Ingen Consulting
Alstonville NSW 2477
0417 264 987
michiel@ingenconsulting.com.au
www.ingenconsulting.com.au



Our Reference: J1065 letter 290721

ITHIS AND THE FOLLOWING 223
IS THE ANNEXURE MARKED WITH THE LETTER
REFERRED TO IN THE
AFFIDAVIT OF DEA MARKED TO IN THE
SWORN THE DAY OF THE PEACE SOLICITOR

chael Santin

Michael Santin
C/o
Fishburn Watson O'Brien
134 West High Street
Coffs Harbour NSW 2450

Karen Leigh Hutchings

Justice of the Peace

NSW # 253689

29th July 2021

Re: Response to Statement of Facts and Contentions Case number 2021/00026242

Dear Michael,

I refer to the request to address contentions 4, 6, 7, 8, 9 and 10 of the Statement of Facts and Contentions. Our detailed response is provided in Annexure A – SOFAC response table. Further Annexures referred to in Annexure A are:

- Annexure B Section 138 approval letter
- Annexure C Stamped approved S138 plans
- Annexure D Blakebrook Quarry Noise and Blast Management Plan
- Annexure E Blakebrook Quarry Noise, Vibration and Blast Monitoring Sub Plan
- Annexure F Santin Quarry survey plan
- Annexure G Noise berm concept engineering drawing
- Annexure H 2018 and 2019 blast reports.

I confirm that I have read and agree to be bound by the Expert Witness Code of Conduct in Schedule 7 and Division 2 of Part 31 of the Uniform Civil Procedure Rules 2005.

Riverbank Quarry
Response to Statement of Facts and Contentions



If you have any questions, please do not hesitate to contact our office.

Yours sincerely,

**Michiel Kamphorst** 

Director / Principal Engineer

MSc, BSc, RPEng, RPEQ, NER (Civil)



# ANNEXURE A - SOFAC RESPONSE TABLE

Annexure A - SOFAC response table

	Contention	
Number		Response
4	Extending the life of the quarry will result in the continued use of Riverbank Road by heavy haulage trucks for another 16 years. This will cause unacceptable damage to Riverbank Road and this has not been addressed in the modification application. Riverbank Road is heavily potholed and is in a poor condition that is not satisfactory for use by residents of the street and other road users. The development as proposed will further deteriorate the condition of the road.	Decisions about priority of maintenance of roads. Development contributions are not the only source Priorities about maintenance of roads, as against
49	No measures to improve, properly maintain or properly repair the road during the further 16 year period and following completion of quarrying are included in the application apart from payment of Section 7.11.contributions, Funds collected from Section 7.11. contributions would not be sufficient to properly maintain or repair Riverbank Road. Its continuing to function in a damaged condition would be an unacceptable and ongoing environmental impact.	A 5138 approval was obtained to satisfy conditions 39 and 40 of DA 92/523. Attached (Annexure B and C.) is the 5138 approval for the upgrade of the intersection of the Quarry entry road with River Bank Road. This includes a 115 metre long pavement upgrade, specifically designed for the turning movement of quarry trucks. The works would be funded entirely by the quarry owner and would commence upon receipt of approval of the 54.55 modification application to extend the life of the quarry. These works would result in a full pavement repair and upgrade for the worst-affected section of pavement on Riverbank Road, being that in front of the quarry. This constitutes a physical contribution to the road pavement, in addition to any
	Even at the end of the 16 year period, using the contribution figures given in the 2014 594 plan, with a capped production of 29,970 tonnes per annum, only \$258,941 would be collected. That monetary figure will be reduced depending on the actual date of approval, and the exact period of operation up to 12 May 2036. Council's cost estimate to repair the section of Riverbank Road between the quarry and Wyrallah Road is \$300,000. Neither the future costs nor contributions have been indexed for inflation so like with like can be compared. Further, no monies would be available to repair other sections of the road network used by quarry trucks.	In 2019, LCC Sport \$18,593.06 + GST on resurfacing a 71m section of pavement on Riverbank Road (Refer Annexure I), resulting in a rate of \$261.87 per lineal metre. This is conservative as 'economy of scale' savings would be made compared to the short 71m section of repair that was carried out. The total length of Riverbank Road between the quarry entrance and Wyrally Road is approximately 820 metres. 71m was resurfaced in 2019, 60m overlaps with the \$138 works of the entrance intersection, therefore a length of 820 71-50 = \$89m remains. @\$261.87/m, this amounts to \$180,428 + GST, which is significantly less than the amount claimed in contention 4b. This amount is covered by the predicted collected \$258,941.
4 <del>p</del>		Clause D2.05 of the Northern Rivers Develpment Design Specification D2 Pavement Design specifies that the minimum design life for a flexible unbound granular pavement is 20 years. For maintenance and upgrade planning purposes, the road authority should plan for a full resurfacing of Riverbank Road every 20 years, that means spending at least \$180,000 / 20 = \$9,000 per annum on the 820m section of Riverbank Road. Council records show only \$18,593.06 was spent between 2010 and 2021 (11 years), averaging around \$1,700 per annum. If one were to argue that under Table 7.2 of the Austroads Guide to Pavement Technology Part 2: Pavement Structural Design, the typical design life of a pavement is between 20 and 40 years, and therefore we should base the average annual resurfacing cost on a 40 year design life, than the \$1,700 per annum spent over the past 11 years is still significantly less than the \$180,000 / 40 = \$4,500 required.
		The above analysis supports the view that Lismore City Council has not spent sufficient funds on maintenance and upgrade of Riverbank Road, resulting in the pavement damage described in the contention.
9	The noise management provisions of the PoM are deficient and will not effectively manage noise impacts and issues arising out of the quarry's operations for the following reasons:	
0	The PoM relies on the assessments, management practices and mitigation measures outlined in the Noise Assessment Report dated 30 June 2020 which are deficient for the reasons set out in contentions 7, 8 and 9; and	The Noise Assessment Report is not deficient, as demonstrated by the contention responses to 7, 8 and 9 below.

(11)	the PoM does not contain the following naise information and management measures: It	Items A to D would be an inappropriate addition to a PoM, as in my view adds unnecessary information and length to a plan that is meant to be to-the-point, practical, concise and easy to understand to operators and the wider public. Further, section 4.10 of the noise report recommends regular compliance monitoring is carried out for the first 12 months following the approval of the application and compliance reports to
7	The Noise Assessment dated 30 June 2020 underestimates the sound power levels for the Ir quarry equipment and attempts to resolve the predicted noise impact by recommending unsustainable and impractical mitigation measures.	Council on a quarterly basis. Incorrect. Equipment sound power levels are based on a combination of field test and modelling calibration.
7a	The adjusted sound power levels for machinery adopted in the Noise Assessment dated 30 V June 2020 cannot be supported. The sound power levels contained in the Ingen Noise lessessment dated 29 August 2019 (referenced in the 30 June 2020 report) are lower than the 2020 modelling contained in the 30 June 2020 report. The author of the Noise net 2020 modelling contained in the 30 June 2020 report. The author of the Noise ness than typical for a basalt quarry and can only be sustained if the equipment operates in act similar way in 2020 into the future. The sound power levels, and thus the noise impact to bely considered, is likely to be higher than that accounted for.	Interest sound power levels for machinery adopted in the Noise Assessment dated 30 When operating a quarry, the level of noise emissions is influenced by the manner of operating machinery, lune 2020 cannot be supported. The sound power levels contained in the 30 June 2020 report. The author of the Noise Replacement dated 29 August 2039 (referenced in the 30 June 2020 report.) are lower than Assessment dated 29 August 2039 (referenced in the 30 June 2020 report.) are lower than Assessment dated 30 June 2020 report. The author of the Noise Raintained and operating in a proper and efficient manner and running staff-education programs and Rasessment dated 30 June 2020 acknowledges that the adjusted sound power levels are regular toolbox talks on the effects of noise and the use of quiet work practices are all part of the application less than typical for a basalt quarry and can only be sustained if the equipment operates in a of Best Management Practise (BMP). As such, the June 2020 Noise Impact Assessment has demonstrated sound power levels, and thus the noise impact to be what the impact of applying BMP can be when comparing against the earlier August 2019, during which some of these BMP practises were not applied.
		It is reasonable and within the scope of the NPI to rely on the use of BMP and therefore the sound power levels adopted are not 'unsustainable' or 'Impractical' as alleged in this contention.
7.0	The Noise Assessment relies on a variety of ad hoc noise mitigation measures. These include covering plant and equipment with insulation material, placing rocks in the hopper is rather than dropping from a height, and having the crusher and screening equipment operating in a similar manner to operations which were apparent during noise testing. These are not practical measures for long term quarry operations.	The mitigation measures adopted are practical for long term operations. No justification has been provided in contention 7b why these measures would not be practical. If insulation materials wear down over time they can easily and quickly be replaced with new material. The manner of placing rocks in the hopper is managed by BMP toolbox talks as described in 7a above. Refer to the response to 7a for more detail about the use of Best Management Practises.
00	full	The report contains sufficient information on key noise mitigation measures, this is detailed in the responses to be sub-contentions below.
98		Common practise is to provide those details with the Construction Certificate Application.
8c	ed with the	The purpose of the berm is to interrupt the 'line of sight' between the receivers to the north/northwest and the quarry equipment. As such one would expect the berm to improve the visual aspect of the quarry overall.
P8	There is no engineering information provided to demonstrate that a 6m high "berm" (presumably constructed from earthen materials) could be safely constructed within the area shown on the plan. The berm shown on Figure 11 Page 16 of Council's assessment report scales at about 7.2m wide at the base. A 6m high earthen berm with external slopes of one vertical to three horizontal for maintenance would have a base width of almost 40m, meaning that it would occupy a considerably larger area of the quarry floor than was depicted in the proponent's figure.	The assertion that the berm base width is 7.2m is incorrect. The modelled base width is 14 metres.  No engineering information was provided with the report as this was assumed to be self-evident. Typically, construction information for specially designed berms would be provided with a Construction Certificate Application.  We have now prepared a detailed concept engineering drawing for this wall, provided in Annexure G.
<b>∞</b>	No information has been provided to show how the berm would be maintained nor erosion controlled on the proposed berm.	This information was not provided as it was not warranted at the S4.55 stage of the application. As per the response to contentions 8b-8d, this type of information would normally be provided with a Construction Certificate Application. Despite this, erosion control is included in the engineering drawing in Annexure G.
86	No information is provided about how the berm is to be constructed, the timing or staging of construction and whether quarry operations are proposed during construction or will commence only after completion of the berm.	It is implied in the report that any mitigation measures such as the berm should be in place for the quarry to perform as estimated in the report. If approval were granted for the extension, then the berm would need to be constructed prior to operation. It is anticipated that a consent document would include approval conditions to that extent.

