



METROMIX PTY LIMITED

ELEMENT 3: Blast Management Plan (Incorporating a Blast Management Program)

July 2020

Approved by
the Secretary's nominee, Matthew Sprott on 12 February 2020



Blast Management Plan

(Incorporating a Blast Management Program)



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COMMONLY USED ACRONYMS

AHD	Australian Height Datum
AS	Australian Standard
BS	British Standard
CCC	Community Consultation Committee
DPIE	Department of Planning, Industry and Environment
DRG	Division of Resources and Geoscience
ENCM	Environmental Noise Control Manual
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPL	Environment Protection Licence
PA	Project Approval



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1 INTRODUCTION

This Blast Management Plan (the Plan) has been prepared by Metromix Pty Ltd (Metromix) for the Teralba Quarry (the Quarry). The Quarry is located west of the suburb of Teralba, beyond the western shores of Lake Macquarie (Figure 1.1). The Plan has been prepared in satisfaction of Condition 16 of Schedule 3 of Project Approval (PA) 10_0183 (originally approved on 22 February 2013). A modification to PA 10_0183 was approved on 16 April 2018.

Condition 3(16): Blast Management Plan

“The Proponent must prepare and implement a Blast Management Plant for the project to the satisfaction of the Secretary. This plan must:

- (a) be submitted to the Secretary for approval within 4 months from the date of project approval;*
- (b) be prepared in consultation with the Council and interested members of the local community potentially affected by blasting operations;*
- (c) describe the measures that would be implemented to ensure:*
 - best management practice is being employed; and*
 - compliance with the relevant conditions of this approval;*
- (d) include a road closure management plan for blasting within 500 metres of a public road, that has been prepared in consultation with Council;*
- (e) include a specific blast fume management protocol to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated; and*
- (f) include a monitoring program for evaluating the performance of the project including:*
 - compliance with the applicable criteria; and*
 - minimising fume emissions from the site.”*

The Proponent must implement the plan as approved by the Secretary.

The plan addresses the following elements.

- The activities approved under PA 10_0183.
- The consultation undertaken during preparation of this Plan.
- The legal and other requirements associated with management of blast emissions from the Quarry.

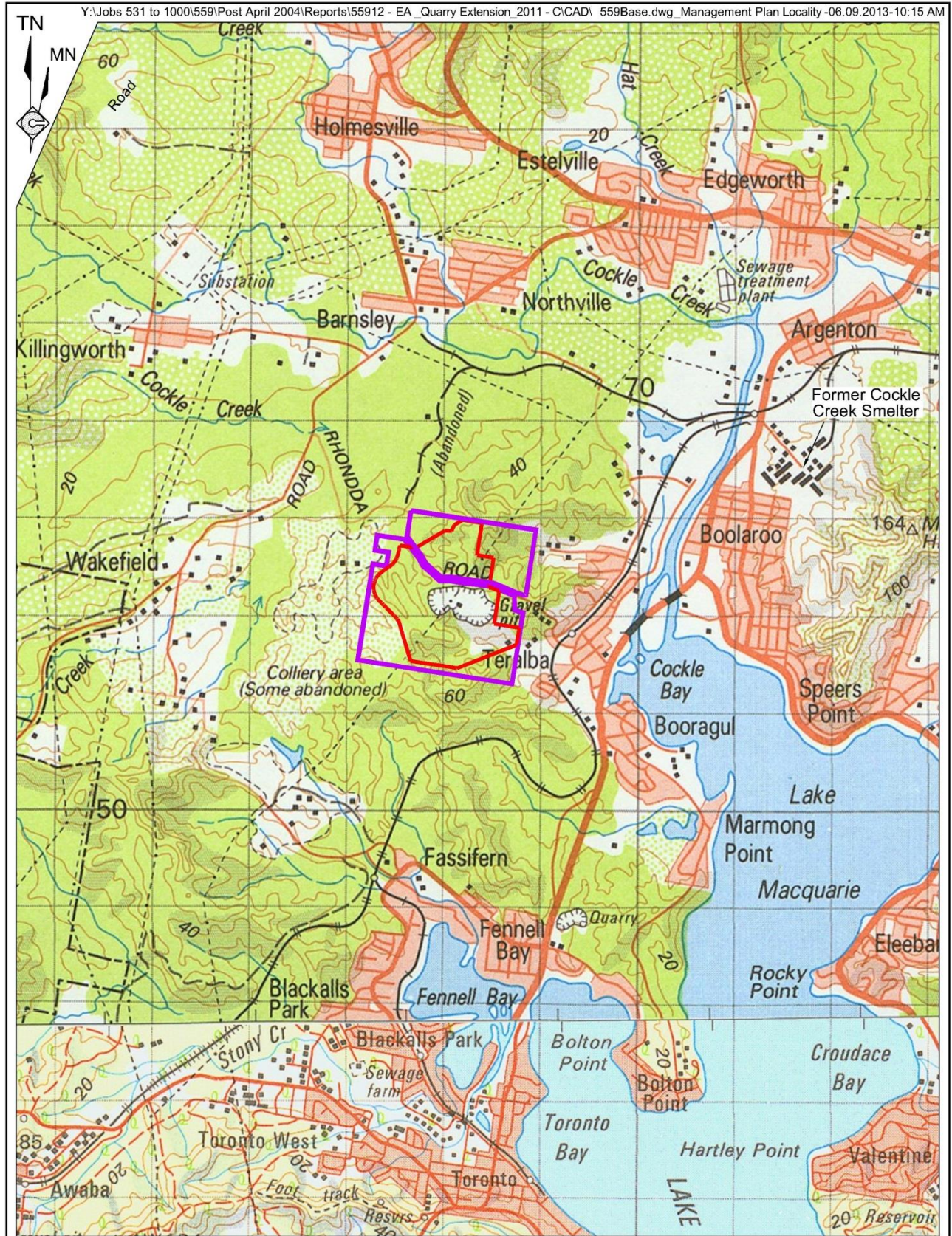


Figure 1.1
LOCALITY PLAN



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- The objectives and key performance outcomes for this Plan and the Quarry.
- Roles and responsibilities in implementing this Plan.
- Competence training and awareness for Metromix's personnel and contractors.
- The proximity of surrounding residences.
- A description of the potential blast-related impacts.
- Blast management measures that will be implemented during the ongoing operation of the Quarry.
- Blast-related monitoring that will be undertaken.
- Evaluation of compliance with blast criteria.
- Corrective and preventative actions that will be implemented should exceedance(s) of the relevant criteria be identified.
- Complaints handling and response procedures that will be implemented.
- Incident reporting procedures.
- Publication of monitoring information.
- Plan review.

The above elements reflect each of the relevant specific issues outlined in *Condition 5(3)* of PA 10_0183, where relevant.

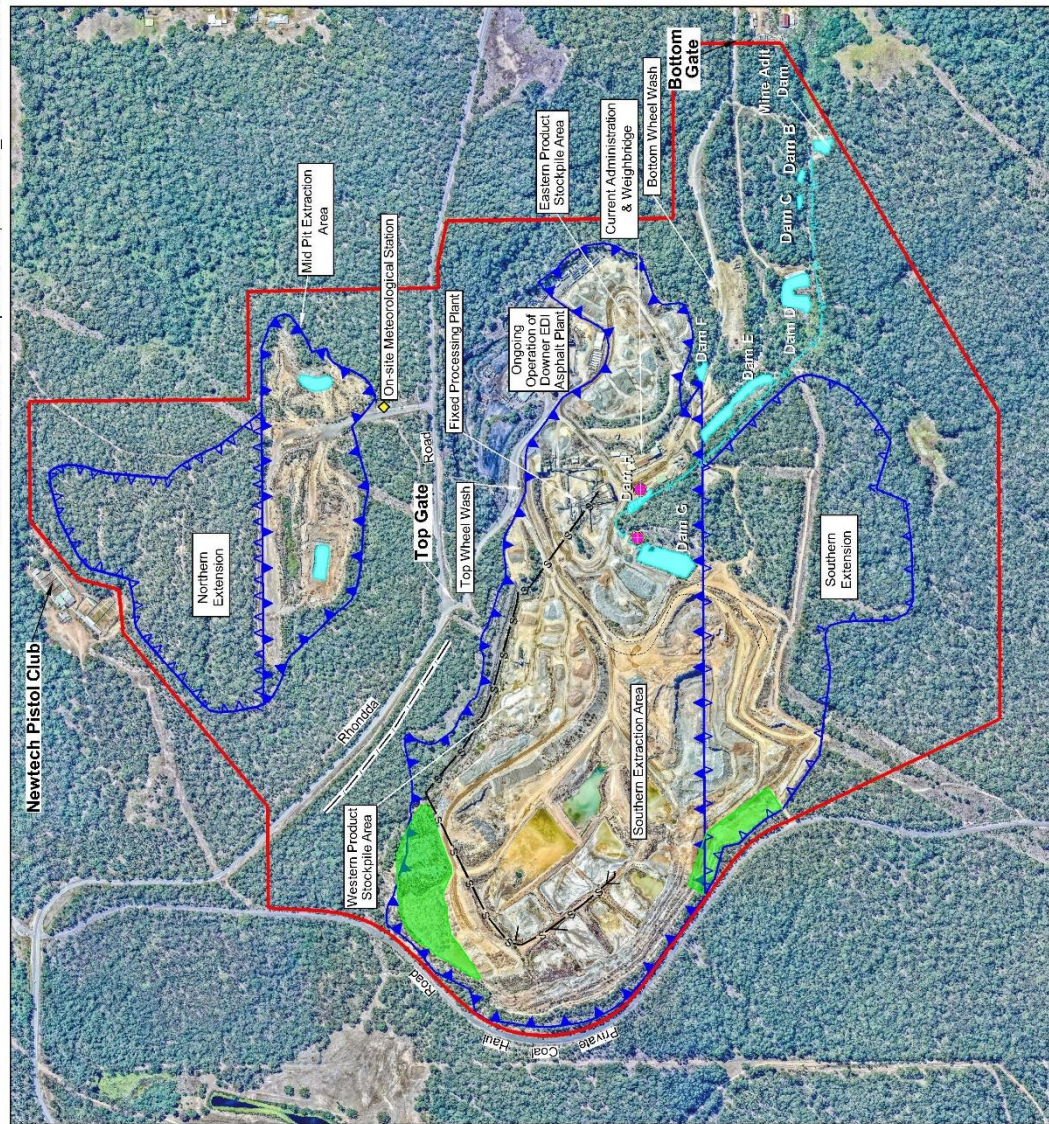
Blasting has been undertaken at Teralba Quarry for in excess of 40 years, 27 years of which has been undertaken by Metromix. Hence, this Plan reflects the considerable experience gained and documentation retained over those years.

