- Sound power spectrums including low-frequency content were derived from measurements of current operations and include octave band data from 16Hz to 8kHz.
- Predicted receiver overall noise levels (A and C weighted) and low frequency octave bands were compared against the triggers for low-frequency noise described in the NPfl Fact Sheet C.

The requirement for low-frequency noise corrections was not triggered. A summary of the low-frequency noise analysis is included in **Appendix C**.

Based on the observed typical extraction operations, plant noise emission characteristics and historical noise monitoring, annoying aspects such as tonal or intermittent noise emissions are not expected to be generated by the Project.

## 7.5 CUMULATIVE OPERATIONAL NOISE ASSESSMENT

### 7.5.1 Cumulative Assessment with Existing Processing Area

In order to provide a cumulative operational noise assessment of the Project and the existing fixed processing plant and product stockpile area, noise levels were predicted from the fixed processing plant using the validated existing noise model. A summary of the cumulative noise assessment at the receivers surrounding the Project Area is shown in **Table 20** and **Table 21**. The predicted levels are compared to the PNTLs to determine the potential cumulative impact from the Project.

Predicted cumulative noise levels from the Project Area and the existing fixed processing plant and product stockpiling area to the north of the Project Area during typical operations as shown in **Table 20** are compliant with the PNTLs at all receivers during all stages.

Predicted cumulative noise levels for amenity barrier works, vegetation mulching, soil stripping, and near-surface drilling, combined with the existing fixed processing plant and product stockpiling area to the north of the Project Area are shown in **Table 21** and indicate potential for exceedance of the PNTL by up to 8dB(A) during these short-term activities. The additional mitigation and management measures discussed in Section 7.3.3 would be implemented when required to ensure the noise levels predicted at the residences on "Figtree Hill" remain as low as reasonably practicable in lieu of a negotiated agreement with the owners of "Figtree Hill"..

**Table 20 Cumulative Noise Levels During Typical Operations**

Scenario	Receiver Location	Noise Level LAeq(15minute) dB(A)					Compliance
		Project Noise Trigger Level	Existing Processing Area	Typical Extraction Operations Predicted	Cumulative	Exceedance	
Stage 5/6 - Typical extraction operations and existing processing area	"Figtree Hill" "The Cottage" – R1	41	<30	38	38	-	Yes
	"Figtree Hill" "The Hill" – R2	41	<30	36	36	-	Yes
	"Figtree Hill" "Approved Residence" – R3	41	<30	35	35	-	Yes
	R4	48	<30	<30	<30	-	Yes
	R5	48	<30	<30	<30	-	Yes
	R6	48	<30	<30	<30	-	Yes
	R7	48	<30	<30	<30	-	Yes
	R8	48	<30	<30	<30	-	Yes
	R9	48	<30	<30	<30	-	Yes
	R10	48	<30	<30	<30	-	Yes
	R11	48	<30	<30	<30	-	Yes
	Shell Cove West	42	<30	<30	<30	-	Yes
	Shellharbour Anglican College	43	<30	<30	<30	-	Yes
Greenmeadows Estate	45	41	<30	41	-	Yes	
Stage 7a - Typical extraction operations and existing processing area	"Figtree Hill" "The Cottage" – R1	41	<30	39	39	-	Yes
	"Figtree Hill" "The Hill" – R2	41	<30	38	38	-	Yes
	"Figtree Hill" "Approved Residence" – R3	41	<30	41	41	-	Yes
	R4	48	<30	<30	<30	-	Yes
	R5	48	<30	<30	<30	-	Yes
	R6	48	<30	<30	<30	-	Yes
	R7	48	<30	<30	<30	-	Yes
	R8	48	<30	<30	<30	-	Yes
	R9	48	<30	<30	<30	-	Yes
	R10	48	<30	<30	<30	-	Yes
	R11	48	<30	<30	<30	-	Yes
	Shell Cove West	42	<30	<30	<30	-	Yes
	Shellharbour Anglican College	43	<30	<30	<30	-	Yes
Greenmeadows Estate	45	41	<30	41	-	Yes	

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Table 20 (Cont'd) Cumulative Noise Levels During Typical Operations

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Scenario	Receiver Location	Noise Level LAeq(15minute) dB(A)					Compliance
		Project Noise Trigger Level	Existing Processing Area	Typical Extraction Operations Predicted	Cumulative	Exceedance	
Stage 7b - Typical extraction operations and existing processing area	"Figtree Hill" "The Cottage" – R1	41	<30	41	41	-	Yes
	"Figtree Hill" "The Hill" – R2	41	<30	41	41	-	Yes
	"Figtree Hill" "Approved Residence" – R3	41	<30	41	41	-	Yes
	R4	48	<30	<30	<30	-	Yes
	R5	48	<30	<30	<30	-	Yes
	R6	48	<30	<30	<30	-	Yes
	R7	48	<30	<30	<30	-	Yes
	R8	48	<30	<30	<30	-	Yes
	R9	48	<30	<30	<30	-	Yes
	R10	48	<30	<30	<30	-	Yes
	R11	48	<30	<30	<30	-	Yes
	Shell Cove West	42	<30	<30	<30	-	Yes
Shellharbour Anglican College	43	<30	<30	<30	-	Yes	
Greenmeadows Estate	45	41	<30	41	-	Yes	
Stage 7c/7d - Typical extraction operations and existing processing area	"Figtree Hill" "The Cottage" – R1	41	<30	41	41	-	Yes
	"Figtree Hill" "The Hill" – R2	41	<30	41	41	-	Yes
	"Figtree Hill" "Approved Residence" – R3	41	<30	41	41	-	Yes
	R4	48	<30	<30	<30	-	Yes
	R5	48	<30	31	31	-	Yes
	R6	48	<30	38	38	-	Yes
	R7	48	<30	<30	<30	-	Yes
	R8	48	<30	<30	<30	-	Yes
	R9	48	<30	<30	<30	-	Yes
	R10	48	<30	<30	<30	-	Yes
	R11	48	<30	34	34	-	Yes
	Shell Cove West	42	<30	<30	<30	-	Yes
Shellharbour Anglican College	43	<30	<30	<30	-	Yes	
Greenmeadows Estate	45	41	31	41	-	Yes	