	The Noise Assessment dated 30 June 2020 is inadenuate in that it does not seem to be a seem of the see	With the contract of
6	modelling information and it fails to consider information which impacts upon the assessment as to whether the development will or will not have an adverse acoustic impacts on currounding regulators.	I his claim that the noise assessment is inadequate is incorrect. The report was prepared in accordance with the requirements of the NPI, The responses below demonstrate that the Noise Assessment is adequate.
99	The Noise Accessment was not seen the	
3	the Notes Assessment does not provide modelling for and assessments of:	
€	representative stages of quarry development over the proposed 16 year period.	Refer to attached quarry survey (Annexure F) including magenta line marking the approved quarry extent. Since the quarry face can only move further south, away from the worst affected receivers that are located to the north, and given the crusher and screener circuit would not move with the quarry face and therefore the only noise sources affected by this move is the loader working the quarry face. By moving the quarry face further south, the loader will move further away from the receivers to the north/northwest and will face further south, the loader will move further screening has been proposed for the loader. Thus, the quarry face moving further south reduces the noise impact on the critical receivers to the north/northwest and further modelling was not warranted at the time of preparation fo the report. Regardless, it is recommended that compliance monitoring is carried out as per section 4.10 of the Noise Assessment.
(9)	reflected noise from quarry faces. It is expected that noise from the quarry plant and equipment located in the quarry would reflect off the quarry walls in a north and northwest direction. The Noise Assessment has not modelled, assessed or addressed expected reflected noise and impacts on residential properties to the north and northwest;	The claim that noise reflected from quarry faces was not modelled is incorrect. The quarry floor and faces were modelled as hard surfaces in soundplan, with the quarry floor and faces included in the Digital Terrain Model using the most recent survey information available at the time.
(ii)		This was not carried out for the following reasons:  1 - Modelling core drilling is not common practise in this region. As an illustration of this, the noise reports for Lismore City Council's Blakebrook Quarry (the only other active hardrock quarry in the Lismore LGA) do not include core drilling modelling. Refer to Annexures D and E for the relevant Blakebrook Quarry documentation.  2 - Core drilling would be considered part of blasting, which is outside the scope of the Noise Impact Assessment. The chapter on 'Vibration' in the noise report justifies why a further blasting and vibration assessment (other than providing blast test result records) is not warranted.  3 - Blasting at Riverbank Quarry occurs not more than once per year on average (refer table 17 of the noise report), during a period of 3-4 days, for which neighbours are notified and blasts are strictly monitored.  4 - Blasting has been compliant in the past and is monitored by the blasting contractors during the blasting and change is proposed to the blasting process, therefore a further assessment of the blasting is not warranted under the Noise Assessment.
(iv)	the various areas, bench heights and stages for ripping activities, presumed to be the removal of rock to replace blasting;	There are quarry stages and the quarry face is not benched.
<u>(S</u>		This was not warranted at the time of preparation of the report as the noise impact is low, since overburden removal happens very rarely, there is only a very thin layer of soil above the quarry that would require removal prior to blasting and the removal of overburden would be done using a small excavator. Additionally, section 4.10 of the Noise Assessment captures the assessment of additional equipment brought to site.
(vi)	the construction of bunds to the west and northeast of the quarry as outlined in the Plan of Management and the Draft Plan of Quarry Rehabilitation;	The scope of the noise report states it is prepared in accordance with the NPJ, AS1055 and AS2659. Clause 1.5 of the NPI excludes construction activities from the policy. Therefore contention 9a(vi) does not support the claim made in contention 9 that the noise secondaries in advances.
		יב כינוון ווומסב ווו רסוולבוווסיי ש תופר תוב ווסופ מפסביפתובוו ופ וומספקעם ב

	blasting and vibration. The Noise Assessment dated 30 June 2020 assumes that	No justification has been provided to support the claim a detailed blasting and vibration assessment is remained it is merely provided as a statement. Chapter 6 demonstrates compliance with the blasting and
		vibration criteria with the exception of a blast in 1992. Refer to the response to contention 9a(iii) for more
(iiv)	assessment is warranted. Additional assessment would be expected for a quarry clear to be sexpected for a quarry development proposing activities for a further 16 years. An assessment would need to	detail. Annexure H contains blast reports from 2018 and 2015.
	consider a staged quarry working program; blast design details including locations,	
	bench heights, total weights of exploded maximum instantaneous tonnages yield per	
	blast, and what are the predicted vibration or overpressure impacts for nearby	
	residential receivers.	
	additional mobile crusher and loader equipment. The Noise Assessment does not	The proposal does not include a mobile crusher. There was no mobile crusher on site during the various
	appear to factor in additional equipment such as those mobile machines elevated on	inspections we carried out on site. From the photographs referenced, the mobile crusher appears to be
11117	stockpiles as pictured in Photographs 17 and 29 contained in the 'Photographs'	parked there, no stockpile is visible below the conveyor belt. If this mobile crusher is not operated on site
(MIN)	document dated 27 August 2019 and 19 May 2020 accompanying the modification	then any mention of it in the context of this application would be irrelevant.
	application. The noise assessment does not provide the coordinates or heights at	
	which operational/machinery noise was assessed.	
q6	The Modelling carried out does not accurately factor in meteorological conditions for the	Section 4,5 of the Noise Assessment demonstrate the meteorological conditions included in the model are in
	locality:	ווב אווון מריקוררי כן דור זון
	ft Rehabilitation Plan does not contain any noise assessment of the rehabilitation	It is not common in this region to include a prediction of quarry rehabilitation noise emissions in the Noise
	activities proposed and the noise controls referred to are inadequate.	Assessment. Reference is made to the Blakebrook Quarry documentation by way of illustrating this point.
10		Further, condition 4 or the consent provides that the Plan of Mahagement (Which Includes fendomidation) shall be ungraded very two years, unless determined otherwise by Council. In addition, compliance activites
		would monitor and assess the impact of any additional equipment brought to the site for the purpose of
		rehabilitation (as per section 4.10 of the Noise Assessment).

# ANNEXURE B - SECTION 138 APPROVAL LETTER



Our Ref: DF:73.2019.72.1

Contact: Mr L J Myers

27 November 2019

Ingen Consulting Pty Ltd ATF The Trustee for Kamphorst Family Trust 9 Elliott Avenue ALSTONVILLE NSW 2477

michiel@ingenconsulting.com.au

Dear Mr Kamphorst

# Approval under Section 138 Roads Act for Works upon a Public Road DP 701527 lot 4, 72 River Bank Road MONALTRIE

Pursuant to Section 138 of the Roads Act notice of approval to carry out works in a public road, being the construction of intersection works in Riverbank Road, as identified in drawings numbers: J1065\_S138\_01 to J1065\_S138\_21, is hereby granted subject to the following requirements.

- All works are to be in accordance with the stamped approved plans or as amended in red. A copy of the stamped approved plans are attached to this consent.
- The enclosed Notice to Commence Works be completed and returned to Council prior to commencement of works.
- Prior to commencement of works, a prestart meeting is to be arranged with Council. Inspection fees in accordance with Council's Fees and Charges are to be paid prior to the prestart meeting.
- Implementation of a traffic control plan prepared by an RMS accredited person for the proposed works.
- Should it be determined during the construction or set-out of works, that additional works are necessary, Council reserves the right to require that this work shall be completed to its satisfaction.
- Upon completion of works a set of Work-as-executed plans and Council Asset Forms shall be provided to Council. These plans must be submitted and approved by Council prior to the Final Inspection (acceptance on maintenance).
- Payment of a bond, equivalent to 5% of the cost of the works, to guarantee rectification of any defects occurring with the work within a six (6) month period. This bond must be paid to Council prior to the Final Inspection (acceptance on maintenance).
- Following completion of works it is the applicant's responsibility to arrange a final inspection with Council at which time a Certificate of Completion will be issued for major works and formal acceptance by correspondence for minor works, e.g. driveway accesses.

### **Construction Hours**

 Building and/or Civil/Excavation works construction shall be restricted to within the hours of 7.00 am to 5.00 pm Monday to Friday and on Saturday to within the hours of 8.00 am to 1.00 pm inclusive, with no work on Sundays and Public Holidays.

Demolition and excavation works shall be restricted to within the hours of 8.00 am to 5.00 pm Monday to Friday only.

It is a condition of this Section 138 Application and any subsequent Approval, that the applicant be responsible for managing the safety of the nominated work zone. The applicant must comply with all relevant work health and safety Legislation, Regulations, Codes of Practice, and Standards applicable to the nominated works and ensure all hazards relating to the works are appropriately controlled to protect all employees, contractors, public and Council staff from any unnecessary risk and potential harm.