2 APPROVED ACTIVITIES

The approved activities within the Teralba Quarry comprise the full range of activities undertaken prior to 22 February 2013 and the extension of extraction operations to the north and south of the previously approved extraction areas. The approved activities on site comprise the following, the locations of which are displayed on **Figure 2.1**.

- Conglomerate extraction (blasting and excavation).
 - Southern Extraction Area.
 - Mid Pit Extraction Area.
 - Southern Extension.
 - Northern Extension.
- Processing Operations (size reduction, screening and blending).
 - Existing processing plant and pug mill.

Y:\Jobs 531 to 1000\559\Post April 2004\Reports\55964_Annual Review 2017\CAD\559Base\MGA56.dwg_1.2 Approved Quarry Layout-19.07.2018-10:15 AM



- REFERENCE**
- Quarry Site Boundary
 - Extraction Area Boundary
 - Extension Area Boundary
 - Area Under Rehabilitation
 - Water Pipeline
 - Silt Pipeline
 - Dam
 - Water Cart Fill Point

Figure 2.1
QUARRY SITE LAYOUT





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- On-site Load and Haul Operations.
 - Off-road trucks on the on-site road network.
 - Proposed conveying primary-crushed rock from the Southern and Northern Extensions to processing plant (including conveyor beneath Rhondda Road).
- Off-site Transportation of Products.
- Vehicle/equipment maintenance and ancillary activities and stores.
- Administration and product despatch.
- Progressive rehabilitation and maintenance.

The sequence of extraction throughout the life of the Quarry will be consistent with the staging of vegetation clearing and therefore retirement of biodiversity credits specified in Conditions 3(54) to 3(56) of PA 10_0183. It is estimated that extraction activities over approximately the next 15 years, will only take place in the Southern Extension. Subject to sales, extraction activities will be progressively transferred beyond this period to the extraction areas north of Rhondda Road.

The relevant limitations upon the approved activities nominated in Conditions within Project Approval 10_0183_ are as follows.

- “The Proponent shall not carry out quarrying operations below 20 AHD in the Southern Extension and 24m AHD in the Mid Pit Extraction Area and Northern Extension” (*Condition 2(6)* of PA 10_0183).
- “The Proponent shall not extract more than 1.2 million tonnes of extractive materials from the site in any calendar year” (*Condition 2(7)* of PA 10_0183).

“The Proponent shall not:

- a) transport more than 1 million tonnes of quarry products from the site in any calendar year; or
 - b) despatch more than 326 laden trucks from the site on any day; or
 - c) despatch more than 241 laden trucks per day or 20 per hour westwards along Rhondda Road;
 - d) despatch more than 85 laden trucks per day or 8 per hour eastwards through Teralba;
 - e) despatch laden trucks for travel through Teralba between 6:00pm and 6:00am; or
 - f) receive unladen trucks via the Railway St entrance between 6:00pm and 7:00am”
- (*Condition 2(8)* of PA 10_0183).

The approved quarry life is until 31 December 2038 (*Condition 2(5)* of PA 10_0183) and the approved hours of operation are set out in **Table 2.1** in accordance with *Condition 3(6)* of PA 10_0183.



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Table 2-1: Approved Hours of Operation

Day	Receipt of Concrete or VENM	Loading and Despatch of Quarry Trucks	Extraction and Processing Operations
Monday to Friday	7:00am to 5:00pm	4:00am Monday to midnight Friday	7:00am to 7:00pm
Saturdays	7:00am to 2:00pm	midnight Friday to 6:00pm Saturday	7:00am to 2:00pm
Sundays and Public Holidays	None	None	None

Note: Maintenance activities may occur at any time provided they are inaudible at privately owned residences.

The approved hours of operations of blasting are between 10:00am and 4:00pm Monday to Friday, in accordance with *Condition 3(10)* of PA 10_0183.

3 CONSULTATION

3.1 GOVERNMENT AGENCY CONSULTATION

An updated draft of this plan prepared following approval of a modification to PA 10_0183 was provided to Council in October 2018. Council responded in October 2019 noted that it had no comments on the draft plan. The most recent Council comments are included in **Appendix 1**.

3.2 COMMUNITY CONSULTATION

Condition 3(16) of PA 10_0183 requires this Plan to be prepared in consultation with “interested members of the local community potentially affected by blasting operations”. The proposed blasting for both the Southern and Northern Extensions will occur at distances greater than 500m from any residences, i.e. the distance considered to be a threshold below which residents will not be potentially affected by blasting at the Teralba Quarry. This position is supported by the absence of substantiated blast-related complaints over many years of blasting. Notwithstanding this position, Metromix undertook a letterbox drop to all residences fronting the following streets in Teralba or as otherwise listed.

- Rhondda Road
- Watkins Lane
- Rodgers Street
- Railway Street (105 to 157)
- Pitt Street
- Myrtle Street
- James Street

The letter invited any resident to review or discuss the Blast Management Plan or practices. Metromix received no responses to the letterbox drop.

Metromix consults with the Community Consultative Committee twice per year and no issues relating to air quality or noise has been raised by the committee.

4 LEGAL AND OTHER REQUIREMENTS

4.1 PROJECT APPROVAL PA10_0183

Metromix was granted *Project Approval (PA) 10_0183* on 22 February 2013 pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval includes a comprehensive set of conditional requires that Metromix must comply with during the life of the Quarry and sets out the core requirements of this Plan in *Condition 5(3)* of PA 10_0183. Blast-related conditions relevant to operations within the Quarry within this approval are reproduced in **Table 4.1**.

Table 4-1: Blast-related Project Approval Conditions – Operations

Page 1 of 2

Condition	Requirement											
3(9)	<p>Blasting Criteria</p> <p>The Proponent shall ensure that the blasting on the site does not cause exceedances of the criteria in Table 4.</p> <p><i>Table 4: Blasting Criteria</i></p> <table border="1"> <thead> <tr> <th>Location</th> <th>Airblast overpressure (dB(Lin Peak))</th> <th>Ground vibration (mm/s)</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Any residence on privately owned land, or any public infrastructure</td> <td>120</td> <td>10</td> <td>0%</td> </tr> <tr> <td>115</td> <td>5</td> <td>5% of the total number of blasts over a period of 12 months</td> </tr> </tbody> </table> <p>However, these criteria do not apply if the Proponent has a written agreement with the relevant owner or infrastructure provider/owner, and the Proponent has advised the Department in writing of the terms of this agreement.</p>	Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	Any residence on privately owned land, or any public infrastructure	120	10	0%	115	5	5% of the total number of blasts over a period of 12 months
Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance									
Any residence on privately owned land, or any public infrastructure	120	10	0%									
	115	5	5% of the total number of blasts over a period of 12 months									
3(10)	<p>Blasting Hours</p> <p>The Proponent shall only carry out blasting onsite between 10:00am and 4:00pm Monday to Friday inclusive. No blasting is allowed on weekends or public holidays, or at any time without the written approval of the <i>Secretary</i>.</p>											
3(11)	<p>Blasting Frequency</p> <p>The Proponent shall not carry out more than one blast a day on site, unless an additional blast is required following a misfire.</p>											
3(12)	<p>Property Inspections</p> <p>If the Proponent receives a written request from the owner of any privately-owned land within 500 meters of proposed blasting for a property inspection to establish the baseline condition of any buildings and/or structures on his/her land, or to have a previous property inspection report updated, then within 2 months of receiving this request the Proponent shall:</p> <ol style="list-style-type: none"> a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the <i>Secretary</i>, to: <ul style="list-style-type: none"> - establish the baseline condition of any buildings and/or structures on the land, or update the previous property inspection report; and - identify any measures that should be implemented to minimise the potential blasting impacts of the project on these buildings and/or structures; and b) give the landowner a copy of the new or updated property inspection report. 											



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Table 4.1: Blast-related Project Approval Conditions – Operations (Cont'd)

Condition	Requirement
3(13)	<p>Property Investigations</p> <p>If the owner of any privately-owned land claims that the buildings and/or structures on his/her land have been damaged as a result of blasting on site, then within 2 months of receiving this claim in writing from the landowner the Proponent shall:</p> <ul style="list-style-type: none"> a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties, to investigate the claim; and b) give the landowner a copy of the property investigation report. <p>If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damages to the satisfaction of the <i>Secretary</i>.</p> <p>If the proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the <i>Secretary</i> for resolution.</p>
3(14)	<p>Operating Conditions</p> <p>During blasting operations, the Proponent shall:</p> <ul style="list-style-type: none"> a) implement best management practice to: <ul style="list-style-type: none"> - protect the safety of people and livestock in the surrounding area; - protect public or private infrastructure/property in the surrounding area from any damage; and - minimise the dust and fume emissions of any blasting;; and b) operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on site, <p>to the satisfaction of <i>Secretary</i>.</p>
3(15)	<p>The Proponent shall not undertake blasting within 500 metres of:</p> <ul style="list-style-type: none"> a) any public road without the approval of Council; or b) any land outside the site not owned by the Proponent, unless: <ul style="list-style-type: none"> - the Proponent has an agreement with the relevant landowner to allow blasting to be carried out closer to the land, and the Proponent has advised the Department in writing of the terms of this agreement, or - the Proponent has: <ul style="list-style-type: none"> ▪ demonstrated to the satisfaction of the <i>Secretary</i> that the blasting can be carried out closer to the land without compromising the safety of the people or livestock on the land, or damaging the buildings and/or structures on the land; and ▪ updated the Blast Management Plan to include the specific measures that will be implemented while blasting is being carried out within 500 meters of the land.

4.2 STATEMENT OF COMMITMENTS

Table 4.2 presents the blast-related commitments relevant to operations within the Quarry from the Statement of Commitments incorporated as Appendix 3 in the Project Approval and where each is addressed in this Plan.

Table 4-2: Blast-related Commitments – Operations

Commitment	Requirement
10.9	Review blast designs and modify, if required.
11.8	Schedule blasts so that they do not occur during high wind situations.

4.3 ENVIRONMENT PROTECTION LICENCE

Table 4.3 presents the relevant blast-related requirements from Section L5 within Environment Protection Licence (EPL) 536.