**Table 21 Cumulative Noise During Short Term Activities**

Scenario	Receiver Location	Noise Level LAeq(15minute) dB(A)					
		Project Noise Trigger Level	Existing Processing Area and Stockpiling Area	Standard or additional measures	Loudest Short Term Activity	Cumulative	Exceedance of PNTL by
Stage 7a – Short term activities and existing processing area	“Figtree Hill” “The Cottage” – R1	41	<30	Standard	48	49	8
		41		Additional	42	42	1
	“Figtree Hill” “The Hill” – R2	41	<30	Standard	46	47	6
		41		Additional	40	40	-
	“Figtree Hill” “Approved Residence” – R3	41	<30	Standard	50	51	10
		41		Additional	44	44	3
Stage 7b - Short term activities and existing processing area	“Figtree Hill” “The Cottage” – R1	41	<30	Standard	41	44	3
		41		Additional	35	41	-
	“Figtree Hill” “The Hill” – R2	41	<30	Standard	40	44	3
		41		Additional	34	34	-
	“Figtree Hill” “Approved Residence” – R3	41	<30	Standard	46	47	6
		41		Additional	40	42	1
Stage 7c/7d - Short term activities and existing processing area	“Figtree Hill” “The Cottage” – R1	41	<30	Standard	55	55	14
		41		Additional	49	49	8
	“Figtree Hill” “The Hill” – R2	41	<30	Standard	52	52	11
		41		Additional	46	46	5
	“Figtree Hill” “Approved Residence” – R3	41	<30	Standard	54	54	13
		41		Additional	48	48	7

## 7.5.2 Cumulative Assessment with other Industrial Noise Sources

The NPfI aims to limit continuing increases in noise levels from progressive developments with the application of the amenity criteria. To account for cumulative noise from the Project with existing industrial premises in the area, the recommended amenity noise level is reduced by 5dB(A) to give the Project amenity noise level. The Project amenity noise level is used in conjunction with the Project intrusiveness noise level to determine the Project Noise Trigger Levels (PNTLs) for operational noise from the Project (refer to Section 5).

As such, it is considered that cumulative noise impacts from the Project with existing industrial noise sources in the area have been accounted for with the adoption of the PNTLs in the assessment of operational noise impacts detailed in Section 7.5.1.

Except for receivers at “Figtree Hill” during short term surface activities (as shown in **Table 21**, all receivers are expected to meet the PNTLs and meet cumulative noise criteria.



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In lieu of a negotiated agreement with the owners of “Figtree Hill”, the additional mitigation and management measures will be implemented for the Project, which will ensure the cumulative industrial noise levels comply with the amenity criteria at all sensitive receivers. At “Figtree Hill” short term surface activities would result in a trigger of the VLAMP discussed in the following Section 7.6.

## 7.6 VLAMP TRIGGERS ON CUMULATIVE NOISE IMPACTS

As detailed in Sections 7.4 and 7.5, when the predicted noise levels exceed the PNTLs after the implementation of feasible and reasonable noise mitigation and management measures, the requirement to consider further treatment under the VLAMP is triggered.

Noise levels with the implementation of the additional mitigation measures are predicted to be up to 8dB(A) above the PNTL at residences on “Figtree Hill”. In line with the characterisation of noise impacts and potential treatments described in the VLAMP, the predicted noise levels fall within the range of day time impacts greater than 5dB(A) above the NPfI criteria but less than the NPfI amenity noise level of 50 dB(A) for the day time period.

This characterises the impact as “moderate” which results in potential treatment of a dwelling with mechanical ventilation to allow windows to be closed without compromising internal air quality and upgrade of façade elements such as windows, doors or roof insulation.

Cleary Bros is continuing discussions with the owners of “Figtree Hill” regarding the predicted noise levels throughout the Project life and the impacts at the residences on the “Figtree Hill” property. An agreement has not yet been reached at the time of submitting the Development Application and EIS, however, Cleary Bros is continuing to discuss matters in good faith with the owners of “Figtree Hill” in order to reach a negotiated agreement.

Predicted residual noise impacts are less than the PNTLs for all other sensitive receptors, and as such the requirements of the VLAMP are not triggered for those properties.

## 7.7 NOISE MONITORING

Noise emissions from the current Stage 5/6 extraction activity is managed via the current *Albion Park Quarry Extension Noise and Blast Management Plans*, “NBMP” (SLR Consulting, 2017). The NBMP would be updated for the monitoring of noise impacts from the proposed Stage 7 activities.

Noise monitoring is to be undertaken as detailed below:

- Annual independent noise compliance monitoring would continue similar to the current program and include monitoring during the winter months inclusive of 7 days of unattended noise logging and 15 minute attended noise measurements with monitoring conducted within the Project Area boundary and at the Cottage on “Figtree Hill” – Residence R1. The monitoring data from within the Project Area would be utilised with a noise model to determine quarry noise levels attributable to activities in the Project Area at other noise sensitive receivers.