Should you require any further information pertaining to this matter please do not hesitate to contact me.

Yours faithfully

Mr L J Myers Development Assessment Engineer

Attached: Stamped approved plan and Notice to Commence Work

# ANNEXURE C - STAMPED APPROVED S138 PLANS

ORIGINAL SIZE:
A3
REVISION:

3106S DRAWING NUMBER: 31065\_5138\_01 PROJECT NUMBER:

ORAWING TITLE: Title page

### REVISION Sediment and Erosion Control Plan standard drawings Sediment and Erosion Control Plan layout Riverbank Road longitudinal section DRAWING TABLE Riverbank Road cross sections Notes and legend Existing conditions Geometric fayout Typical sections Traffic Control Plan Design layout Title page DRAWING NUMBER J1065\_S138\_03 J1085\_S138\_04 J1065\_S138\_06 J1065\_S138\_20 J1065\_S138\_02 J1065\_S138\_05 J1065\_S138\_08 J1065\_S138\_10 J1065\_S138\_07 J1085\_S138\_09 J1065\_S138\_11 J1065\_S138\_12 J1085\_S138\_13 J1065\_S138\_14 J1065\_S138\_16 J1065\_S138\_15 J1065\_S138\_17 J1065\_S138\_18 J1085\_S138\_19 J1065\_S138\_21



Council Officer

MSs, BSs, RPEng, RPEng, NER RPEng (Chvil) number: 877901-0045 RPEQ (Chvil) number: 15790 NER (Chvil) number: 9276303 Date: 6/11/19 5138 application S VOU DIG DESCRIPTION

# S138 ENGINEERING DRAWINGS

RIVERBANK QUARRY ENTRANCE INTERSECTION UPGRADE 72 Riverbank Road, Monaltrie



LOCALITY MAP
N.T.S.
Source of map: Usingere Inframage 2019

, NSW 16 4987	Santin Quarry Products	Entrance intersection upgrade for Riverbank Quarry	
ngenconsulting.com.au enconsulting.com.au			

Ingen Consulting Pty Ltd ACN: 623 948 112 a: Alstonwille, NSW p: 4514 1726 4987 e: michle@ingenconsulting.com.au w: www.uspericonsulting.com.au	CLIENT: Santin Quarry Products	PROJECT: Entrance intersection u for Riverbank Quarry
Copyright in the diswings, information and data solely for the use of the authorised mognost and	opmyte in the drawings, information and data recorded in this document is the property of lings. Consulting This document and the set Alsy for the use of the authorised regions and this document may not be used, consistent or advances in many the second consistency in the second consistency.	in Consulting. This document and the sol
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- THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE FOLLOWING DOCUMENTS:
  - OTHER PROVIDED ENGINEERING DRAWINGS;
  - TECHNICAL SPECIFICATIONS:
  - SLIPPI EMENTARY SPECIFICATIONS:
- ALL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT SPECIFICATION FOR THE WORKS TOGETHER WITH THE REQUIREMENTS OF ALL. THE RELEVANT CODES OF PRACTICE REFERRED TO THEREIN AND THE REQUIREMENTS OF WRITTEN INSTRUCTIONS.
- BRACING, PROPPING ETC, TO DRAINAGE PIPES DURING CONSTRUCTION, STRUCTURES SHALL THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND PROVISION OF ANY TEMPORARY BE MAINTAINED IN A STABLE POSITION AND NO PART SHALL BE OVERSTRESSED NRLG STANDARDS AND SPECIFICATIONS.
  - ALL LOCATIONS, ORIENTATION AND LEVELS SHALL BE VERIFIED ON SITE BEFORE COMMENCING ANY WORK, DISCREPANCIES SHALL BE REFERRED TO THE SITE
- DO NOT OBTAIN DIMENSIONS FROM SCALING.
- NATURAL SURFACE LEVELS ON THE DRAWINGS ARE INDICATIVE ONLY.
- 7. ANY PERMITS AND APPROVALS REQUIRED FOR CONSTRUCTION OF PERMANENT OR TEMPORARY WORKS SHALL BE OBTAINED BY THE CONTRACTOR.
  - NRLG STANDARD DETAILS ARE TO BE ADOPTED UNLESS STATED OTHERWISE.
- DESIGN SUBJECT TO GROUND CONDITIONS. PRESENCE OF SHALLOW ROCK MAY REQUIRE DESIGN SURFACE TO BE LIFTED TO MINIMISE ROCK BREAKING.
  - 10. ADEQUATE SEDIMENT AND EROSION CONTROL TO BE IN PLACE FOR ALL WORKS. 11.IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONFIRM ALL SETOUT PRIOR TO COMMENCEMENT OF WORKS.

# ROADWORKS

- SHALL BE CONSTRUCTED IN ACCORDANCE WITH NRLG STANDARD SPECIFICATIONS AND LINOTWITHSTANDING THE DETAILS SHOWN ON THE DRAWINGS ALL PUBLIC ROAD WORKS
- DRAWINGS AND AS DIRECTED BY THE SUPERINTENDENT, REFER NRLG STANDARD DRAWINGS 3.FLUSHING POINTS SHALL BE PROVIDED FOR SIDE DRAINS AT THE REQUIRED SPACING IN 2.SIDE DRAINS SHALL BE CONSTRUCTED UNDER ALL NEW KERBS AS SPECIFIED WITHIN THESE ACCORDANCE WITH NRLG STANDARD DRAWINGS AND SPECIFICATIONS.
- THE SUPERINTENDENT, THESE TESTS SHALL BE USED TO CONFIRM THE PAVEMENT DESIGN FINAL BOXING, TESTS SHALL INCLUDE SOAKED CBR AND/OR OTHER TESTS AS REQUESTED BY 4.GEOTECHNICAL TEST RESULTS ARE TO BE FORWARDED TO THE SUPERINTENDENT PRIOR TO SHOW ON THESE DRAWINGS.
- TESTS ARE REVIEWED AND APPROVED BY THE SITE SUPERINTENDENT, CONSTRUCTION OF THE PAVEMENT TO THE DESIGN SHOWN ON THE DRAWINGS PRIOR TO RECEIPT OF THE FINAL 5.THE PAVEMENT DESIGN ON THE DRAWINGS IS NOT FOR CONSTRUCTION UNTIL FINAL CBR CBR TEST SHALL BE UNDERTAKEN AT THE CONTRACTOR'S OWN RISK.
- SERVICES PRIOR TO WORKING IN THE VICINITY, ANY DAMAGE WILL BE REPAIRED AT THE Z.WORK TO ANY SERVICES SHOULD BE DONE IN CONSULTATION WITH THE APPROPRIATE CONTRACTOR'S EXPENSE

6.THE CONTRACTOR SHALL OBTAIN THE LOCATION OF ALL SERVICES AND PROTECT THESE

- SERVICE PROVIDER.
- ANY DAMAGE TO DRIVEWAYS SHALL BE REPAIRED AT THE BEXISTING DRIVEWAYS WITHIN THE LIMITS OF THE CONSTRUCTION WORKS SHALL BE PROTECTED FROM DAMAGE. CONTRACTOR'S EXPENSE.
  - ENTRY INTO EXISTING PROPERTIES SHALL BE MAINTAINED AT ALL TIMES.

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# Sign nox

HEV.	DESCRIPTION:	DAIE	DRAWIN	-1	APPROVED.	EVELLIAPPROVED. Approved by:
11	S138 application	61/2/1	MK	MK	MK	Michiel Kamphorst,
1	Design revision	6/11/19	MK	MK	MK	PEng, RPE
1						RPENG (CIVII) number: 67/901-0045
						on the second
						W.C.
						6/11/19

- NRLG CONSTRUCTION SPECIFICATIONS AND ALL DOCUMENTS REFERENCED WITHIN LIGRANULAR PAVEMENT MATERIAL OF PUBLIC ROADS TO BE IN ACCORDANCE WITH THESE SPECIFICATIONS.
- WITHIN THESE 2. THE PAVEMENT SEAL IS TO BE IN ACCORDANCE WITH NRLG CONSTRUCTION ALL DOCUMENTS REFERENCED AND SPECIFICATIONS

".AL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT SPECIFICATION FOR THE WORKS TOGETHER WITH THE REQUIREMENTS OF ALL THE RELEVANT CODES OF PRACTICE REFERRED TO THEREIN AND THE REQUIREMENTS OF THE

STATUTORY AUTHORITIES WHERE APPLICABLE.

ANY MANUFACTURER'S STANDARD DRAWINGS AND SPECIFICATIONS.

NRLG DRAWINGS AND SPECIFICATIONS;

LAIL DRAINAGE STRUCTURES ARE TO BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING

3.STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ONLY. THE CONTRACTOR IS RESPONSIBLE FOR THE ASSESSMENT OF CONSTRUCTION LOADS AND PROVISIONS OF ANY TEMPORARY BRACING, PROPPING ETC. REQUIRED DURING CONSTRUCTION, STRUCTURES SHALL BE

4. PRECAST REINFORCEMENT CONCRETE PIPES ARE TO BE MANUFACTURED IN ACCORDANCE WITH AS

MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED.

6, ALL PIPES UP TO AND INCLUDING 0600 ARE TO BE RUBBER RING JOINTED, ALL PIPES ABOVE 0600 CHEADWALL END STRUCTURES TO BE TYPE A, CAST IN SITU CONCRETE WITH CONCRETE APRONS

5. ALL STORMWATER PIPES SHALL BE CLASS '2' RCP. U.N.O.

4059 AND AS 1992.

ARE TO BE FLUSH JOINTED U.N.O.