Table 4-3: Blast-related Environment Protection Licence 536 Conditions

Condition	Requirement	Addressed in Section
BLASTING		
Environment Protection Licence		
L6.1	Blasting in or on the premises must only be carried out between 1000 hours and 1600 hours Monday to Friday. Blasting in or on the premises must not take place on weekends or Public Holidays.	8.2
L6.2	The licensee is only permitted to carry out one (1) blast per day at the premises, unless an additional blast is required flowing a blast misfire.	8.2
L6.3	The airblast overpressure level from blasting operations at the premises must not exceed: a) 115dB (Lin Peak) at any noise sensitive locations for more than five per cent of the total number of blasts over each reporting period. b) 120dB (Lin Peak) at any noise sensitive locations. At any sensitive noise location. Error margins associated with any monitoring equipment used to measure this are not be taken into account in determining whether or not the limit has been exceeded.	Section 8 and Section 9
L6.4	Ground vibration peak particle velocity from the blasting operations at the premises must not exceed: a) 5mm/sec at any time at any noise sensitive location for more than five per cent of the total number of blasts over each reporting period. b) 10mm/sec at any time at any noise sensitive location. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Section 8 and Section 9
L6.5	Blasting limits apply at any residence, or noise sensitive location that is not owned by the licensee or subject of a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration or overpressure level.	Figure 7.1



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4.4 STATUTORY REQUIREMENTS

Blasting at the Teralba Quarry is conducted in accordance with the following statutes:

- Work Health and Safety (Mines and Petroleum) Act 2013.
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.
- Work Health and Safety Act 2011.
- Work Health and Safety Regulation 2017.
- Explosives Act 2003.
- Explosives Regulation 2013.

Metromix will also have regard to the NSW Resource Regulator guidance provided in the *Health and Safety at Quarries 2018* guideline when planning blast events with blasting contractors to ensure compliance with work place health and safety requirements.

5 OBJECTIVES AND OUTCOMES

Table 5.1 presents the objectives and key performance outcomes relating to blasting at Teralba Quarry.

Table 5-1: Objectives and Key Performance Outcomes

Objectives	Key Performance Outcomes
Blast	
(a) To ensure compliance with all relevant Project Approval and Environment Protection Licence conditions, commitments and reasonable community expectations.	(i) Compliance is achieved with all relevant criteria nominated in Tables 4.1, 4.2 and 4.3 and community complaints are minimised.
(b) To implement appropriate blast management and mitigation measures throughout the life of the Quarry.	(ii) All identified blast management and mitigation measures are implemented to the extent required.
(c) To implement an appropriate monitoring program to establish compliance or otherwise with relevant criteria throughout the life of the Quarry.	(iii) All nominated monitoring is undertaken in accordance with the relevant procedures for all blasts.
(d) To implement an appropriate complaints handling and response protocol	(iv) Complaints (if any) are handled and responded to in an appropriate and timely manner.
(e) To implement continual improvement for investigating, implementing and reporting on reasonable and feasible measures to reduce blasting impacts.	(v) An appropriate continual improvement program will be implemented throughout the life of the Quarry.
(f) To implement an appropriate incident reporting program, if required.	(vi) Incidents (if any) are reported in an appropriate and timely manner.

6 PERSONNEL MANAGEMENT

6.1 ROLES AND RESPONSIBILITY

Table 6.1 presents the roles and responsibilities for the implementation of this Plan.

Table 6-1: Roles and Responsibilities for Blast Management

Page 1 of 2

Role	Responsibility
Quarry Manager	<ul style="list-style-type: none"> Oversee the implementation of the Blast Management Plan. Co-ordinate blast monitoring in accordance with this Plan. Notify regulatory authorities and affected landholders of any blasting related exceedance and undertake associated reporting. Co-ordinate periodic reviews of this Plan. Assist the Blasting contractor with investigations of blasting exceedances, incidents or complaints. Co-ordinate the implementation of the Metromix blast monitoring program in accordance with this Plan. Co-ordinate the management of records and reporting of blast monitoring results. Manage blasting related complaints in accordance with the complaints management procedure. Maintain records for blasts initiated
Quarry Supervisor	<ul style="list-style-type: none"> Ensure the drill pattern is drilled in accordance with the blast design; and Ensure that the blast is loaded with the correct quantity and quality of explosive and stemmed in accordance with the blast design. Ensure all Metromix requirements are complied with during blasting operations Notify the Blasting Contractor of any factors that may lead to non-compliance with this Plan. Ensure the pre-blast checklist is strictly complied with. Ensure blasts are loaded and fired in accordance with the design supplied by the Blasting Contractor. Record drill status, including hole depths, pattern and relevant information, including any environmental issues and electronically stored on a database.
Blast Designer	<ul style="list-style-type: none"> Design blasts to meet objectives of this plan. Design blasts in accordance with this plan. Conduct design blast risk assessments.
Shotfirer	<ul style="list-style-type: none"> Load and initiate blasts in accordance with blast design and this plan. Conduct design blast risk assessments. Report any deviations from blast design to Blast Designer, Quarry Manager / Quarry Supervisor. Ensure blast monitoring equipment is positioned correctly.
All personnel and blast contractors	<ul style="list-style-type: none"> Comply with all relevant Blast Control Measures (see Section 8) Identify and report hazards that may present a risk of safety, health or environmental harm.



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The Quarry Manager will also be responsible for ensuring the appropriate blast management training is included in the induction for the relevant personnel.

6.2 COMPETENCE TRAINING AND AWARENESS

Metromix personnel are currently responsible for positioning and drilling all blast holes and a contractor delivers, loads and initiates all explosives. The contractor also monitors each blast.

All Metromix personnel, contractors and their employees involved in drilling and blasting operations are required to undergo training. The following areas are covered in the training.

- Blast management awareness.
- Communication procedures.
- Sentry Responsibilities.
- Lower Level Management Plan

In addition to the general training above, the driller, their supervisor and the personnel handling, transporting, loading and initiating the shot receive specialised explosive training and licencing.

7 SURROUNDING RESIDENCES AND POTENTIAL BLAST-RELATED IMPACTS

7.1 SURROUNDING LAND AND RESIDENCES

It is noted that in accordance with Condition 15(a) of Schedule 3 of PA 10_0183, Lake Macquarie City Council has confirmed approval for Metromix to blast within 500m of Rhondda Road, assuming that a 400m exclusion zone is maintained from Rhondda Road, suitable notification is provided to Council and the control measures described in this document are implemented (see **Appendix 2**).

Metromix is consulting with landowners to reach agreements that would satisfy Condition 15(b) of PA 10_0183 (either through written agreement or through consultation and control measures that satisfy the Secretary of the Department of Planning, Industry and Environment (DPIE)). Once this process is finalised, an update to this Plan would be presented to the DPIE for approval. Until that time, no blasting within 500m of privately-owned land will occur.

Figure 7.1 displays the locations of residences surrounding the Quarry Site. No residences are located within 500m of any proposed blasting nor have a direct line of sight to the planned blasting areas within approved extraction areas principally due to the design of the extraction areas whereby topography within extraction areas will shield the effects of blasting.



7.2 POTENTIAL BLAST-RELATED IMPACTS

7.2.1 Introduction

Blasting at Teralba Quarry is required to fragment the conglomerate which is loosely cemented. The type of blasts initiated are not conventional face blasts but rather blasts to disaggregate the conglomerate in situ which does not involve substantial movement of the conglomerate. Each blast at Teralba Quarry typically yields between approximately 10 000 tonnes and 60 000 tonnes and will typically occur up to twice per week.

This section describes the potential airblast overpressure and ground vibration structural impacts of blasting and the blast emission levels that were predicted during the environmental assessment of the proposed activities. This information was used in the design of mitigation measures and monitoring procedures described in Sections 10 and 11 to ensure best practices are adopted for blast management for the Quarry. In addition, this information will be used to ensure practices are developed for the continual improvement of blast management as described in Section 13.

The following sub-sections are provided as background information for members of the public and others who may be unfamiliar with blasting operations and describes the various blasting-related criteria and impacts on built structures associated with blasting operations.

Air blast overpressure is a pressure wave that travels through the air following a blast, while ground vibration is caused by energy from the blast travelling through the intervening rock strata surrounding the blast location.

7.2.1 Airblast Overpressure Structural Impacts

Plaster that has cracked within residences is the type of damage that is monitored in most airblast overpressure complaints. However, it is window panes that fail before any other structural damage. The probability of damage to window panes exposed to a single airblast overpressure event is listed in **Table 7.1**.

Table 7-1: Airblast Overpressure Structural Impacts

Airblast Overpressure dB Linear	Level kPa	Probability of Damage	Effects on Window Panes
140	0.2	0.01%	No damage – windows rattle
150	0.6	0.5%	Very occasional failure
160	2.0	20%	Substantial failure
180	20	95%	Almost all fail



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It should be noted that Metromix operates with an airblast overpressure limit of 115dB for the majority of blasts (an exceedance to a limit of 120dB is permitted for 5% of blasts).

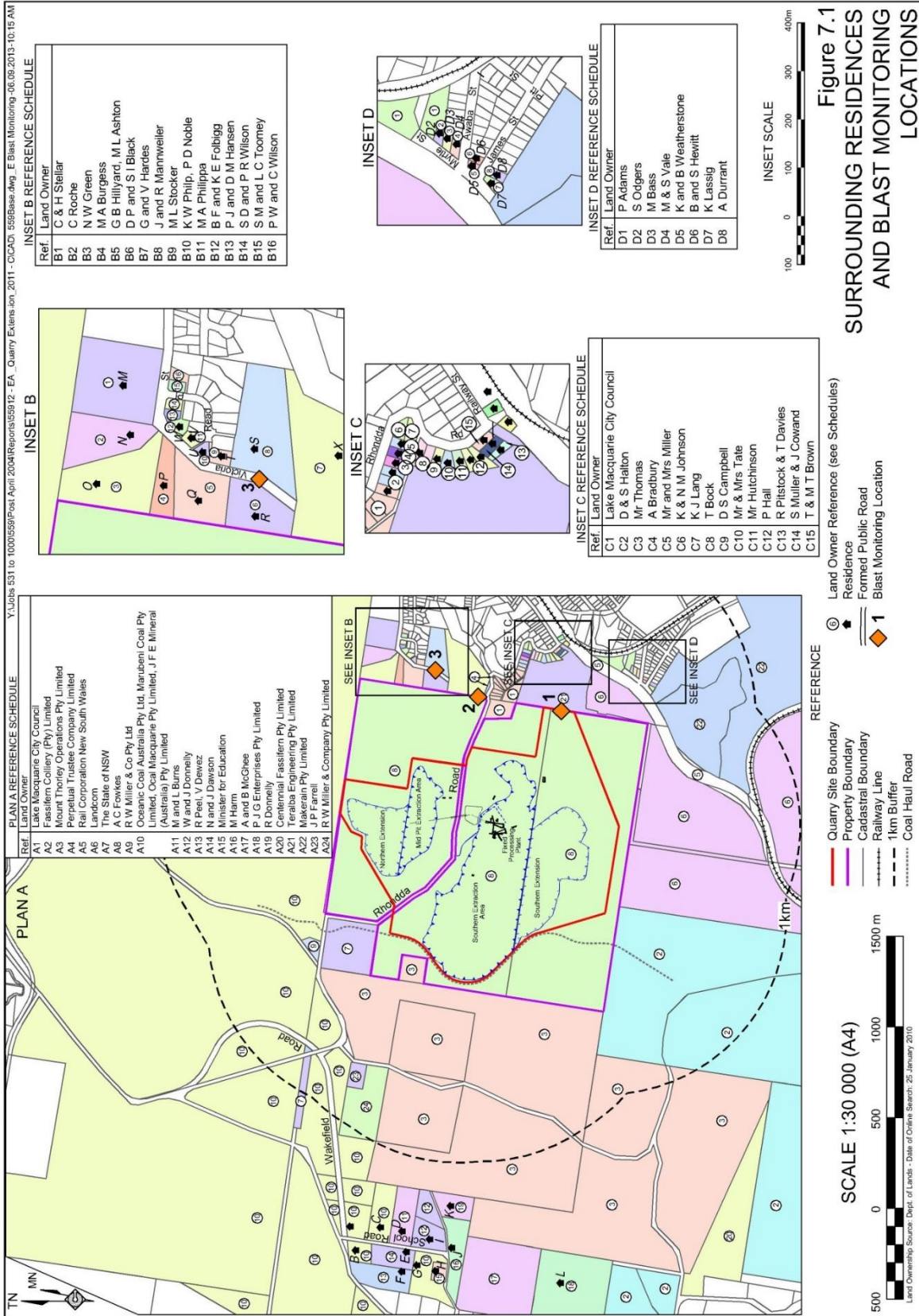
7.2.2 Ground Vibration Structural Impacts