- Meteorological data recorded at the on-site automatic weather station during the monitoring period would be accessed for use in the interpretation of the noise monitoring results.

In lieu of a negotiated agreement with the owners of “Figtree Hill”, the following additional noise monitoring would be implemented for the Project, as described below, all of which would be undertaken by Cleary Bros personnel using either a noise logger or handheld noise meter.

- It is proposed to introduce a program of monitoring of the short-term noise generating activities within the Project Area in order to demonstrate compliance with the predicted noise levels at the residences on “Figtree Hill”.
- Periodic monitoring of primary crushing and screening operations would be undertaken to provide guidance to the Quarry Manager and operational staff that the noise generated by the operation of this equipment after each blast on the uppermost bench, with the mitigation measures in place, would be appropriate and enable the Company to ensure the noise level at the “Figtree Hill” residences is no greater than 41dB(A).

## 8. BLAST EMISSIONS LIMITS AND MANAGEMENT

### 8.1 EXISTING BLASTING CRITERIA AND OPERATING HOURS

Conditions 10 and 11, Schedule 4 of the 2017 Quarry Extension Development Consent 10639/2005 – Mod 3 state that:

#### **“Airblast Overpressure Criteria**

10. *The Applicant must ensure that the airblast overpressure level from blasting at the development does not exceed the criteria in Table 3 at any point that is located at least 3.5 m from any residence or other sensitive receiver on privately owned land.*

<b>Airblast overpressure Level [dB(Lin Peak)]</b>	<b>Allowable Exceedance</b>
115	5% of the total number of blasts over any 12 month reporting period
120	0%

Table 3: Airblast Overpressure Limits

#### **Ground Vibration Criteria**

11. *The Applicant must ensure that the peak particle velocity from blasting at the development does not exceed the criteria in Table 4 at any point that is located at least 3.5 m from any residence or other sensitive receiver on privately owned land.*

<b>Peak particle velocity (mm/s)</b>	<b>Allowable exceedance</b>
5	5% of the total number of blasts over any 12 month reporting period
10	0%

Table 4: Ground Vibration Limit

Condition 12, Schedule 4 of the 2017 Quarry Extension Development Consent states:

#### **“Blasting Restrictions**

12. *Blasting operations on the premises may only take place:*
- between 9.00am and 5.00pm Monday to Friday inclusive;*
  - are limited to 1 blast each day; and*
  - at such other times as may be approved by the EPA.”*

These limits are also incorporated within EPL 299 for the Quarry.

### 8.2 EXISTING BLAST MANAGEMENT PLAN

A Blast Management Plan has been prepared and refined to meet Condition 14, Schedule 4 of the 2017 Development Consent, and outlines the practices Cleary Bros implements to:

- ensure compliance with the blasting criteria and operating conditions of this consent;

- avoid any flyrock impacts on the “Figtree Hill” property;
- minimise dust and fume emissions; and
- minimise, mitigate, remediate or compensate for any other blasting impacts of the development, including any such impacts on people, livestock and property,

### 8.3 BLAST HISTORY

Cleary Bros has typically blasted between 12 and 35 times each year fragmenting between approximately 10,000 tonnes and 100,000 tonnes during each blast.

A detailed review of the historic blast designs and corresponding blast emissions (ground vibration and airblast) monitoring data, as presented in **Appendix D**, was conducted by SLR for blasting in Stages 1 to 4 of the current extraction area in order to complement the findings presented in SLR Report 610.04156-R3 Revision 4 "Albion Park Quarry Extension Revised Blast Management Plan" (RBMP dated 18 November 2015). In addition to this data set, the blast monitoring results from Blast 10/17 to Blast 22/20 have been added to the data and the blast emissions site laws (ground vibration and airblast) have been updated accordingly. The findings of the updated review form the basis of this assessment.

Note: Additional blast emissions monitoring results to those presented in **Appendix D** have been recorded in order to increase the accuracy of the predicted site laws. The additional data collected to prepare the site laws does not contain any exceedances of the 2017 Consent blast emissions criteria at the closest residence, i.e. “Figtree Hill” ‘The Cottage’ – Residence R1.

A statistical summary of all monitoring results from blasting in Stages 1 to 6 between 2009 and March 2021 is provided in **Table 22**. During this time, 266 blasts were recorded at the permanent monitoring site adjacent to R1, with the allowable MIC for each blast determined by the site laws current at the time of the blast. This practice has been successful to date, with no exceedances of the performance criteria established in **Table 22**. The low proportion of blasts recorded above the 95th percentile criteria (0.4%) for both vibration and airblast indicates that either the site laws are conservative and/or that the MIC adopted at time of the blast was below the allowable maximum.

In relation to Condition 14 Schedule 4 of the 2017 Consent, consultation with the owners of the “Figtree Hill” property (refer to Property 8 on **Figure 1**) included providing a copy of the draft management plans and convening a meeting between a Cleary Bros representative and “Figtree Hill” representatives to discuss the proposed management plan and reflect the concerns raised by the representatives of “Figtree Hill” in the final plan. Cleary Bros intends to continue its consultation with “Figtree Hill” representatives for the planned update of the Blast Management Plan in the event that development consent for the Stage 7 Extension is granted.