- SUPERVISING ENGINEER AT MINIMUM AT COMPLETION OF THE BULK EARTHWORKS. BE UNDERTAKEN AS DIRECTED BY THE 3,GEOTECHNICAL TESTING IS TO
  - SAMPLING SHALL BE CARRIED OUT IN ACCORDANCE WITH NRLG GUIDELINES. TRAFFIC NUMBERS ARE BASED ON NRLG GUIDELINES.
- AND MAY RESULT IN AN AMENDMENT TO THE PAVEMENT DESIGN SHOWN ON THIS 6.FINAL PAVEMENT DESIGN IS SUBJECT TO SUPERVISING ENGINEER'S DIRECTION DRAWING.
- PAVEMENT DESIGN IS BASED ON NRLG GUIDELINES.

1.FINAL SIGN LOCATIONS TO BE DETERMINED ON SITE BY THE SUPERVISING ENGINEER

B.PRECAST BND STRICTURES MAY BE USED ON CULVERTS LESS THAN OR EQUAL TO 15° SKEW, SUBJECT TO THE APPROVAL OF THE SUPRRINTENDENT. PRECAST END STRUCTURES SHALL BE CONSTRUCTED WITH A REINFORCED CONCRETE CUT OFF WALL AS DETALLED FOR TYPE 3 APRONS

(INCLUDING OUT OFF WALLS) U.N.O. REFER TO NRLG CONSTRUCTION MANUAL FOR DETAILS.

ELEMENT MUST BE SURVEYED PRIOR TO CONSTRUCTION, THE SURVEYED LEVELS SHALL BE PROVIDED TO THE SITE SUPERINTENDENT TO CONFIRM THE CONNECTION AND LEVELS PRIOR TO

11.BACKFILL AND BEDDING TO PIPE TO BE IN ACCORDANCE WITH NRLG STANDARD DRAWINGS AND 12.UNSUITABLE FOUNDING MATERIAL FOR PIPES AND STRUCTURES SHALL BE REMOVED OR IMPROVED 13.ALL TRENCH BACK FILL MATERIAL UNDER THE PAVEMENT SHALL BE CBR 15 OR APPROVED 14, STEEL GRATES AND FRAMES ARE TO BE FABRICATED FROM MILD STEEL AND HOT DIP GALVANISED. 15.GRATE SUPPORT TO BE CONSTRUCTED LEVEL TO ENSURE THAT THE GRATE DOES NOT ROCK AFTER 16,ALL LEVELS ARE APPROXIMATE ONLY AND ARE SUBJECT TO FULL DETAIL SURVEY OF THE EXISTING

IN ACCORDANCE WITH NRLG SPECIFICATIONS.

SPECIFICATIONS. CONSTRUCTION.

10.WHERE A CONNECTION IS MADE TO AN EXISTING DRAINAGE PIPE OR PIT, THE LEVEL OF THAT

PROTECTED, REMOVED OR MODIFIED AS SPECIFIED

BY NRLG.

9.EXISTING STORMWATER DRAINAGE PIPES AND MANHOLES WITHIN THE LIMIT OF WORK SHALL BE

- 2. ALL TRAFFIC SIGNS TO BE SIZE 'A' U.N.O.
- 3.FOR GUIDE POST INSTALLATION AND DETAILS, REFER NRLG CONSTRUCTION
- FOR TRAFFIC SIGN SUPPORT DETAILS, REFER NRLG CONSTRUCTION MANUAL. ALL SIGN MATERIAL TO BE CLASS 1.
- 6.ALL SIGNAGE, LINE MARKING & RRPMS ARE TO BE PREPARED IN ACCORDANCE WITH NRLG CONSTRUCTION MANUAL

# SURVEY

- 1.APPROVAL FROM SURVEYOR GENERAL TO BE SOUGHT PRIOR TO REMOVAL OF ANY PERMANENT SURVEY MARKS.
- SUBGRADE LEVEL AND FINISHED LEVEL TO DEMONSTRATE ADEQUATE PAVEMENT 2.RIVER BANK ROAD WORKS-AS-EXECUTED SURVEY TO BE CARRIED OUT AT THICKNESS HAS BEEN ACHTEVED.
  - 3,ANY DISCREPANCIES IDENTIFIED DURING SETOUT TO BE IMMEDIATELY REPORTED TO SUPERVISING ENGINEERING.

# Section 138 Approval 73.2019.72.1 These are the approved plans LISMORE CITY COUNCIL referred to in the

# Council Officer

Entrance intersection upgrade Notes for Riverbank Quarry	PROJECT NUMBER:
Entrance for Rivert	

17.3.AS AN APPROXIMATE GUIDE TO STONE SHAPE: THE BREADTH OR THICKNESS OF A SINGLE STONE SHOULD NOT BE LESS THAN ONE-THIRD ITS LENGTH. ROUND MATERIAL CAN

BE USED AS RIP-RAP, PROVIDED IT IS NOT PLACED ON SLOPES GREATER THAN 1.3.

IN SHAPE, IT SHALL BE FREE FROM OVERBURDEN, SPOIL SHALE AND ORGANIC MATTER.

17.2.ROCK IS TO BE HARD, DENSE, DURABLE, RESISTANT TO WEATHERING AND ANGULAR

ARE NOT TO EXCEED 20% BY WEIGHT OF EACH LOAD.

ROCK THAT IS LAMINATED, FRACTURED, POROUS OF OTHERWISE PHYSICALLY WEAK SHALL

NOT BE USED.

STONE SIZE SHALL 8E DEPENDENT ON THE DS0 VALUE SPECIFIED ON THE DRAWINGS, D10 SHALL BE XD50 AND D90 SHALL BE 1.35xD50. STONES SMALLER THAN THE SPECIFIED D10

18.17.1.THE STONE SHALL BE REASONABLY WELL GRADED THROUGHOUT THE RIP-RAP LAYER.

12. THE THICKNESS OF THE RIP-RAP PROTECTION SHALL BE TWICE THE DS0 STONE SIZE SPECIFIED ON

THE DRAWINGS.

INSTALLATION. STRUCTURE

ALL GRATES ARE TO BE CLASS D U.N.O. AND BICYCLE SAFE IN ACCORDANCE WITH AS 3996 U.N.O.

CLIENT: Santin Quarry Produ Ingen Consulting Pty Ltd ACN: (623 948 112 S at Astorwile, NSW p: +614 1726 4987 e: michiel@ingenconsulting.com.au

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ORIGINAL SIZE:
A3
REVISION:
1 Edge of gravel shoulder Power pole and stay Control line chainage Contours (1.0m) Contours (1.0m) Survey mark PROPOSED Toe of batter EXISTING Table drain Table drain Boundary AC surface Edge of AC LEGEND Inlet pit Culvert Fence Tree DRAWING TITLE: Notes and legend PROJECT NUMBER: Copyright in the American and state intension within discussion in the papering of hydro Consultance. This counters was the efficiency and money and an expension of the efficiency and the efficiency of the effi 80 1 PROJECT: Entrance intersection upgrade for Riverbank Quarry [] (3) Section 138 Approval 73.2019.72.1 CLIENT: Santin Quarry Products These are the approved plans LISMORE CITY COUNCIL Ingen Consulting Pty Ltd ACN: 623 948 112 S and Manavalle, NSW p: +614 1726 4987 e: michiel@ingencorsulting.com.au w: www.ingentoorsulting.com.au referred to in the Council Officer 4.THE LISTED SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE THICKNESS OF APPLIED FINISHES. PROVIDE CHAMFERS, FILLETS, REGLETS AND DRIP GROOVES AS SHOWN ON THE STRUCTURAL DRAWINGS. 5.DO NOT MAKE ANY PENETRATIONS OR CHASES OR EMBED ANY ITEMS OTHER THAN THOSE SHOWN IN THE STRUCTURAL DRAWINGS WITHOUT 16.54NPLE TEST AND ASSESS CONCRETE COMPLANCE IN ACCORDANCE WITH PROJECT ASSESSMENT OF STRENGTH GRADE TO SECTION 20 OF AS 360.

17. THE CONCRETE SHALL BE COMPACTED USING HIGH-FREQUENCY VIBRATORS.

18. ALL SLABS SYALL BE PLACED AT THE SAME TIME AS BEANS OF WHICH THY FORM PART.

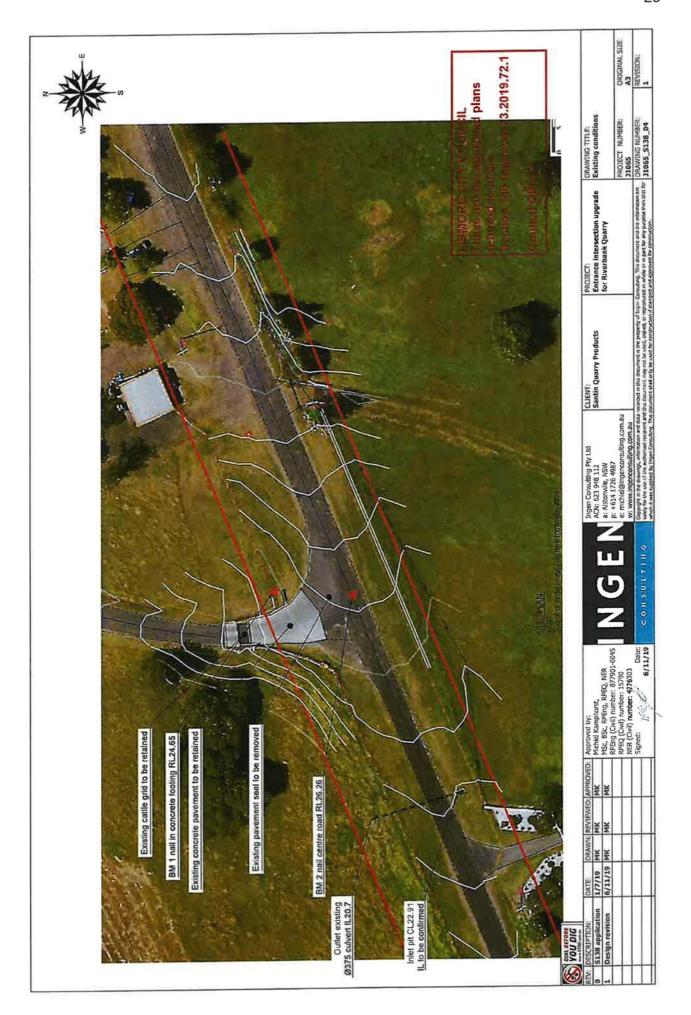
19. TRUM ALL DEBLIFFATIONS LESS THAN 300mm WITH 2 IN 18 DATS EACH SIDE, EACH FACE AND DISPLACE REINFORCEMENT EACH SIDE.