Guide values presented in the British Standard BS 7385 that have been assessed to determine the level of ground vibration that minimises risks for cosmetic damage to residential and industrial buildings are listed in **Table 7.2**.

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Figure 7.1 Surrounding Residences and Blast Monitoring Locations (A4 Colour)





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Table 7-2: Ground Vibration Structural Impacts

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures. Industrial or commercial buildings.	50mm/s above 4Hz	50mm/s
2	Unreinforced or light frame structures. Residential or light commercial buildings	15mm/s to 4Hz increasing to 20mm/s to 15Hz	20mm/s to 15Hz increasing to 50mm/s to 40Hz

Source: BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

7.2.3 Flyrock Impacts

Blasting effectively fragments rock to allow it to be excavated and processed to yield the products required by customers. The energy released during a blast not only fragments the rock to the required size but can propel the fragmented rock a distance from the blast site. Every blast is designed with a blast envelope in which the fragmented rock is designed to remain within. For blasts at Teralba Quarry, the blast envelope is typically <50m from the blast site. Periodically, irregular discontinuities in the conglomerate or other localised features cause the fragmented rock to be propelled beyond the blast envelope. This rock is referred to as “flyrock”.

Potential flyrock impacts relate to both property damage or injury to persons within the area where flyrock lands. For Teralba Quarry, the potential flyrock impacts should not affect the closest residences to an approved extraction area within Teralba Quarry as all blasts will be initiated at distances greater than 500m. This distance is well in excess of the minimum 348m minimum exclusion zone for personnel determined in the flyrock exclusion zone assessment prepared by Orica which has been extended to 400m for blast management controls to be conservative (see **Appendix 3**).

The potential for persons or domestic/farm animals to be present within the “safety zone” during a blast is highly unlikely as it is Metromix’s practice to have a sentry on the coal haul road in conjunction with sentries on our internal road network.

It is estimated that during the next 15 years blasting will be confined to the Southern Extension which is between 1450m and 2300m from the closest residence to the west and between 790m and 1630m from the closest residence to the east. Rhondda Road is approximately 400m north of the closest blasting location within the Southern Extension. Given these distances and the flyrock assessment by Orica (**Appendix 3**), there will be no need to notify any residents or close Rhondda Road for short periods during a blast. It is noteworthy that Metromix has been blasting in the Southern Extraction Area at distances of 200m to 450m from Rhondda Road over the past 20 years without incident.

7.2.4 Fumes

Blasts have the potential to generate fugitive gases or fumes comprising mainly nitric oxide (NO) and nitrogen dioxide (NO₂). The concentration of NO₂ presents the greatest concern with respect to

health impacts. The presence of the oxides of nitrogen is invariably observed as visible clouds with a light brown (low concentrations) to dark orange (high concentrations) colour. The generation of oxides of nitrogen is attributable to many causes although ingress/presence of moisture is a common cause.

7.3 PREDICTED LEVELS OF BLAST EMISSIONS

During the environmental assessment of the Teralba Quarry extensions, the predicted levels of airblast overpressure and ground vibration were assessed by Spectrum Acoustics (2011) for a range of distances and maximum instantaneous charges with these predictions presented in Table 7.3.

Blasting risks and impacts are ultimately determined by a range of parameters, with these managed by the blasting contractors when designing a blast that suits the conditions at the Quarry. Given the many hundreds of blasts initiated at the quarry in the past Metromix has considerable experience in adjusting blast design parameters to ensure the blasting criteria are satisfied. Further information on the design of the blasts and control measures is provided in Section 8.2.

The predicted values for airblast overpressure and ground vibration presented in Table 7.3 are theoretical, with blasts to be adapted over time based on the feedback from monitoring results and through development of a clearer understanding of the site geology, climate and other factors. In order to ensure that blast emissions remain within the specified EPL criteria, the site blast emission site law will continue to be regularly reviewed.

Table 7-3 Theoretical Overpressure and Ground Vibration Values

Distance	Airblast Overpressure (dB)	Ground Vibration (PVS)
12kg MIC		
450m	114.3	0.64
600m	112.6	0.45
700m	111.7	0.37
800m	110.9	0.32
1000m	109.6	0.24
20kg MIC		
450m	115.3	0.88
600m	113.6	0.62
700m	112.7	0.51
800m	111.9	0.44
1000m	110.7	0.33
40kg MIC		
450m	116.4	1.34
600m	114.7	0.94
700m	113.8	0.78
800m	113.0	0.66
1000m	111.7	0.50
60kg MIC		
450m	117.0	1.71
600m	115.3	1.20
700m	114.4	1.00
800m	113.6	0.85
1000m	112.3	0.65



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7.4 MONITORED BLAST IMPACTS

Metromix provides a summary of all blast monitoring in the Annual Review for each year. **Table 7.4** provides a summary of results over the period from 2013 to 2017. The results demonstrate the negligible blast impacts experienced over this time and reinforce the assertion that Metromix has comprehensive experience planning blast events at the Quarry.

Table 7-3 Blast Monitoring Results 2013 – 2017

Year	Number of Blasts	Blast Monitor Not Triggered	Percentage Not Triggered	Highest Airblast Over pressure (dB(L))	Highest Ground Vibration (mm/s)
2013	32	26	81.3%	109.5	0.81
2014	41	37	90.2%	119.0	0.75
2015	31	30	96.8%	109.9	0.22
2016	39	39	100%	-	-
2017	36	8	22.2%	112.8	0.84
Criteria				115/120	5.0/10.0

8 CONTROL MEASURES

8.1 INTRODUCTION

Condition 3(16)(c) of PA 10_0183 requires this Plan to describe the measures that will be implemented to ensure:

- best management practice is being employed; and
- compliance with the relevant conditions of *Project Approval 10_0183 (Table 4.1)*.

8.2 BLASTING NOTIFICATION

Metromix will ensure that those parties that have requested notification of proposed blasting activities would be notified of intended activities. The current blasting notification protocols include the following.

- Notification of Lake Macquarie City Council by email at least one week (7 days) prior to intended blasting events.
- Neighbouring resource companies (Centennial Coal and Glencore) are to be notified by email at least 24 hours prior to intended blasting events.
- Any community members or groups that request notification will be notified in accordance with their preferences (timing and method), where reasonable. There are currently no community members or groups that have requested notification.



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8.3 OPERATING HOURS AND FREQUENCY OF BLASTING.

Metromix will ensure that the approved operating hours for blasting (10:00am to 4:00pm Monday to Friday only) and conditions identified in (**Table 4.1**) are strictly complied with.

The Quarry Manager will be responsible for ensuring the operating hours are included in Metromix's and the contractor's Safe Work Method Statements and that no breaches of this condition will be tolerated.

Blasting will occur no more than once per day except in the event of a misfire. Historically blasting has been required no more than twice per week.

8.4 OPERATING CONDITIONS

8.4.1 Blasting Operations

All blasting will be undertaken in accordance with *AS 2187.2 Explosive Storage, Transport and Use (2006)*. The following lists the key control measures that will be implemented to satisfy these requirements.

- Blast design including limiting Maximum Instantaneous Charge (MIC).
- Drilling and loading techniques.
- Blasting techniques including types of explosives and detonators being used.
- Timing of blast (initiation sequence, timing and direction).

8.4.2 Flyrock, Dust and Fume Management Measures

All blasting will continue to be undertaken with the adoption of the following well-proven control measures at Teralba Quarry to minimise flyrock and dust emissions from each blast.

- Control of burdens (target average of 2.8m and minimum of 2.5m, with 2.3m considered a worst-case scenario where a low density and lower energy bulk explosive is used).
- Minimum of 1.8m of 10mm or 14mm stemming material.

Metromix has worked closely with its explosive supplier to implement management measures that avoid/minimise the generation of oxides of nitrogen and hence any visible blast fumes. The key management measures adopted are as follows.

- Control of explosive type and optimum/correct fuel content for damp and wet holes, i.e. use of a heavy ANFO-based explosive.
- Ensuring weathered, soft conglomerate is removed by bulldozer or excavator and not blasted.



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- Utilising free face blasts whenever possible.
- Reduce the number of fully confined blasts.

8.4.3 Management of Air Blast Overpressure and Ground Vibration

AS2187.2 (2006) describes control measures that may be effective in reducing the impact of air blast. These control measures may include one or more of the measures presented in **Table 8.1**. All blasting activities at the Quarry are designed and undertaken by external contractors and ultimately it is the responsibility of the blast contractors to determine which of the relevant controls are required for any blast event. Regardless, the controls presented in **Table 8.1** are included to educate Metromix personnel on the appropriate measures to assist in their management of these processes.