**Table 22 Historical Blast Monitoring Statistics for Stages 1 – 6 at R1 (2009 – 2021)**

<b>Statistic</b>	<b>Ground vibration (mm/s)</b>	<b>Airblast (dB Linear)</b>
95th percentile limit	5	115
100th percentile limit	10	120
Number of monitoring records	266	266
Average result	1.69	103.9
Median result	1.43	104.9
95th percentile of monitoring records	3.68	111.8
Maximum result	7.39	115.6
Number of blasts over 95th percentile limit	1	1
Proportion of blasts over 95th percentile limit	0.4%	0.4%
Number of blasts over 100th percentile limit	0	0

## **8.4 GENERAL BLAST MANAGEMENT**

Cleary Bros engages a specialist Blasting Contractor to drill, load and fire all blasts at the Quarry. Each blast design prepared by the Blasting Contractor is reviewed by a specialist Blasting Engineer to ensure consistency with the requirements of the Noise and Blast Management Plan.

The following blast design parameters would continue to be implemented for all blasts.

- Direction of detonator initiation is away from the closest residence, where possible.
- All blast faces to generally face away from the closest residence, where possible.
- Use of solid decking in the blastholes, where required (solid decking is an inert material used in deck charging, usually stemming material).
- Two (or more) columns of explosives of approximately equal length per blasthole, where decked holes are required.
- Two (or more) detonators per blasthole, where decked blastholes are required.
- Use of 89mm diameter blastholes, unless otherwise approved by the Blasting Engineer.
- Stemming depth 3.0m (nominal).
- Subdrill of 1.0m (nominal) for production blasts in competent rock.
- Bench height up to 14m, unless blastholes are decked.
- Front row burden 4.0m (nominal).
- Subsequent burden 2.5m (nominal)
- Spacing 3.5m (nominal).

## 8.5 PREDICTED BLAST EMISSION LEVELS

Blast emission data from every blast would be used (via the blast emissions site laws developed from the results of the quarry extension blast monitoring to date) to refine subsequent blast designs in order to control blast emission (ground vibration and airblast) levels using the near-field site laws, particularly for later blasting in the Stage 7 Extension area when operating closer to residences.

The ground vibration and airblast criteria for residential receivers nominated in the 2017 Consent cater for the inherent variation in emission levels from a given blast design by allowing a five percent exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the “5% exceedance” prediction formulae were generated in the blast emissions site laws. All subsequent blast emissions to the closest non Project-related residence would be predicted using the continually refined combined site laws. The site laws relating to minimising impacts at receivers are based on providing a statistical 95% confidence that the lower of the levels in the Consent would not be exceeded (115dB Linear of airblast and 5mm/s for vibration).

Prior to implementing any revisions to the site laws for the extraction area, Cleary Bros would consult with the “Figtree Hill” representatives in relation to how the change(s) may affect their property.

## 8.6 MANAGING NEAR FIELD BLAST EFFECTS

A near-field ground vibration site law has been specifically developed for the current extraction area to assist in designing the blasts so that the peak particle component velocity levels for blasting within the extraction area do not exceed 200mm/s at any point on any external property boundary. This limit was established following a study of vibration impacts on dairy cattle which demonstrated that there were no adverse impacts on the cattle’s health (including stress and contentment) in response to vibration velocities of up to 223mm/s (*Report on Vibration Effects in Transported Cattle*, Heggies Australia Pty Ltd dated 15 November 2005). Furthermore, observations made by Quarry personnel of cattle behaviour in adjacent paddocks when blasting in recent years in Stages 1 to 6 show no observable change in cattle movement or response throughout the blasting sequence.

The near-field vibration site law was developed by monitoring blast emissions at offset distances of between 21m and 151m from the blast and is presented in **Appendix E**. These distances reflect those used for monitoring purposes.

Similarly, a near-field airblast site law has been developed to assist in designing the blasts so that the airblast levels for blasting within the Project Area do not exceed 135dB Linear at any point on any external property boundary. The 135dB Linear limit has been adopted in order to limit potential health impacts to persons and was determined via reference to Regulation 49 of the OH&S Regulations 2001 (which defines the noise limits that are applicable in NSW) as well as Clause 2.1.3 of the ANZEC’s *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*, September 1990.

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The near-field airblast site law is also presented in **Appendix E**. For the near-field site laws, the 1% exceedance confidence interval would be applied (compared to the 5% exceedance interval applied for blasting emissions at residences) in order to reduce the risk of any exceedance of these near-field limits.

The continued implementation of these near-field site laws at the property boundary, including a maximum vibration of 200mm/s and airblast of 135dB Linear, would protect the health of stock and people respectively on neighbouring properties.

## 8.7 MANAGING AIRBLAST

The Maximum Instantaneous Charge (MIC-kg) for blasts would not exceed the mass of explosives given by the then current airblast site law. The following formula is based on the current 5% exceedance combined airblast site law, where the blast design is controlled by blast emissions at the closest "Figtree Hill" property residence:

$$\text{MIC (kg)} = [(\text{Distance to nearest Receiver (m)}) / 101.3]^3$$

Where the blast design is controlled by blast emissions at the closest external property boundary, the MIC for the blast would not exceed the mass of explosives given by the then current near-field site law. The following formula is based on the current 1% exceedance near-field site law:

$$\text{MIC (kg)} = [(\text{Distance to nearest Receiver (m)}) / 5.337]^3$$

Blast design procedures would continue to be implemented with the objective of maintaining the levels of airblast at the closest residences to below 115dB Linear and protecting people and/or cattle at external property boundaries.