20.CURUNG OF ALL CONCRETE SURFACES SHALL COMMENCE IMMEDIATELY AFTER SURFACES ARE FINISHED AS SPECIFIED AND SHALL CONTINUE FOR A MINIMUM OF 2 DAYS. CONCRETE IN CONTACT WITH GROUND 65nm 9.SUPPORT REINFORCEMENT IN 1TS CORRECT POSITION DURING CONCRETING BY APPROVED BAR CHAIRS, SPACERS OR SUPPORT BARS DO NOT WELD OR SITE BEND REINFORCEMENT UNLESS SHOWN IN THE DRAWINGS OR OTHERWISE SPECIFIED BY THE ENGINEER. REINFORCEMENT IS REPRESENTED OLIGRAMMATICALLY AND IS NOT NECESSARLY SHOWN IN TRUE PROJECTION. PROVIDE QUALITY OF FINISHES OF FORMED SURFACES IN ACCORDANCE WITH AS 3610 AND AS FOLLOWS U.M.O. ON DRAWINGS: BARS WITH MORE THAN 300mm OF CONCRETE UNDER THEM SHALL HAVE LARS 1,25 TIMES THESE LENGTHS. LAP MESH REINFORCEMENT BY ONE COMPLETE MESH. MAXIMUM 56 DAY SHRINKAGE STRAIN TO BE 65µ WHEN TESTED IN ACCORDANCE WITH AS 1012. Nichiel Kamphorst, RPC, NER RPEG, RPC, NER (CAN) number: 97991-0045 RPEC (CNN) number: 15790 NER (CNN) number: 4276303 Date: 6/11/19 ADMIXTURES SHALL NOT BE USED WITHOUT THE WAITTEN APPROVAL OF THE ENGINEER Approved by: CEMENT SHALL BE TYPE A NORMAL CLASS PORTLAND CEMENT U.N.O. 6. FORM CONSTRUCTION JOINTS ONLY WHERE APPROVED BY THE ENGINEER "RF" & "L" DENOTES HARD DRAWN RIBBED WIRE FABRIC TO AS 1304; "S" DENOTES GRADE 250S HOT ROLLED DEFORMED BAR TO AS 1302; "Y" DENOTES GRADE 400Y HOT ROLLED DEFORMED BAR TO AS 1302; "R" DENOTES GRADE 250R HOT ROLLED PLAIN BAR TO AS 1303; "N" DENOTES GRADE SOON HOT ROLLED DEFORMED BAR TO AS 1302. THE NUMBER FOLLOWING THE BAR SYMBOL IS THE BAR DIAMETER IN min. DESIGN AND CONSTRUCT FORMWORK IN ACCORDANCE WITH AS 3610. PROVIDE PREMIX CONCRETE FOR EACH ELEMENT AS FOLLOWS: LAP BAR REINFORCEMENT AS FOLLOWS U.N.O. ON DRAWINGS DATE DRAWN; REVIEWED; APPROVED; 1/7/19 MK MK MK 6/11/19 MK MK MK COVER MAX AG SLUMP "W" DENOTES HARD-DRAWN PLAIN WIRE TO AS 1303: 40mm TOP PROVIDE COVER TO REINFORCEMENT AS FOLLOWS: SUTTABLE FOR THE EXPOSURE CONDITIONS. IN CONTACT WITH GROUND - CLASS 5. CONCEALED SURFACES - CLASS 4; GRADE N32 APPROVAL OF THE ENGINEER. NZD COMPLY WITH AS 3600 1100mm 1300mm 1500mm 1700mm 550mm 1900mm MASS CONCRETE DESCRIPTION: 5138 application N20 N24 N28 Design revision N12 N16 N32 N36 N42 YOU DIG

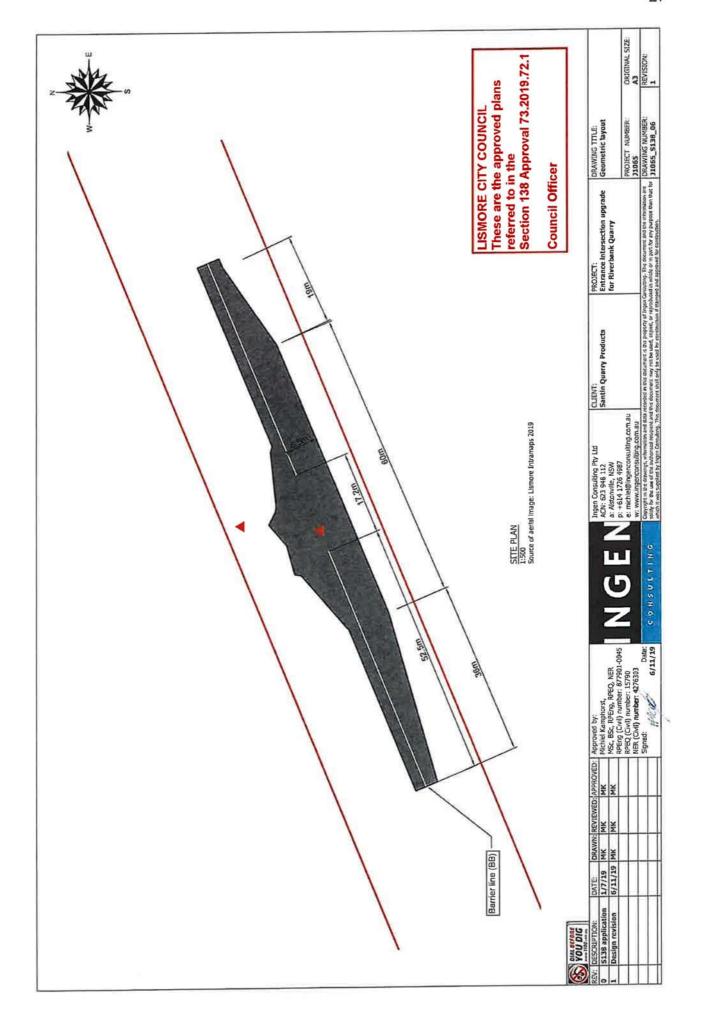
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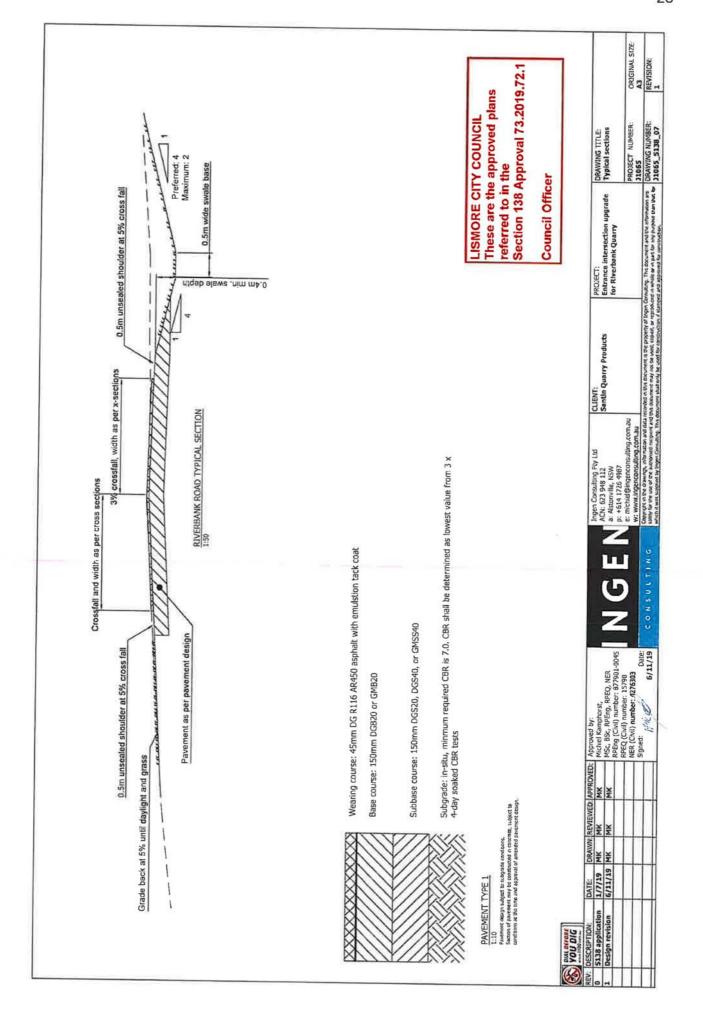