Table 8-1 Air Blast Overpressure and Ground Vibration Controls

Variables	Ground Vibration			Air Blast		
	Influence on ground vibration			Influence on overpressure		
	Significant	Moderately Significant	Insignificant	Significant	Moderately Significant	Insignificant
1. Within the Control of blasting operators						
MIC: Maximum instantaneous charge (Effective charge mass per delay)	✓			✓		
Delay interval	✓			✓		
Burden and spacing		✓		✓		
Stemming amount or type			✓	✓		
Charge length and diameter			✓		✓	
Angle of blast hole			✓			✓
Direction of initiation		✓		✓		
Charge mass per blast			✓			✓
Charge depth			✓	✓		
Covering of detonating cord			✓	✓		
Charge confinement	✓			✓		
Blasthole deviation	✓					
2. Not within the control of blasting operators						
General surface			✓		✓	
Geological conditions	✓			✓		
Wind and weather conditions			✓	✓		
Water saturated ground	✓					✓
Source: AS2187.2 -2006 Table J6.1						



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8.4.4 Safety Measures

The Quarry Manager will be responsible to ensure that the relevant safety measures have been implemented prior to blasting within the Quarry.

8.5 PROPERTY INSPECTIONS

Given all surrounding residences are greater than 500m from the approved extraction area where blasts will be initiated, no property inspections will be required.

8.6 PROPERTY INVESTIGATIONS

The Quarry Manager will be responsible to ensure any claims of damage due to blasting are managed according to the requirements of Condition 3(13) of Project Approval 10_0183.

9 MONITORING

9.1 INTRODUCTION

Condition 3(14)(a)(b) of PA 10_0183 requires that this Plan include a protocol for evaluating blasting impacts and demonstrating compliance with the blasting criteria at all privately-owned residences and structures. This sub-section has been prepared in satisfaction of that requirement.

All blast monitoring will be undertaken in accordance with the following sections.

9.2 BLAST MONITORING LOCATIONS

Figure 7.1 shows the locations of three blast monitoring sites used to monitor airblast and ground vibration from blasts undertaken at Teralba Quarry. The locations and coordinates of each monitoring site are as set out in Table 9.1.

Table 9-1 Blasting Monitoring Locations

Site	Easting	Northing
1	368912	6351945
2	369065	6352305
3	369139	6352621

9.3 FUME MONITORING

Fume monitoring will be undertaken utilising the following procedure.

- Video recording and analysis of each blast to determine visible fume generation and the resulting video being stored for a minimum of one year;



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- Video footage for each blasting event will be taken for a minimum of at least 1 minute duration and follow the blast until the visible fume (if present) has dissipated or leaves the view of the camera;
- Evaluate any visible fume event in accordance with colour chart analysis consistent with the *Code of Practice Prevention and Management of Blast Generated NOx Gases in Surface Blasting* - Australian Explosives Industry and Safety Group Inc. 2011¹ (refer to **Appendix 4** for details) and records for fume assessment must be kept for a minimum of 2 years; and
- Record the meteorological conditions during the period any visible fume occurs.

All fume monitoring should be undertaken in conjunction with the blast contractors. Where blast fumes are visible (i.e. greater than Level 1 in accordance with the colour charts provided in **Appendix 4**) an investigation of blast fume causes should be undertaken to inform future blast design.

Where blast fumes are not localised and are observed to leave the Quarry Site, neighbours in the vicinity of the blast would be notified of the event through door-knocking of residences in the vicinity.

Where necessary, the blast controls (Section 8.3.2) would be revisited and updated to reflect modified control measures that are implemented as a result of the above review.

9.4 BLAST MONITORING PROTOCOL

Each blast will be monitored for air blast overpressure and ground vibration at the locations identified in **Table 9.1**. Blast monitoring is undertaken at two locations during each blast. Blasts initiated south of Rhondda Road are monitored at Sites 1 and 2 whilst blasts north of Rhondda Road are monitored at Sites 2 and 3.

All blast monitoring instrumentation will be installed, calibrated and maintained in accordance with both AS2187.2 - 2006 and the manufacturer's specifications.

The Blasting Contractor will be responsible for blast monitoring and Metromix's Quarry Supervisor is responsible for over-seeing the monitoring and reviewing the video of each blast.

10 EVALUATION OF COMPLIANCE

The monitoring results will be reviewed by the Quarry Manager and a record of the time of blast and ground vibration and overpressure included within the results table for *Annual Review*. A copy of the results sheet will be updated on Metromix's website on a monthly basis.

¹ See <http://www.aeiscg.org.au/aeiscg-codes-of-practice/>



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11 CORRECTIVE AND PREVENTATIVE ACTIONS

In the event that blast monitoring identifies an exceedance of the blast criteria identified in *Conditions 3(8) and 3(9)* of PA 10_0183, the exceedance will be investigated to determine the likely cause. All corrective and preventative actions are entered into the Rapid Online Reporting Database. An investigation will then follow to determine:

- what immediate action(s) shall be taken to fix the problem in the short term, if applicable;
- the root causes of the problem (i.e. management system, human factors/behaviour, work environment, training);
- corrective actions required to eliminate the root cause(s);
- action(s) taken to verify effectiveness of corrective action(s) (i.e. what measures and checks are taken to ensure the corrective actions that are in place are effective to prevent any further exceedance).

On completion of the investigation, an electronic copy will be forwarded to Metromix's Risk Manager for review/approval of corrective and preventative actions.

In accordance with Metromix's SHE procedures, if an event or activity occurs within the Quarry Site that has caused, is causing, or is likely to cause harm to the environment, whether the harm occurs on or off the premises, Metromix will report the event to the EPA after it becomes known to any employee or contractor. The reporting will be undertaken in accordance with the Company's Pollution Incident Response Management Plan, i.e. DPIE and EPA will be notified by Metromix as soon as practicable after the incident and a report will be prepared and submitted to the DP&E and EPA within 7 days of the exceedance in accordance with *Condition 5(7)* of PA 10_0183.

Corrective and/or preventative actions will be assigned to relevant Metromix personnel. Actions will be communicated internally through planning meetings and toolbox talks and outstanding actions will be monitored for their effectiveness upon completion.

12 COMPLAINTS HANDLING AND RESPONSE

Metromix will advertise the community inquires/complaints line 02 4950 6640 as a minimum in the local phone directory and may also consider advertising the number through local media or on newsletters. Contact information for the purpose of complaints or in the case of emergency is available on signage at the two entrances to the Quarry and from the Metromix website.

Metromix will respond to any registered community inquiries or complaints received as described in the Rapid Online Reporting System. However, the flowchart in Chapter 13 shows the process that Metromix will follow in the event a noise complaint is received.



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All complaints will be recorded using a proforma complaints record sheet and the nature and outcome of the complaint and subsequent investigation provided in summary form to the Community Consultative Committee and in the Annual Review.

INCIDENT REPORTING

PA 10_0183 defines an incident is an occurrence or set of circumstances that:

- causes or threatens to cause material harm to the environment; and/or
- exceeds the limits or performance measures/criteria in this approval

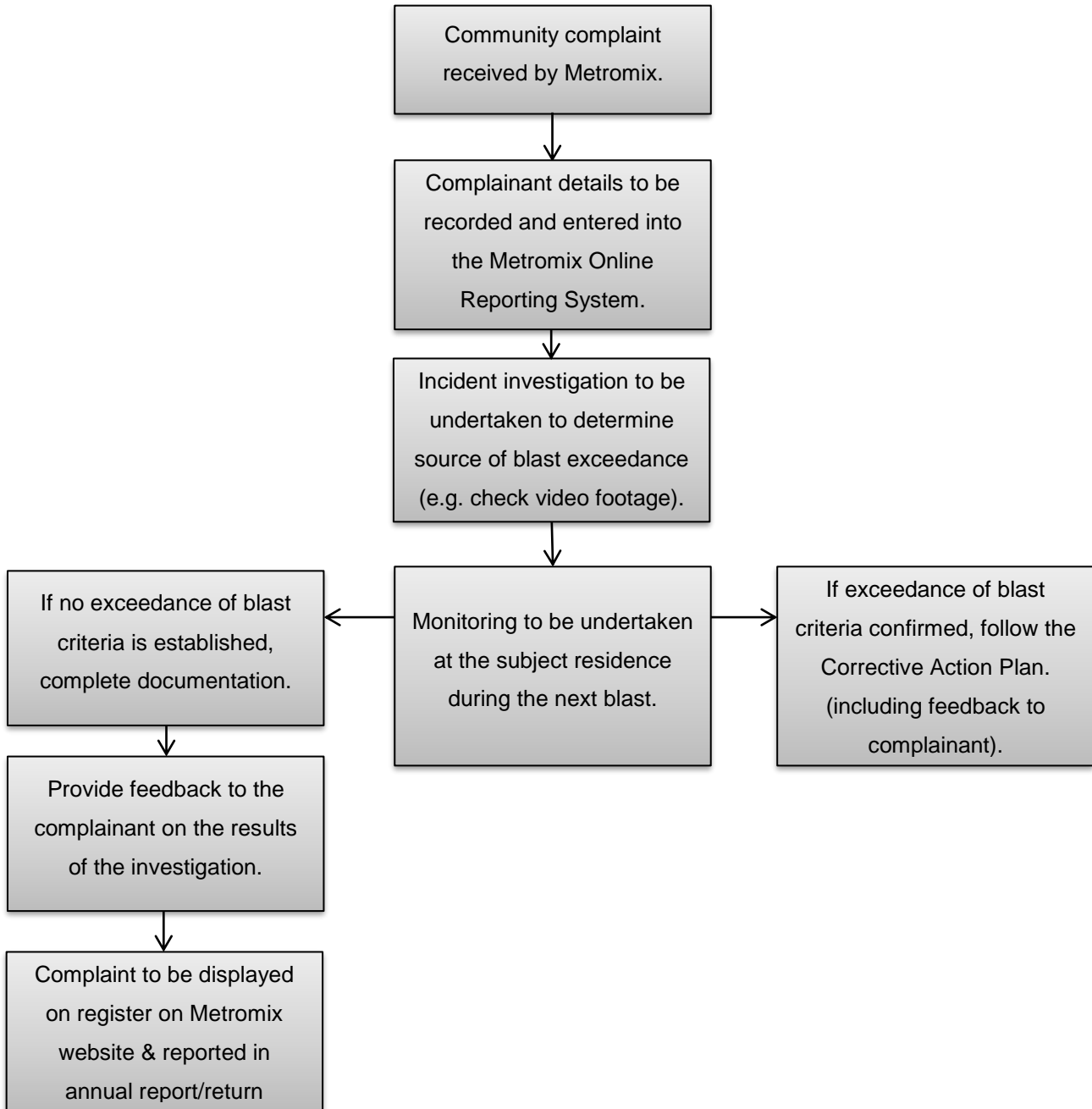
where material harm to the environment is unauthorised harm that:

- involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or
- results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)

Incidents relating to blast management are to be recorded using the “Rapid Online Reporting System” that is available through the Metromix website. The Risk Manager is to be notified as soon as possible to assist in determining appropriate corrective actions.