By incorporating , when required (i.e. when a single explosive column weight exceeds the then allowable MIC), deck charging (a method of loading blastholes in which the explosive charges in the same blasthole are separated by an inert material) of (at least) the front row of blastholes in each blast and generally initiating the blast in the direction away from the closest receiver location, it is predicted that emissions from blasting in the proposed Stage 7 extension, using an MIC in accordance with the then current combined airblast site law established for the extraction area, would result in compliance with the 115dB Linear airblast limit.

In relation to the protection of people and stock potentially located on the external property boundaries during blasting, as an example, for an MIC of 80kg, the current 1% exceedance near-field site law predicts that an airblast level of 135dB Linear would occur at a distance of approximately 23m from the blast. As a precaution, when blasting within about 50m of the property boundary, the MIC for each blast may need to be restricted to below 80kg. However, this would be based on the then current near-field airblast site law for the extension Project Area.

Based on the current near-field airblast site law, conventional blasting during Stage 7 would be able to occur up to approximately 20m of external property boundaries. This setback would be reviewed in response to future near-field blast emissions monitoring and blasting techniques, which may increase or decrease the required offset to achieve the nominated blast emissions criteria and safety limits. Non-explosive rock fracturing techniques may need to be used to allow extraction of the hard rock resource in closer proximity to the external property boundaries, if the then current near-field site laws restrict productive explosive blasting techniques.

## 8.8 MANAGING VIBRATION

The MIC (kg) of blasts in Stage 7 would not exceed the mass of explosives given by the then current combined ground vibration site law. The following formula is based on the current 5% exceedances site law, where the blast design is controlled by blast emissions at the closest "Figtree Hill" property residence:

$$\text{MIC (kg)} = (\text{Distance to nearest Receiver (m)})^2 / 2,620.3$$

Where the blast design is controlled by blast emissions at the closest external property boundary, the MIC for the blast would not exceed the mass of explosives given by the then current near-field site law. The following formula is based on the current 1% exceedance near-field site law.

$$\text{MIC (kg)} = (\text{Distance to nearest Receiver (m)})^2 / 9.158$$

Blast design procedures would be implemented with the objective of maintaining the levels of ground vibration at the closest residences below 5mm/s.

By incorporating, when required (i.e. when a single explosive column weight exceeds the then allowable MIC), deck charging of the blastholes for each blast and generally initiating the blast in the direction away from the closest receiver location, it is predicted that emissions from blasting in the proposed Stage 7 extension, using an MIC in accordance with the then combined ground vibration site law established for the Project Area, would result in compliance with the 5mm/s ground vibration limit.

The impacts of vibration from blasting at the closest residential receivers and close to the external property boundaries would be mitigated in line with the control of the MIC associated with the control of airblast levels, based on the then current combined and near-field vibration site laws for the Stage 7 extension.

Further, as discussed, non-explosive rock fracturing techniques may need to be used to allow extraction of the hard rock resource in closer proximity to external property boundaries, if the then current near-field site laws preclude the use of conventional explosive blasting techniques.

## 8.9 FLYROCK IMPACTS AND MANAGEMENT

There are generally two main areas within the blast from which flyrock has the potential to be produced. These are at the blasthole collar (where the stemming length has not been optimised and the explosive column is too close to the upper surface of the rock mass creating crater effects - rifling) and at the face of the blast (where there could be less than optimum burden on a blasthole whereby the explosives gases are able to vent to atmosphere - blowouts, producing flyrock).

In relation to the impacts of flyrock, the Blasting Contractor has indicated that historically blasted rock generally falls within an envelope with dimensions:

- 50m in front of the blast face;
- 20m on either side of the face; and
- 10m behind the face

and that such dimensions are consistent with industry best practice.



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In order to minimise the risk of unexpected flyrock on the safety of people and stock, Cleary Bros would contact the occupier(s) of all properties adjoining the Stage 7 extraction area prior to blasting in accordance with the process described in Section 8.13.

For the blasting undertaken within the Project Area, the front row blastholes would continue to be “Boretracked” in order to identify any areas of less than optimum burden in order that, if required, inert material (rather than explosives) can be placed at this location in the blasthole. Consequently, in relation to flyrock ejection, the latter situation would not occur.

In terms of collar ejection, the nominal minimum stemming length of 3.0m and stemming material, comprising aggregate typically 10-14mm in size would continue to be used as the stemming material (rather than drill cuttings or other materials) again in order to contain the explosives within each blasthole. Aggregate is used as stemming material as it “locks” at the collar of the blasthole upon initiation of the blast enabling the explosives gases to be used in fracturing and moving the rock instead of being ejected from the blasthole (“rifling”).

The blast design procedures for blasting near external property boundaries would be determined through reference to the then current near-field blast emissions site laws (refer to Sections 8.7 and 8.8). As stated, the site specific Stage 7 extension and near-field site laws (for ground vibration and airblast) would be regularly updated and used to design subsequent blasts. Consequently, the allowable MICs to comply with the nominated ground vibration and airblast safety limits at the external property boundaries would progressively reduce as blasting approaches closer to the boundary, thereby further reducing the likelihood of flyrock.

In line with previous commitments, prior to implementing any revisions to the site laws for the Project Area, Cleary Bros would consult with the representatives of the “Figtree Hill” property in relation to how the change(s) may affect blasting practices.

## **8.10 EXTERNAL BLAST DESIGN REVIEW**

Prediction of the far and near-field ground vibration and airblast levels would be conducted prior to each blast by the Blasting Engineer in order to determine the potential impacts at the closest receiver location. The ground vibration and airblast site laws would be updated on a regular basis to reflect the blast results obtained.