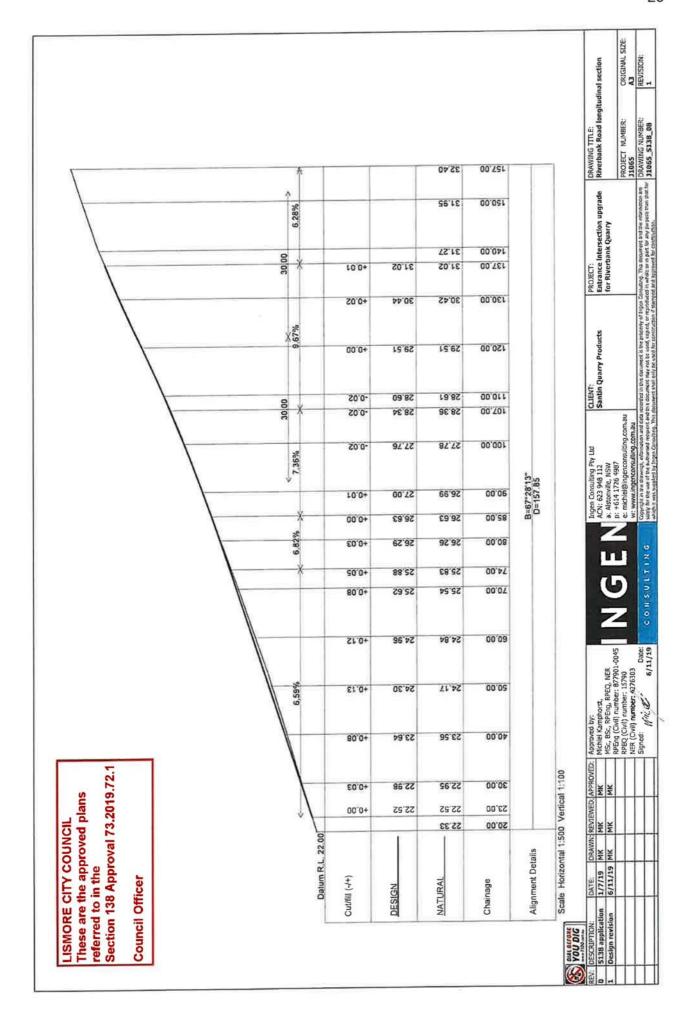


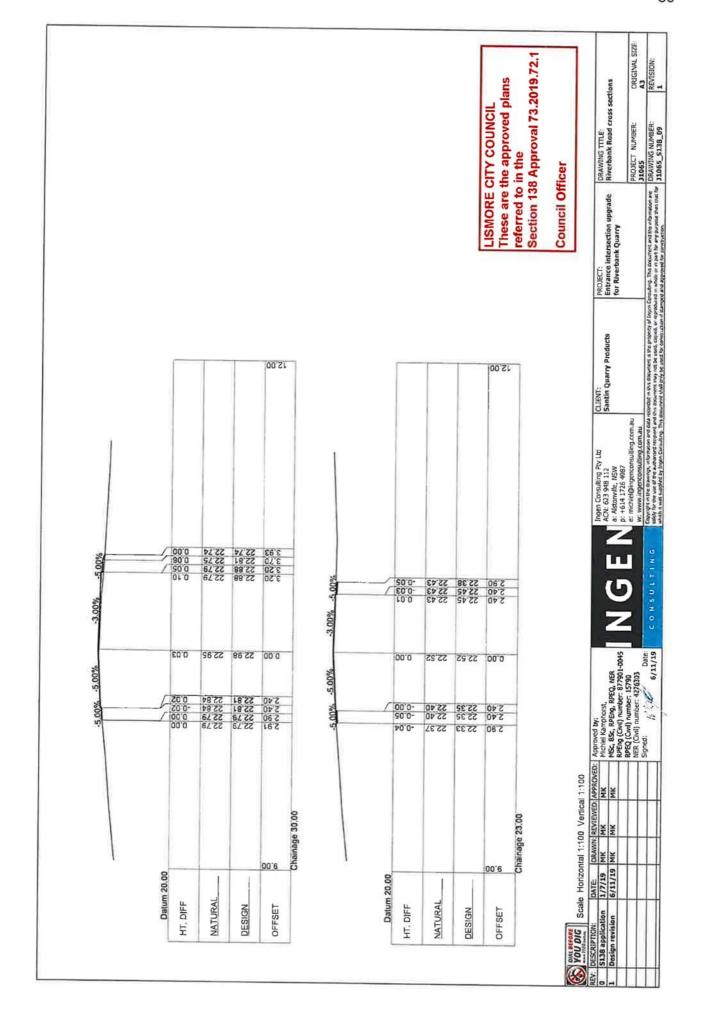


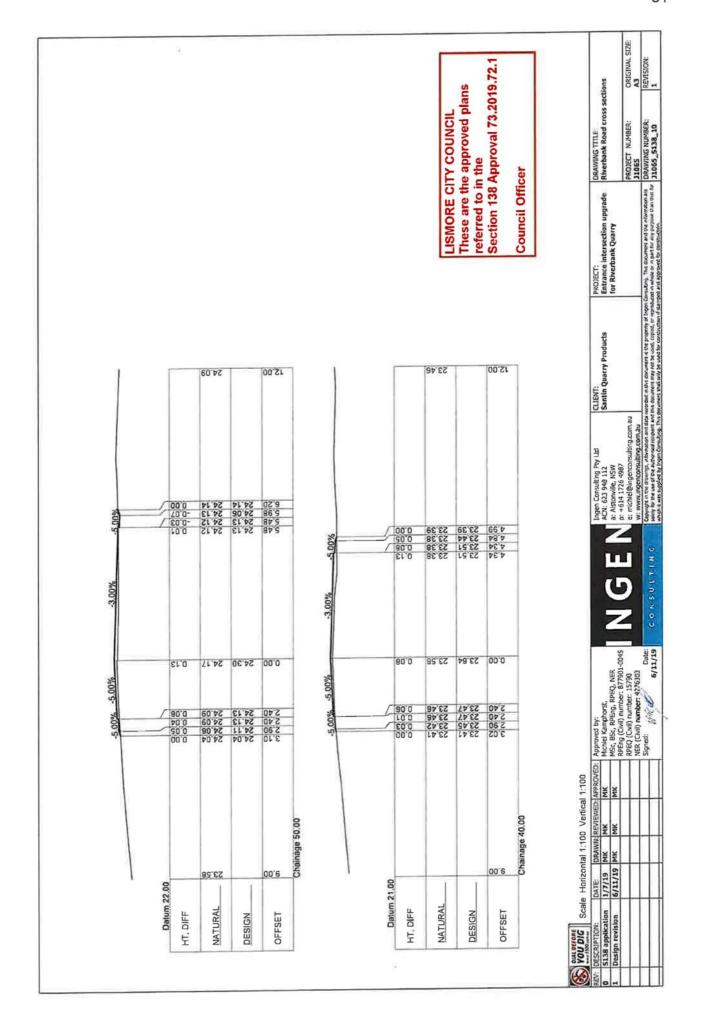
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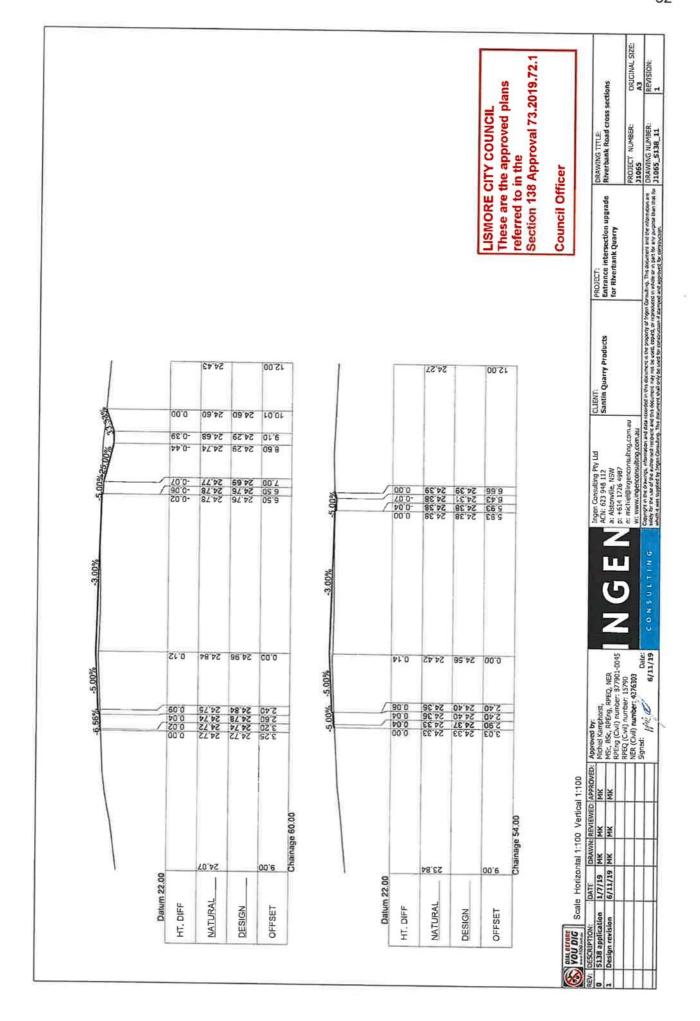
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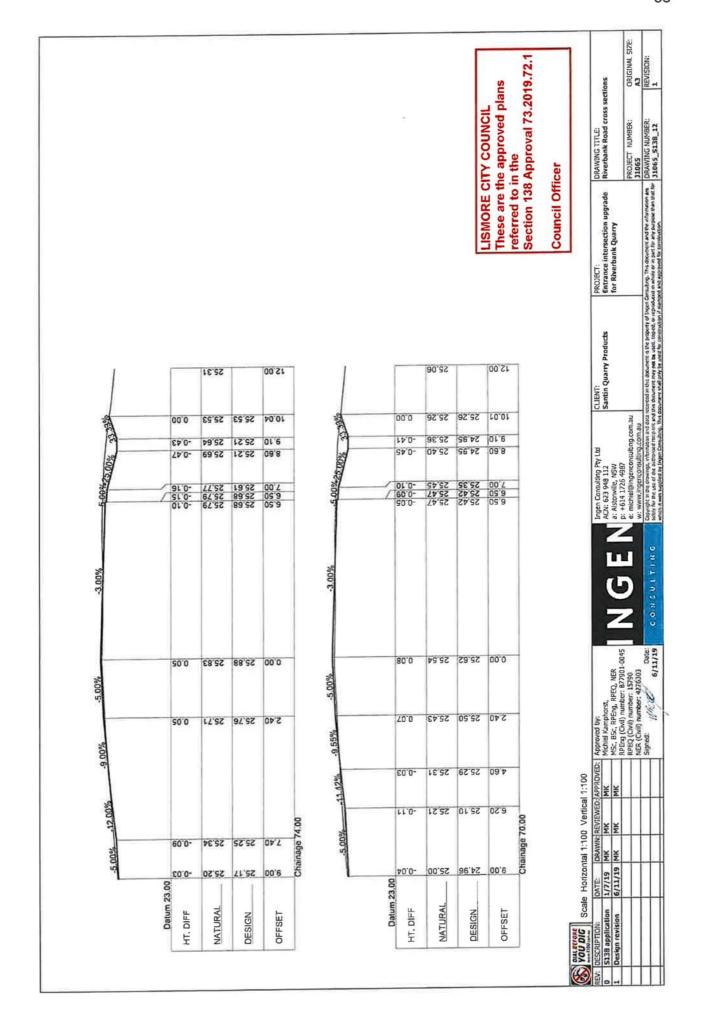