All incidents are to be notified to the Department of Planning, Industry and Environment in accordance with Condition 7 of Schedule 5 of PA 10_0183 and a report detailing at a minimum the time and date of the incident, details of the incident, measures implemented to prevent re-occurrence and discussion of any non-compliance with PA 10_0183 that resulted.

In addition, a summary of all incident reports will be provided to the Community Consultative Committee (CCC), made publicly available on the Metromix website and included in the *Annual Review* for the Quarry.



13 PUBLICATION OF MONITORING INFORMATION

The following information relating to each blast initiated at the Quarry will be included in each Annual Review and included in the Metromix website:

- a) the date and time of the blast;
- b) the location and approximate elevation of the blast on the premises;
- c) the blast monitoring results at each blast monitoring station; and
- d) an explanation for any missing blast monitoring results, if relevant.



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Blast monitoring results will also be presented at CCC meetings and will also be made available to the public via the Metromix Website. These results are to be updated on a monthly basis.

14 PLAN REVIEW

In accordance with *Condition 5(3)(h)* of PA 10_0183, this *Blast Management Plan* will be reviewed and, if required, revised within 3 months of an:

- a) annual review;
- b) incident report;
- c) independent audit report; or
- d) any modification Project Approval 10_0183.

The Quarry Manager will be responsible for the review of this Plan.



Appendices

- Appendix 1 Consultation Record
- Appendix 2 Lake Macquarie City Council – Blasting approval (dated 7 January 2020)
- Appendix 3 Determining the Exclusion Zone for the Metro-Mix Teralba Quarry (August 2019)
- Appendix 4 Blast Fume Visual Rating Guide (Appendix 2 and Appendix 3 from the *Code of Practice Prevention and Management of Blast Generated NOx Gases in Surface Blasting - Australian Explosives Industry and Safety Group Inc. 2011*)



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Appendix 1

Consultation Record



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Blast Management Plan

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From: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Sent: Friday, 11 October 2019 4:33 PM
To: Nicholas Warren
Subject: RE: 559 - Teralba Quarry - Management Plan

Hi Nicholas,

I have received a response for air quality and blast management as below:

Blast Management Plan

I have reviewed the report titled *Metromix Pty Limited, Blast Management Plan (Incorporating a Blast Monitoring Program), November 2016* prepared by Metromix.

The report was initially approved by the Secretary's nominee Howard Reed on 10 October 2013.

The changes to this plan are mostly administrative such as the project approval reference, the Environmental Protection Licence conditions and the relevant legislation. There is also the inclusion of blast monitoring data from 2013 to 2017.

As a result, there are no objections to the updated report.

Air Quality Management Plan

I have reviewed the report titled *Metromix Pty Limited, Air Quality Management Plan (Incorporating Weather Monitoring), February 2019* prepared by Metromix.

The report was initially approved by the Secretary's nominee Howard Reed on 10 October 2013.

The changes to this plan are mostly administrative such as the project approval reference. There is also the inclusion of historic air quality monitoring results from 2013 to 2017.

In relation to traffic management plan the following comment has been received:

Roads maintenance and asset implications

In the Transport Management Plan Page 15 under Clause 4.3 Statement of Commitments –Commitments Table 4.3 - Item 9.4

“Provide a contribution to Lake Macquarie City Council during the ongoing life of the quarry if a suitable project approval is granted. “

In accordance with Lake Macquarie City Council's Contributions Plan- Toronto Contributions Catchment 2016- Part 4 Community Infrastructure and Contributions Item 4.2 Road Haulage - Council will seek road haulage contributions from developments that generate heavy vehicle movements as a significant and integral component of their operations.

A range of factors will be taken into consideration when calculating the haulage contribution rate for each applicable development including:

- The affected road sections and pavement types
- The rehabilitation costs, routine maintenance costs and programmed maintenance costs
- Existing traffic load quantified in terms of the number of equivalent standard axle loads
- Proposed increase in traffic load as a result of the development proposal quantified in:-
- ✓ terms of ESA
- ✓ Quantity of goods or materials proposed to be transported along nominated haulage routes as specified in the development proposal.

Council will calculate the haulage contribution rate for each applicable development using the formula as described in the plan, that could be levied on a tonne per kilometre or average rate per tonne that may leave the facility. A review of the agreed levy must be allowable based on any changes to the operation of the plant and impact on surrounding road network.



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Truck configuration leaving the facility affects the ESA determination for the haulage levy and details on type and size of trucks may need further clarification. Should new markets, for the products be found, then this will influence production, routes and truck configuration.

Previous discussions held with Metromix regarding the proposed levy will require further work to enable the proposed payment structure to proceed.

All truck movements are to adhere to the approved routes. No truck movements in a Northerly direction along Racecourse Road shall be permitted that runs off Route 3 and Route 4.

Kind Regards,

Glen Mathews

Senior Development Planner



T 02 4921 0399 M 0439 647 504
E gmathews@lakemac.nsw.gov.au

lakemac.com.au



From: Nicholas Warren <nick@rwcorkery.com>

Sent: Tuesday, 8 October 2019 10:26 AM

To: Glen Mathews <gmathews@lakemac.nsw.gov.au>

Cc: Mo Yunusa <MoY@metromix.com.au>; Melissa Anderson <Melissa.Anderson@planning.nsw.gov.au>

Subject: RE: 559 - Teralba Quarry - Management Plan

Hi Glen,

I thought to follow up on the Teralba Quarry Air Quality Management Plan, Blast Management Plan and the Transport Management Plan comments from Council.

Please be advised that due to the length of time taken to receive comments, if we do not receive feedback by the end of this week, we will proceed to submit the plans to DPIE for final approval.

Metromix are operating in accordance with approved plans, however have been waiting almost 12 months since these plans were first submitted to Council.

Regards,
Nick

Nick Warren

Principal Environmental Consultant

B.Sc., M. Bus., M. Env.Sc.

Phone: 02 9985 8511

Mobile: 0437 635 975

Email: nick@rwcorkery.com

RW Corkery & Co Pty Limited

Geological and Environmental Consultants



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From: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Sent: Friday, 6 September 2019 11:57 AM
To: Nicholas Warren <nick@rwcorkery.com>
Cc: Mo Yunusa <MoY@metromix.com.au>
Subject: RE: 559 - Teralba Quarry - Management Plan

Hi Nick,

I have received feed back from Council's waste section yesterday identifying:

Waste Storage:

- *The plan does not detail waste storage areas on the site to demonstrate that there is sufficient, safely accessible storage space (including routes between waste sources and storage) and communicate where each waste type is to be stored.*

Waste Collection:

- *The waste management plan and transport management plan do not detail waste collection vehicle access routes, turn circles and clearances. Although the transport plan mentions contractors must be provided with competence training, it does not clarify whether this applies to contracted waste collection vehicles.*

Air quality have been in contact and a reviewing currently and I will chase traffic again for their comments on the transport management plan.

Kind Regards,

Glen Mathews
Senior Development Planner



T 02 4921 0399 M 0439 647 504
E gmathews@lakemac.nsw.gov.au
lakemac.com.au

From: Nicholas Warren <nick@rwcorkery.com>
Sent: Friday, 6 September 2019 11:44 AM
To: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Cc: Mo Yunusa <MoY@metromix.com.au>
Subject: FW: 559 - Teralba Quarry - Management Plan

Hi Glen,

Can you please give me an update on progress with this review?

Please let me know if you are not intending to review these plans so we can let the Department of Planning know that they can complete their review.

Regards,
Nick

Nick Warren
Principal Environmental Consultant
B.Sc., M. Bus., M. Env.Sc.
Phone: 02 9985 8511
Mobile: 0437 635 975
Email: nick@rwcorkery.com



Blast Management Plan (Incorporating a Blast Management Program)



RW Corkery & Co Pty Limited
Geological and Environmental Consultants



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From: Nicholas Warren
Sent: Friday, 16 August 2019 4:02 PM
To: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Cc: 'Mr Mo Yunusa' <moy@metromix.com.au>
Subject: FW: 559 - Teralba Quarry - Management Plan

Hi Glen,

As discussed, please use this link to download the four management plans for the Teralba Quarry.

<https://www.sendthisfile.com/Egl8PE2hodIntYHL8yn2fxic>

Files:

55946_Air Quality Management Plan_February 2019.pdf
55946_Transport Management Plan_20190321.pdf
55956_Blast Management Plan_November 2018.pdf
55956_Waste Management Plan_20190328.pdf

Regards,
Nick

Nick Warren
Principal Environmental Consultant
B.Sc., M. Bus., M. Env.Sc.
Phone: 02 9985 8511
Mobile: 0437 635 975
Email: nick@rwcorkery.com

RW Corkery & Co Pty Limited
Geological and Environmental Consultants



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From: Nicholas Warren
Sent: Thursday, 28 March 2019 12:55 PM
To: 'gmathews@lakemac.nsw.gov.au' <gmathews@lakemac.nsw.gov.au>
Cc: 'Mo Yunusa' <MoY@metromix.com.au>
Subject: 559 - Teralba Quarry - Management Plan

Greeting Glenn,

I have finalised the relevant review and updates to the management plans for the Teralba Quarry. The following plans are provided for your review and comment.

1. Air Quality Management Plan – Updated to incorporate the relocation of a dust gauge.
2. Transport Management Plan – Updated to incorporate the comments received from RMS on 12 January 2019.



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3. Blast Management Plan
4. Waste Management Plan

You can download the plans from the following link. Please note this link expires in 8 days.

<https://www.sendthisfile.com/EtfJEo4usBpOZDUYpMyCFSyR>

Files:

55956_Waste Management Plan_20190328.pdf
55946_Air Quality Management Plan_February 2019.pdf
55946_Transport Management Plan_20190321.pdf
55956_Blast Management Plan_November 2018.pdf

It would be appreciated if you could provide a consolidated set of comments on these plans once you have had the opportunity to review the documents. I appreciate that other personnel within Council will be reviewing these documents but it would be more efficient if the comments are provided together.

Please note that I have spoken to Janine Koppel and I believe she is finalising a response to you on the plans that she has reviewed. Her input was much appreciated.

We are in the process of reviewing the Biodiversity and Rehabilitation Management Plan to address comments from Council and expect to have this over to you today or tomorrow.