## **8.11 BLAST FUME EMISSIONS**

### **8.11.1 Mitigation of Fume Emissions**

Fumes can be generated by the mechanisms as outlined in **Table 23**. Potential indicative control measures are also presented in **Table 23**. It is noted that wet product is used in both wet and dry blastholes in order to minimise blast fume generation.

**Table 23 Possible Causes and Controls for Blast Fume Generation**

Possible Cause	Potential Control Measures
<b>Explosive Formulation</b>	
Explosive incorrectly formulated or not manufactured to specifications	<ul style="list-style-type: none"> <li>Track explosive mix back with supplier</li> <li>Perform visual check at discharge point</li> <li>Use supplier who operates under an externally accredited quality system</li> </ul>
Improper mixing of raw materials / incorrect metering	<ul style="list-style-type: none"> <li>Perform visual check at discharge point</li> <li>Ensure Mobile Manufacturing Unit (MMU) calibrated every 6 months</li> </ul>
<b>Blast Design</b>	
Inappropriate priming and/or placement	<ul style="list-style-type: none"> <li>Follow manufacturer's recommendations on placement on initiating explosives</li> </ul>

Mitigation measures for fume control during blasting include:

- Fine material collected during drilling would not be used for blasthole stemming;
- All blastholes would be stemmed with 3m of aggregate typically 10-14mm in size; and
- Blasting would only occur between the hours 9.00 am and 5.00 pm, Monday to Friday, or as otherwise approved by the EPA as per the EPL conditions.

A professional Blasting Contractor is hired to survey the blast area, design the blast and conduct the blast. Blasting would only occur following an appropriate assessment of the weather conditions by the Quarry Manager to ensure that the wind speed and direction would not result in excessive fume (or dust) emissions from the Project Area in the direction of the sensitive receptor locations. This measure would be effective in controlling off-site impacts due to fumes released during blasting operations.

Additionally, the design for each blast would aim to maximise the blast efficiency and to minimise the emission of fumes (as well as dust and odour) in order to ensure compliance with site specific blast emissions criteria.

The blasting schedule for each blast would also be made available to the public via the Quarry website, typically three days prior to a blast being initiated.

### **8.11.2 Monitoring Programme for Fume Emissions**

The blast fume emissions would be monitored by a visual assessment being conducted by Cleary Bros Quarry Manager or their delegate immediately after each blast. Each blast would continue to be recorded on video and could be relied upon to review blast fume emissions.

A visual rating of blast fume emissions is approximate at best but gives some indication of the severity of the event, however, it is worth recording.

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The following factors (taken from the Code of Good Practice: Prevention and Management of Blast Generated NO<sub>x</sub> Gases in Surface Blasting issued by the Australia Explosives Industry and Safety Group Inc.) would be considered for inclusion in a post-blast report, in the event that any blast fume is detected.

- Date and time of blast.
- Presence of noticeable post-blast NO<sub>x</sub> gases.
- Post-blast NO<sub>x</sub> gas rating, e.g. 0-5 (refer Appendix F).
- Extent of post-blast NO<sub>x</sub> gas event, e.g. A, B or C (refer Appendix F).
- Duration of any post-blast NO<sub>x</sub> gas event (measure of time to disperse).
- Direction of movement of any post-blast NO<sub>x</sub> plume.
- Movement of any post-blast NO<sub>x</sub> gas plume relative to the established exclusion zone and any establishment management zone (i.e. maintained within or exceeded).
- Climate conditions, including temperature, humidity, wind speed and direction, cloud cover, rain.
- Video results of blast, where relevant.

## **8.12 METEOROLOGICAL CONSIDERATIONS**

Meteorological data from the on-site meteorological station would be evaluated by the Blasting Contractor prior to blasting, as close as practical to the time of blasting. The expected weather conditions and their effect on the airblast (and dust) generated by the blasting would be considered and blast plans and/or timing altered, if necessary. Meteorological conditions that would be considered are:

- Prevailing winds including their direction and velocity;
- Temperature inversions;
- Time of day;
- Seasonal effects on weather patterns; and
- Cloud cover.

Blasting would be avoided, whenever possible, under the following meteorological conditions.

- When winds are blowing from the blast site towards the nearest receiver at a strength likely to enhance blast emissions impacts.
- Where there is heavy low level cloud.
- Where a temperature inversion is indicated.

### 8.13 NOTIFYING LANDOWNERS OR OCCUPIERS OF BLAST EVENTS

All occupiers of properties adjacent to the Stage 7 extraction area (including “Figtree Hill”) would be contacted on the morning of each blast indicating the expected time of firing and any information relevant to their property. The planned day of the next blast would also be available on the Cleary Bros website, typically three days prior to a blast being initiated.

If, when notifying Holcim, it is found that a blast is planned for the same day, measures would be taken to ensure the blasts are adequately separated in time.

### 8.14 STAGE 7 EXTENSION - PREDICTED BLAST EMISSIONS

As an example of the blast emissions management process, **Table 24** presents the predicted levels of ground vibration and airblast from blasting for the allowable MIC at the nearpoint of blasting in Stages 7a, 7b, 7c and 7d (as well as in Stages 1 to 6) to the existing “Figtree Hill” residences (R1 “The Cottage” and R2 “The Hill”), based on the current blast emissions site laws. All more distant residences would experience lower levels of ground vibration and airblast from blasting.

Until such time that the “Figtree Hill” approved residence (R3) is built, the blast designs (i.e. the allowance MICs) would be controlled by compliance with the respective blast emissions criteria at the “Figtree Hill” residences R1 and R2.