Regards,
Nick

Nick Warren
Senior Environmental Consultant
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Appendix 2

Lake Macquarie City Council – Blasting approval (dated 7 and 14 January 2020)



Blast Management Plan

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Blast Management Plan

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From: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Sent: Tuesday, 7 January 2020 11:20 AM
To: Nicholas Warren
Cc: Mo Yunusa; Amy Regado; Elizabeth Lambert
Subject: RE: 559 - Teralba Quarry - Blast Management

Hi Nicholas,

The first recommendation of conclusions provided within the Orica document dated 21/08/2019, *Determining the exclusion zone for metro-mix Teralba quarry*, recommends an exclusion zone of 400m be provided for personnel, as such this should be applied to the public domain.

Council has concern with the incident reporting process identified within section 12 of the Metromix Pty Ltd - Blast management plan. Contact details are not easily identified and should a new resident or motorist driving along Rhonda Road be unaware of works it would be difficult to contact Metromix and lodge their concerns. It is recommended emergency contact details be placed on signage at the main entrance to the quarry to enable issues to be appropriately directed. Further to this for any future blasting events within 500m of Rhondda Road, Council would request that seven day's notice be provided to ensure Council is aware should any enquiries be received.

Subject to works being undertaken in compliance with the NSW Resource Regulation Health and Safety at Quarries 2018, Metromix Blast Management Plan, Orica Determining the exclusion zone for Metromix Teralba quarry and compliance with the above recommendation Council raises no objection to blasting occurring within 400m of the Rhondda Road.

Should you have any questions do not hesitate to ask.

Kind regards,

Glen Mathews
Senior Development Planner



T 02 4921 0399 M 0439 647 504
E gmathews@lakemac.nsw.gov.au
lakemac.com.au



Blast Management Plan

(Incorporating a Blast Management Program)



From: Nicholas Warren
Sent: Monday, 13 January 2020 10:41 AM
To: Glen Mathews
Cc: Mo Yunusa; Amy Regado; Elizabeth Lambert
Subject: RE: 559 - Teralba Quarry - Blast Management
Attachments: 55956_Blast Management Plan_20200113_LMCC.pdf

Hi Glen,

Thanks for your feedback and happy new year!

Please see attached an updated draft of the Blast Management Plan for the Teralba Quarry that incorporates your comments and suggestions. I have tracked the changes to the version that you have reviewed previously for ease of review. I draw your attention to the following sections.

- Section 8.2 has been added to reflect the blasting notification protocols for the Quarry. The notifications to nearby resource companies were already occurring but had not been included and I think this is appropriate here. We have allowed that Council be notified of blasting regardless of the location to ensure this is part of the planning for every blast.
- With regards to complaints (Section 12), there are already contact numbers listed on signage at the entrances to the Teralba Quarry. However, this has been included in the plan for reference. I have also included the fact that contact details are available on the Metromix website for this purpose.

With regards to your comments concerning compliance with the NSW Resource Regulator guideline *Health and Safety at Quarries 2018*, the Blast Management Plan, Orica report and your comments, reference to these are included in the Blast Management Plan. Though please note that compliance strictly relates to the development consent and approved plan (incorporating the Orica report). Metromix also includes reference to the relevant work place health and safety legislation in Section 4.4 of the plan. The NSW Resource Regulator guideline is a guide to best practice for complying with the legislation and therefore strict compliance with this document is not legally required. However, blast design and planning is an iterative process and Metromix works closely with blast contractors to ensure the safety of its personnel (number one priority) through management of blasting events. This includes the handling of explosives, drilling and preparation, shot firing procedures and post-firing review including monitoring and the management of blast fume generation or misfires.

Can you also please advise me of the best email address and person for blast notifications?

For your information, we have identified that blasting may be required within 400m of Rhondda Road during 2020, but not in the near future. We will work towards demonstrating that blast design and management can safely occur in the intended locations and will contact you in the future to discuss these outcomes. I also recommend that you plan a visit to the Quarry to observe a blast when the timing is suitable as this would be beneficial to demonstrate the safety protocols and procedures as well as the nature of blasting at the Quarry. As previously mentioned, blasting at the Quarry is predominantly designed to fracture the conglomerate rock but leave it in place for transport to the processing plant.

Can you please confirm that you are comfortable with the changes to the plan so that we might send this version to the Department of Planning, Industry and Environment for final approval.

Regards,
Nick

Nick Warren
Principal Environmental Consultant
B.Sc., M. Bus., M. Env.Sc.



Blast Management Plan

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From: Glen Mathews <gmathews@lakemac.nsw.gov.au>
Sent: Tuesday, 14 January 2020 10:26 AM
To: Nicholas Warren
Cc: Mo Yunusa; Amy Regado; Elizabeth Lambert
Subject: RE: 559 - Teralba Quarry - Blast Management

Hi Nick,

The changes made have satisfied Council's comments. The best email address for future notification would be council@lakemac.nsw.gov.au.

I would certainly be interested in visiting during a blast, it would be helpful if myself and one other officer could attend this would likely be Amy Regado as acting Chief Development Planner. If there is an upcoming blast that Metromix would be happy for us to attend please let me know.

If you have any further questions do not hesitate to ask.

Kind Regards,

Glen Mathews
Senior Development Planner



T 02 4921 0399 M 0439 647 504
E gmathews@lakemac.nsw.gov.au
lakemac.com.au



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Appendix 3

Orica – Determining the Exclusion Zone for the Metro-Mix Teralba Quarry (August 2019)



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DETERMINING THE EXCLUSION ZONE FOR METRO-MIX TERALBA QUARRY

**PRODUCTION BLASTS 89 MM FREE FACE AND
BUFFERED FREE FACE, S.I.S COMPLIANT**

21/08/2019

Public



Blast Management Plan

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Client: Metro-Mix Teralba Quarry

By Scott Blair

Senior Blasting Technician, Metals SE NSW and New Zealand, NSW Quarries and Construction
Orica Australia Pty Limited

21/08/2019

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Public

Authorised By: Manager Quarries
Location: Divisional Resources
Division / Site: Quarries/Teralba/Management Plans
Document Number:: 3.14 Blast Management Plan

Issue Date: 27.7.20
Approval Date: 27.7.20
Review Date: 27.7.20
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Blast Management Plan

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SUMMARY

Metro-Mix Teralba Quarry requested Orica to conduct a study to determine the blasting exclusion zone distance for production blasting on site, using the Site Information Sheet (SIS) blasting parameters (89 mm SIS).

In the absence of a formal risk analysis, undertaken by an externally accredited blasting consultant, Merto-Mix uses the following minimum exclusion zone distances:

- **Non-blast personnel**- will be positioned no less than 500 m in front of the blasts and no less than 300 m to the side of the blast and no less than 300 m to the rear of the blast.
- **Blast personnel**- will be positioned more than 300 m from the blast (and not in direct line of fire) and within retreat distance of a protective structure i.e. fixed plant or blasting bell.
- No mobile equipment is to be within 300 m of the initiation point without signed Site Manager approval.
- Where a blast is to occur within 100 m of fixed plant, an appropriate blasting specialist will be engaged to design and control the loading and firing process.



EXCLUSION ZONE STUDY

ROCK TYPE AND BLAST PARAMETERS

Teralba Quarry is predominantly a Conglomerate Quarry with its pit shell designed for 15 m and 11m benches. The design drill angle is at 10 degrees, however face holes are subject to variance according to face angle, to maintain optimum face burdens. The minimum stemming length is 1.8 m as per SIS and has been used as a worst-case scenario with respect to flyrock ejection when evaluated in this report.

Standard blasting parameters are based on 12 m bench heights as these are the most predominant on site. The target powder factor for these blasts is 0.62 kg/m³, with a body of blast pattern burden and spacing of 3.1 m x 3.6 m. However it is noted that providing the minimum burdens and stemming heights are maintained, any change in bench heights within the range stated on the SIS, it will not effect the results of the exclusion zone.

The face burden is targeted at 2.8 m and is calculated by the (32 x hole diameter) rule of thumb. The minimum burden of 2.5 m is calculated by the (28 x hole diameter) rule of thumb. These parameters have been allocated to the primary bulk product Centra™ Gold GT 1.2 g/cc.

Face burdens can also be loaded with alternate products such as Centra™ Gold ES 1.1 g/cc down to a burden of 2.3 m. The exclusion zone calculations within this report are based on the Centra™ Gold ES 1.1 g/cc minimum burden of 2.3 m as it represents the worst-case scenario with respect to flyrock ejection. If blasts are conducted with alternative bulk products and or minimum burdens below the 2.3 m evaluated in this report, then a new exclusion zone should be evaluated.

FLYROCK MODEL

Orica has been using Richard and Moore's (2004) model, known as Terrock model (see **Figure 1**).

- Face burst occurs when front row burdens are insufficient to contain the explosive energy. This mechanism can produce flyrock in front of the blast area.
- Stemming ejection (or rifling) occurs when stemming material is of poor quality or where the stemming length is insufficient or the hole is not fully stemmed (e.g. hang ups). These mechanisms can produce flyrock behind the blast area, depending on the angle of the blast hole.

Cratering calculations have been removed from the original Terrock model as cratering calculations are not representative of typical quarry blasts. This is because cratering is not valid as stemming lengths used in typical free faced quarry blasts are well above 20 times hole diameter and should not cause cratering effect. Should fully confined drop cut style blasting be required a cratering modelling should be included.

Given the specific parameters of the SIS, the equations shown in Figure 1 provide a tool which can be used to predict the maximum flyrock distance likely to result from a blast. The site constant (k), considers the measured blasting response of the rock mass at a specific site and takes values between 13 and 28. In instances where the blasting response has not been measured, it is recommend to use a k value of 28. Based on this prediction, a safety factor is applied to give a minimum blast clearance distance. The safety factor applied for buildings and equipment is 2.0. For humans the safety factor is 4.0.