**Table 24 Blast Emissions Predictions based on the Current Site Laws**

Stages	Residence	Near Distance to Blasting	Allowable MIC	Ground Vibration	Airblast
1 to 6	R1	375m	51kg	4.8mm/s	115.0dBLin
	R2	475m			
7a	R1	449m	77kg	5.0mm/s	114.7dBLin
	R2	508m			
7b	R1	741m	210kg	5.0mm/s	113.3dBLin
	R2	765m			
7c	R1	455m	79kg	5.0mm/s	114.6dBLin
	R2	489m			
7d	R1	280m	21kg	3.9mm/s	115.0dBLin
	R2	330m			

## 8.15 BLAST MONITORING PROGRAMME

### 8.15.1 Blast Monitoring Plan Requirements

Condition 14, Schedule 4 of the 2017 Quarry Extension Development Consent states that:

#### ***“Blast Management Plan***

14. *Prior to the commencement of operations in each stage of the development after Stage 1, the Applicant shall prepare, and subsequently implement, a Blast Management Plan for the development in consultation with the landowner(s) of The “Figtree Hill” Land, the EPA and to the satisfaction of the Secretary. This plan must:*
  - (a) *include a summary of monitoring results for the previous quarry stage;*
  - (b) *describe the objectives for noise and blasting at that stage;*
  - (c) *describe the proposed blasting design for that stage, and demonstrate that the design will meet the blast criteria listed in Tables 3 and 4;*
  - (d) *include a monitoring program for evaluating the performance of the development, including:*
    - *compliance with the applicable criteria; and*
    - *minimising the fume emissions from the site;*
  - (e) *describe the measures that would be implemented to:*
    - *ensure compliance with the blasting criteria and operating conditions of this consent;*
    - *avoid any flyrock impacts on The “Figtree Hill” Land;*
    - *minimise dust and fume emissions; and*
    - *minimise, mitigate, remediate or compensate for any other blasting impacts of the development, including any such impacts on people, livestock and property, to the satisfaction of the Secretary.”*

It remains the intent of Cleary Bros to undertake blast monitoring in a manner consistent with that recorded in the current Blast Management Plan. The Plan will, however, be reviewed and updated in the event that the development consent for the Stage 7 Extension is granted.

### 8.15.2 General Procedure

The Programme of Monitoring would be reviewed with reference to the procedures described in AS 2187.2-1993, “Explosives - Storage, Transport and Use” and with reference to the ANZEC’s “Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration”, September 1990.

The blast emissions would be quantified for all blast events conducted within the Project Area.

### 8.15.3 Monitoring Locations

A permanent blast emissions monitor (ground vibration and airblast) has been located at the closest inhabited residence to the Project Area, namely the “Figtree Hill” (“The Cottage”) residence. The permanent blast monitor is located at the same location as noise logger L02 as shown in **Figure 3**.

A portable blast emissions monitor (to measure ground vibration and airblast) would be positioned at the nearest potentially affected residences (or other blast emissions sensitive receivers other than the “Figtree Hill” residences) to the blasting operations, if required, in response to community feedback or concerns.

### 8.15.4 Instrumentation Requirements

#### 8.15.4.1 Blast Emission Monitors

Blast monitoring instrumentation would be employed to meet the measuring equipment specifications presented in Appendix J, Section J3.2.1 (for ground vibration) and Section J3.3.1 (for airblast) of AS 2187.2-2006 “Explosives - Storage and Use. Part 2: Use of Explosives”. The instrumentation would be installed, operated and maintained by suitably qualified or trained personnel. The instruments would be calibrated annually throughout the life of the Project.

#### 8.15.4.2 Permanent Monitor Installation

A permanent blast monitor would be maintained at “Figtree Hill” (The Cottage) throughout all blasting operations.

#### 8.15.4.3 Portable Monitor Installation

A portable blast monitor would be operated manually for each blast requiring additional monitoring.

Vibration velocity geophones would be coupled to the ground via a “star stake” or concrete plinth embedded in the consolidated surface approximately 25m from the subject building or structure, with the associated microphone positioned in the free-field.

#### 8.15.4.4 Weather Monitoring Equipment

An automatic weather station has been located adjacent to Stage 6 of the current extraction area and is considered representative of wind propagation conditions in relation to blast emissions throughout the blast monitoring programme. The automatic weather station is currently located within the footprint of the proposed development, and in the event that development consent is granted for the Stage 7 extension, it would be relocated to a suitable location on the Cleary Bros property, sited and installed generally in accordance with the EPA’s “*Approved Methods of the Modelling and Assessment of Air Pollutants in NSW*”.

The automatic weather station would be programmed, as a minimum, to continuously record the meteorological parameters shown in **Table 25**.

Cleary Bros (Bombo) Pty Ltd

Albion Park Quarry Extraction Area Stage 7 Extension

Table 25 Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean wind speed	km/h (or m/s)	15 minute
Mean wind direction	Degrees	15 minute
Sigma-theta	-	15 minute
Aggregate rainfall	mm	15 minute
Mean air temperature	°C	15 minute
Mean relative humidity	%RH	15 minute

## 8.16 BLAST DESIGN RECORDS

Blast design records would be maintained for all individual blast events. The purpose of the records is to assist in the design and optimisation of future events, the planning and control of blast emissions and to provide a traceable system of documentation in case of accident or complaint.

The Blasting Contractor would provide a description of the blast parameters prior to each blast event and include the location co-ordinates (East, North, elevation (mAHD)) of the blast site (or the distance from the blast site to the blast monitor(s)) and the maximum explosive mass (MIC) to be detonated in any 8ms interval.

Section 8.7 and Section 8.8 present the MIC limiting equations based on the current combined and near-field blast emission site laws for ground vibration and airblast from the results of blasting in Stages 1 to 6 of the existing extraction area. The current combined blast emissions site laws, in the standard form, are presented below. The combined and near-field site law graphs are presented in **Appendix E**.

The 1% and 5% combined site laws for ground vibration and airblast are:

### Ground Vibration

$$PVS (1\%) = 1,669 (SD_1)^{-1.41}$$

$$PVS (5\%) = 1,285 (SD_1)^{-1.41}$$

### Airblast

$$SPL (1\%) = 154.5 - 18.3 \log (SD_2)$$

$$SPL (5\%) = 151.7 - 18.3 \log (SD_2)$$

where PVS (1% and 5%) and SPL (1% and 5%) are the levels of ground vibration (Peak Vector Sum - mm/s) and peak airblast (dB Linear) respectively, above which 1% and 5% respectively of the total population (of data points) would lie, assuming that the population has the same statistical distribution as the underlying measured sample.

$SD_1$  and  $SD_2$  are the ground vibration and airblast Scaled Distances, where:

$$SD_1 = \text{Distance} / MIC^{1/2} \quad (\text{m.kg}^{-0.5})$$

and

$$SD_2 = \text{Distance} / MIC^{1/3} \quad (\text{m.kg}^{-0.33})$$

The distances of blasting in Stage 7 from the closer “Figtree Hill” residence (“The Cottage”) range from 980m (far point of Stage 7b) to 280m (near-point of Stage 7d). Based on the 5% exceedance blast emission site laws presented above, the allowable MICs for compliance with the blast emission levels in the 2017 Consent range from 21kg at a 280m offset to 367kg at a 980m offset, controlled by airblast at 280m and ground vibration at 980m.

The Quarry Manager (or the Blasting Engineer) would verify and approve the proposed blast design with respect to potential blast emissions based on the current combined or near-field exceedance predictive site laws for ground vibration and airblast, whichever are the more restrictive.

In order to maximise the benefits of the blast monitoring process, the significant design parameters, emission levels and meteorological data would be collated and maintained for each blast event.



## 9. CONCLUSION

An assessment of noise and blasting impacts from the proposed Stage 7 Extension to the Albion Park Quarry Extraction Area was undertaken. The assessment was conducted with consideration to the SEARs and relevant current guidelines, standards, and assessment methods.

In relation to operational noise the assessment indicated the following.

- Noise mitigation and management measures would be focused on minimising noise emissions from mobile plant operations.
- Potential noise levels from typical extraction and processing operations in the Project Area are not predicted to impact noise sensitive receivers above the Project Noise Trigger Levels (PNTL).
- Noise levels from works at the surface including construction of amenity barriers, vegetation clearing, topsoil stripping and near surface drilling are predicted to be above the PNTL at the nearest sensitive receivers at “Figtree Hill” (R1-R3). Noise levels at all other sensitive receivers were below the PNTL.
- Cumulative operational noise emissions from existing operations at the Albion Park Quarry and the Stage 7 Extension are predicted to result in noise levels below the PNTL at all sensitive receivers with the exception of the residences on “Figtree Hill”.
- Cleary Bros is continuing discussions with the owners of “Figtree Hill” regarding the predicted noise levels throughout the Project life and the impacts at the residences on the “Figtree Hill” property. An agreement has not yet been reached at the time of submitting the Development Application and EIS, however, Cleary Bros is continuing to discuss matters in good faith with the owners of “Figtree Hill” in order to reach a negotiated agreement. In lieu of a negotiated agreement with the owners of “Figtree Hill”, Cleary Bros would implement the additional noise mitigation and management measures, with the residual impacts managed through the VLAMP.
- Predicted residual noise impacts are less than the PNTLs for all other sensitive receptors, and as such the requirements of the VLAMP are not triggered for those properties.
- Cumulative industrial noise emissions during all stages and at all sensitive receivers are predicted to meet the relevant amenity criteria with the implementation of the proposed additional mitigation and management measures.

In relation to blast emissions, the assessment indicated the following:

- Based on the current near-field airblast site law, conventional blasting during Stage 7 would be able to occur up to approximately 20m of external property boundaries. This buffer would be reviewed in response to future near-field blast emission monitoring and blasting techniques, which may increase or decrease the required offset to achieve the nominated blast emissions criteria and safety limits.

- The impacts of vibration from blasting at the closest residential receivers and close to the external property boundaries would be mitigated in line with the control of the MIC associated with the control of airblast levels, based on the then current combined and near-field vibration site laws for the Stage 7 extension.
- Flyrock management measures would continue to be implemented in accordance with the Blast Management Plan. The allowable MICs to comply with the nominated ground vibration and airblast safety limits at the external property boundaries would progressively reduce as blasting approaches the “Figtree Hill” property boundary, thereby further reducing the likelihood of flyrock.
- With the implementation of the respective blast management procedures and monitoring programmes detailed in Section 8, it is concluded that there would be no adverse impacts in relation to ground vibration, airblast, flyrock or fumes/odour on people, animals, buildings, structures or infrastructure from blasting associated with the proposed operations in the Project Area.

Noise and blasting management measures outlined in this assessment would be incorporated into the quarry Noise and Blasting Management Plan for the operation of the Stage 7 extraction area.