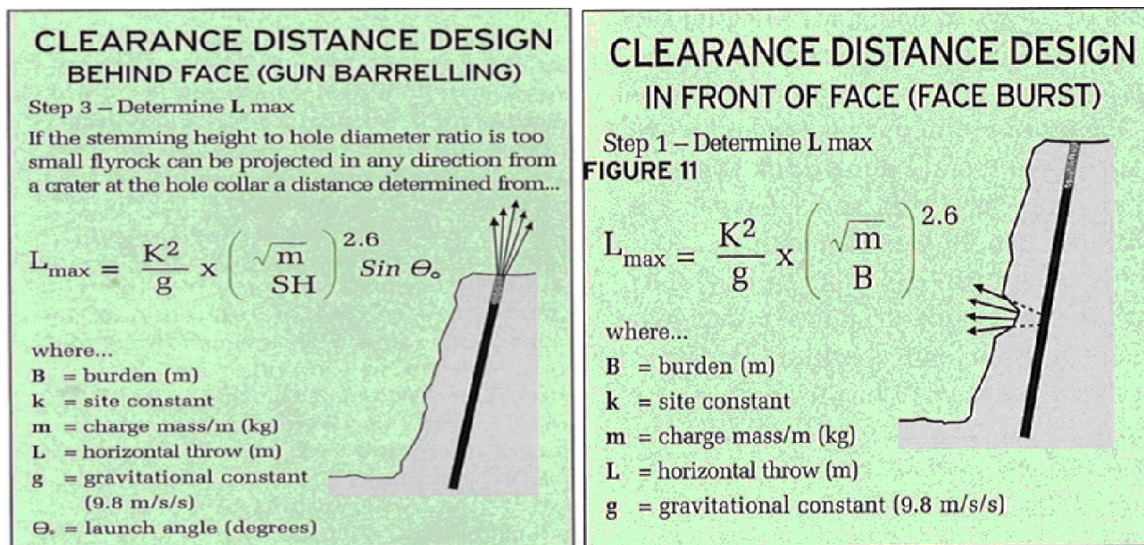


Figure 1 - Terrock's Flyrock Model (Richards and Moore, 2004)

DETERMINING THE SITE CONSTANT K VALUE

To determine the site k value, blast video footage to date was reviewed to approximate observable horizontal and vertical distances. The blasts analysed were of free face nature and included all blast videos over recent years dating back to July 2017.

The maximum approximated horizontal distance observed was 55 m.

The maximum approximated vertical distance observed was 28 m.

The formulas in Figure 1 were used with the observed horizontal and vertical distances to calculate a site constant of 24.7. A site constant (k) value of 24.7 has therefore been used in all exclusion zone calculations.

DETERMINING THE EXCLUSION ZONE FOR PERSONNEL TERALBA

Calculations have been based off SIS compliant minimum front row burdens for Centra™ Gold ES 1.1g/cc product and is designed to provide a worst-case scenario. Minimum SIS compliant face burden is 2.4 m, loaded with the Centra™ Gold ES 1.1 g/cc product, for a 89 mm blasthole, with 1.8 m of aggregate stemming.

Based off these parameters the minimum recommended exclusion zone for personnel at the Metro-Mix Teralba Quarry equates to 348 m for horizontal face burst and stemming ejection, assuming that:

- a) The minimum stemming of 1.8 m is applied, using appropriate stemming material relative in particle size to 0.1- 0.15 x hole diameter
- b) Bridging does not occur; appropriate aggregate fills the stemming column.
- c) pre-conditioned cracked or fractured ground and or overburden is not present in the stemming horizon
- d) The blast face geology type is conglomerate rock.

The modelling results that determined this exclusion zone are included in Appendix 1(TERROCK Model).



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DETERMINING THE EXCLUSION ZONE FOR EQUIPMENT TERALBA QUARRY

Calculations have been based off SIS compliant minimum front row burdens for Centra™ Gold ES 1.1g/cc product and is designed to provide a worst-case scenario. Minimum SIS compliant face burden is 2.3 m, loaded with the Centra™ Gold ES 1.1 g/cc product, for a 89 mm blasthole, with 1.8 m of aggregate stemming.

Based off these parameters the minimum recommended exclusion zone for personnel at the Metro-Mix Teralba Quarry equates to 174 m for horizontal face burst and stemming ejection, assuming that:

- a) The minimum stemming of 1.8 m is applied, using appropriate stemming material relative in particle size to 0.1-0.15 x hole diameter
- b) Bridging does not occur; appropriate aggregate fills the stemming column.
- c) Pre-conditioned cracked or fractured ground and or overburden is not present in the stemming horizon
- d) The blast face geology type is conglomerate rock.

The modelling results that determined this exclusion zone are included in Appendix 1(TERROCK Model).



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CONCLUSIONS

The following can be concluded for this study:

- The model determines a minimum exclusion zone of 348 m for **personnel**. Therefore, it is recommended to adopt 400 m as the minimum for personnel.
- The model determines a minimum exclusion zone of 174 m for **equipment**. Therefore, it is recommended to adopt 200 m as the minimum for equipment.
- The model is limited to the following:
 - a) The model is limited to the applicable current SIS minimum blasting parameters. Blasts outside the SIS have not been considered.
 - b) Minimum stemming is applied.
 - c) Bridging does not occur; appropriate crushed aggregate fills the entire stemming column.
 - d) The presence of broken, fractured ground is recorded and considered in the loading design i.e. increased stemming lengths are considered.
 - e) Laser profiling has been performed to ensure SIS face burden is designed
 - f) Face holes are boretracked and loaded to SIS tolerances
 - g) The rock type material being blasted is consistent with the described conglomerate nature that the k value of 24.7 has been calibrated for.
- Results of this model do not apply for specialised blasting techniques such as, oversize rock popping, toe blasts and fully confined drop cut blasting.
- To reduce the "Maximum Horizontal Distance" to the requested distance of 300 m, it would be advised to review the current S.I.S. and increase the minimum face burdens for Centra™ Gold ES 1.1g/cc from 2.3m to 2.5m. Note that Centra™ Gold GT which is the primary product will need to have the design burden increased to cater for the new parameters.

APPENDICES

APPENDIX 1(TERROCK MODEL)

Exclusion Zone Calculation for Metro-Mix Teralba 89mm S.I.S Free Face Minimum Tolerance Burden Centra™ Gold ES 1.1g/cc

Flyrock Assumptions		
Rock density	g/cc	2.3
Hole diameter	mm	89
Stemming length	m	1.8
Charge length	m	10.2
Burden	m	2.3
Explosive density	g/cc	1.1
Flyrock constant		24.7
Factor of safety	FoS	1
Trajectory angle (Stemming ejection)	deg	10
Charge mass/m	kg/m	6.8
Gravity	m/s/s	9.81

Scaled Depth of Burial		
Contributing charge length factor		8
Scaled depth of burial	m/kg ^{1/3}	1.27

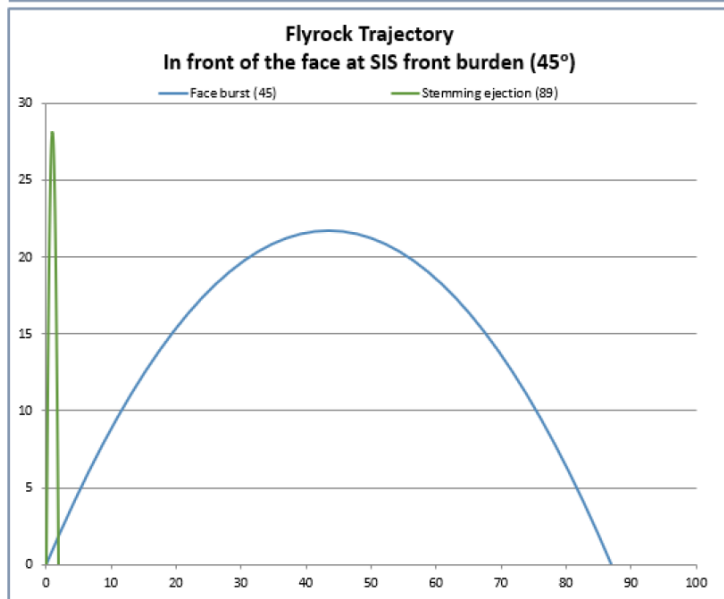
Maximum Flyrock Projection Range		
Distance	m	598

Clearance Distance and Projectile Size		
Projectile size	mm	38
Projectile weight	kg	0.06
Clearance Distance	m	130

Maximum Horizontal Distance		
Face burst	m	87
Stemming ejection	m	56

Maximum Vertical Distance		
Launch velocity (FB)	m/s	29
Launch velocity (C)	m/s	40
Launch velocity (SE)	m/s	23
Face burst	m	43
Stemming ejection	m	28

Factor of Safety	Maximum Horizontal Distance			Maximum Vertical Distance		
	1	2 (Equip)	4 (Human)	1	2 (Equip)	4 (Human)
Face burst	87	174	348	43	87	174
Stemming Ejection	56	112	225	28	56	112





Appendix 4

Blast Fume Visual Rating Guide (Appendix 2 and Appendix 3 from the Code of Practice Prevention and Management of Blast Generated NOx Gases in Surface Blasting - Australian Explosives Industry and Safety Group Inc. 2011)



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APPENDIX 2 - VISUAL NO_x GASES RATING SCALE

The following table, together with the Field Colour Chart in Appendix 3, details how NO_x gases from a surface blast can be assessed.

Level	Typical Appearance
Level 0 No NO _x gas	
Level 1 Slight NO _x gas	
1A Localised	
1B Medium	
1C Extensive	
Level 2 Minor yellow/orange gas	
2A Localised	
2B Medium	
2C Extensive	
Level 3 Orange gas	
3A Localised	
3B Medium	
3C Extensive	
Level 4 Orange/red gas	
4A Localised	
4B Medium	
4C Extensive	
Level 5 Red/purple gas	
5A Localised	
5B Medium	
5C Extensive	

Assessing the amount of NO_x gases produced from a blast will depend on the distance the observer is from the blast and the prevailing weather conditions. The intensity of the NO_x gases produced in a blast should be measured on a simple scale from 0 to 5 based on the table above. The extent of the NO_x gases also needs to be assessed and this should be done on a simple scale from A to C where:-

- A = Localised (ie NO_x Gases localised across only a few blast holes)
- B = Medium (ie NO_x Gases from up to 50% of blast holes in the shot)
- C = Extensive (ie Extensive generation of NO_x Gases across the whole blast)



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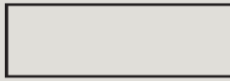



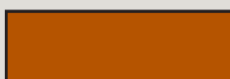
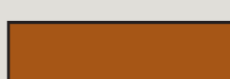


Australian Explosives Industry And Safety Group Inc.



APPENDIX 3 - FIELD COLOUR CHART

Pantone colour numbers have been included in the following Field Colour Chart to ensure colours will be produced correctly thereby ensuring a reasonable level of standardisation in reporting NOx gas events across the blasting industry.

Level	Colour	Pantone Number
Level 0 No NOx gas		Warm Grey 1C (RGB 244, 222, 217)
Level 1 Slight NOx gas		Pantone 155C (RGB 244, 219, 170)
Level 2 Minor yellow/orange gas		Pantone 157C (RGB 237, 160, 79)
Level 3 Orange gas		Pantone 158C (RGB 232, 117, 17)
Level 4 Orange/red gas		Pantone 1525C (RGB 181, 84, 0)
Level 5 Red/purple gases		Pantone 161C (RGB 99, 58, 17)