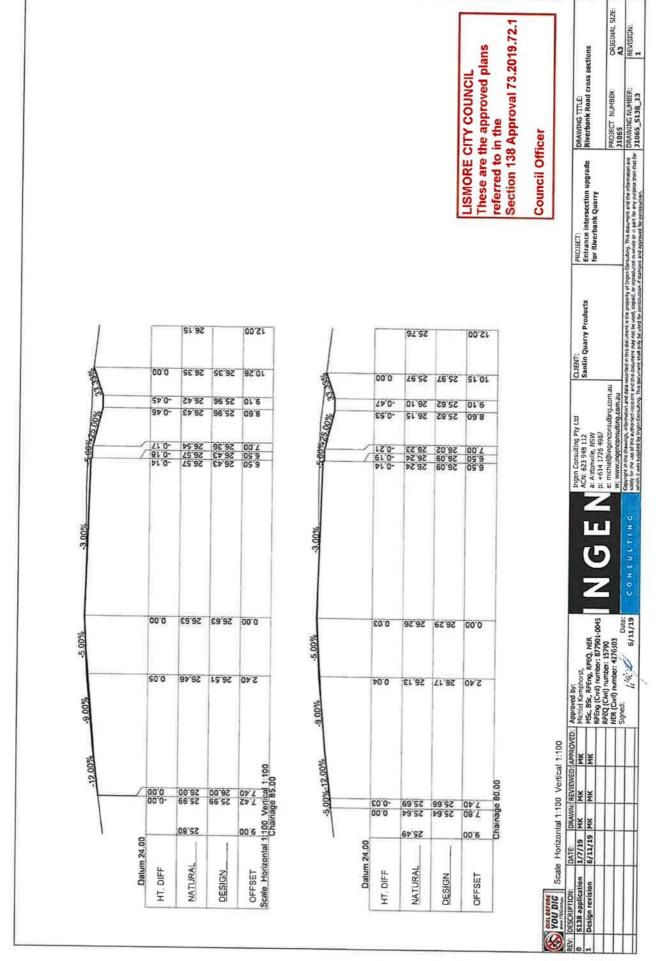


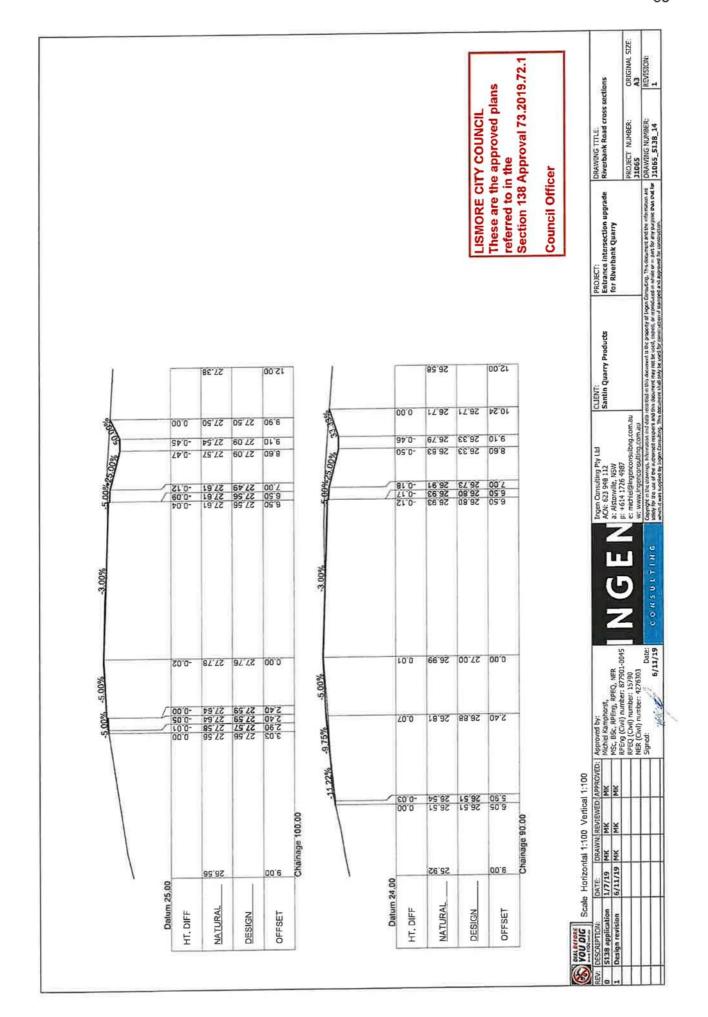


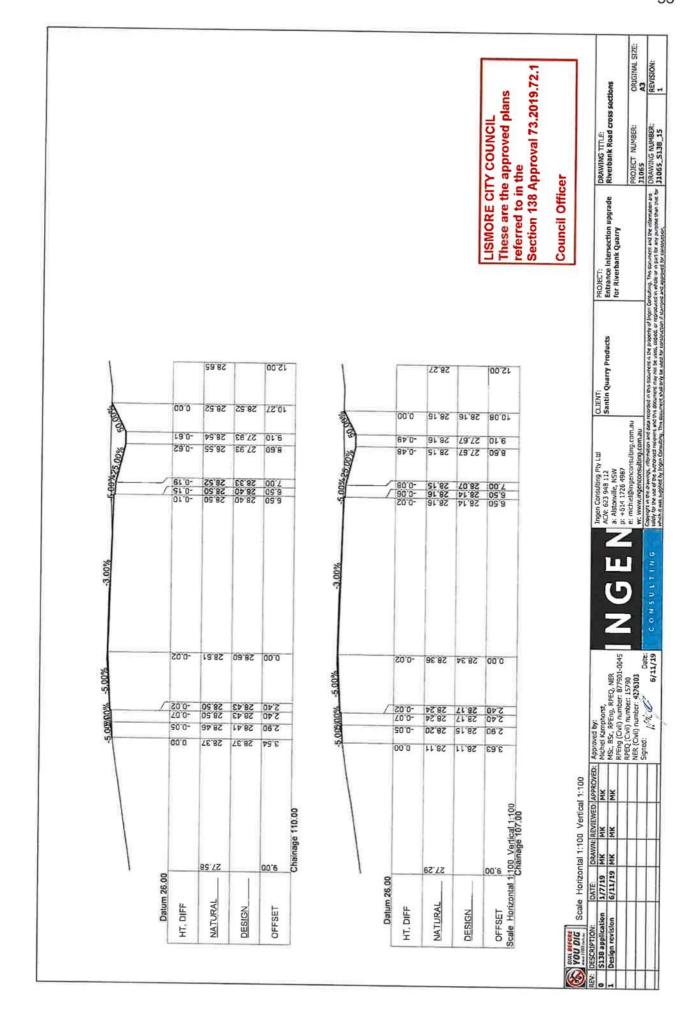


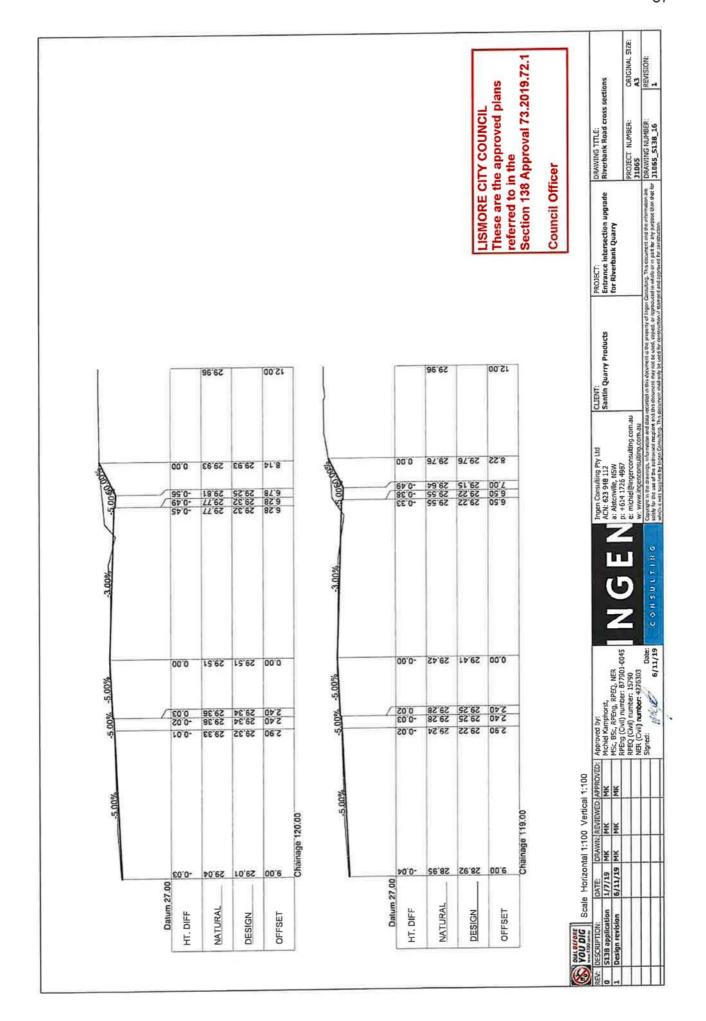
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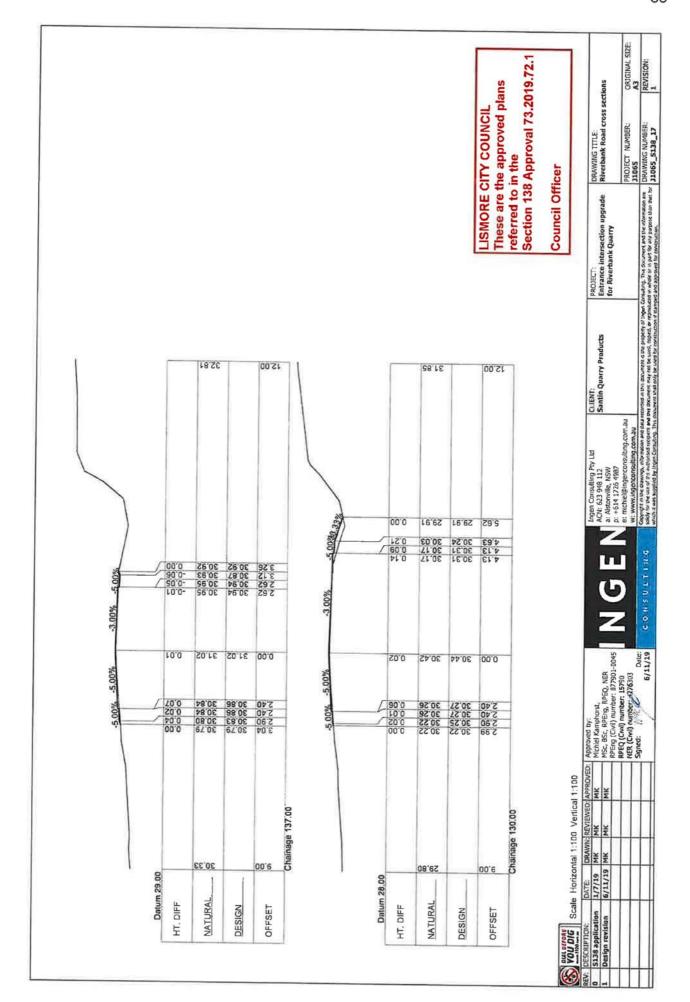






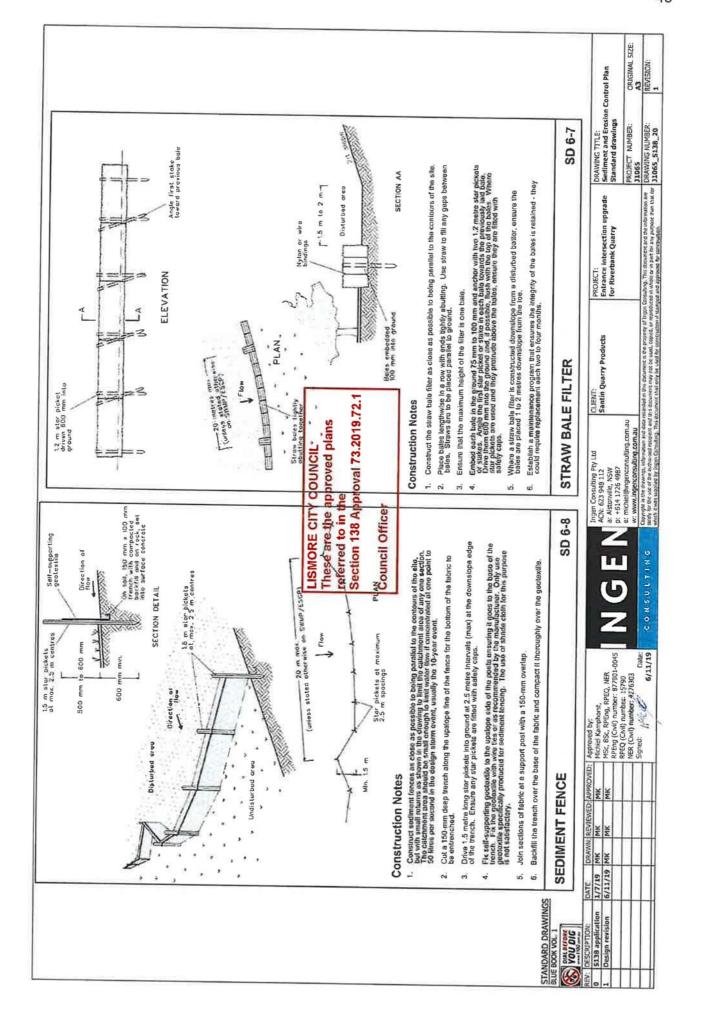


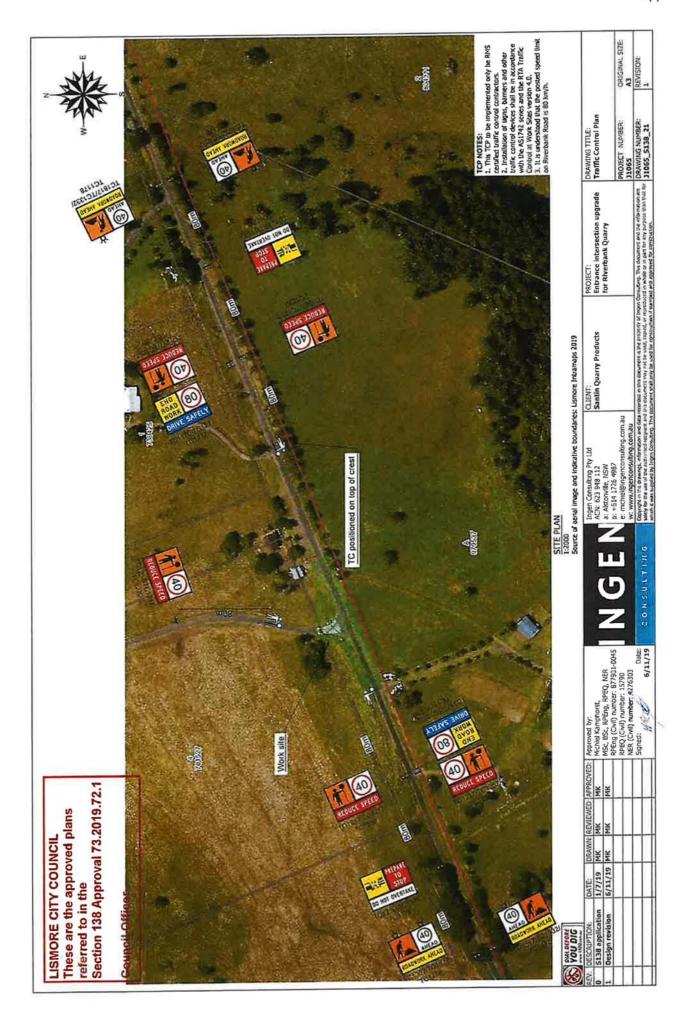




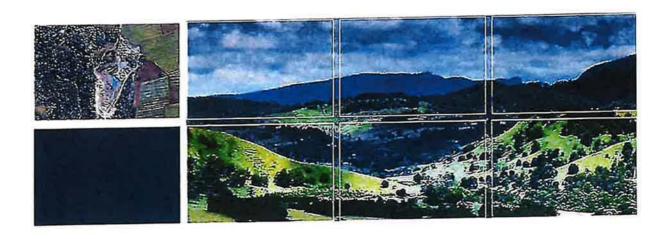


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# ANNEXURE D – BLAKEBROOK QUARRY NOISE AND BLAST MANAGEMENT PLAN





# Blakebrook Quarry Noise & Blast Management Plan



# EMS-MP1

Revision 3.1

for Lismore City Council

August 2018

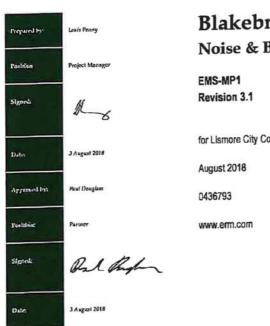
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Rev	Date	Description	By	Review	Approved
1.0	May 2010	Final Draft Noise, Vibration and Blasting	Lismore City Council	Phil Klepzig	Phil Klepzig
		Management Sub-plan	ERM Australia	Steve O'Connor	Steve O'Connor
			Lismore City Council;	Phil Klepzig	Phil Klepzig
Rev A	June 2010	Noise, Vibration and Blasting Management Sub-	ERM Australia	Steve O'Connor	Steve O'Connor
		Plan	DECCW		
			Director General of DoP		*
		Noise, Vibration and	Lismore City Council;	Phil Klepzig	Phil Klepzig
Rev B	April 2011	Blasting Management Sub- plan	ERM Australia	Will Weir	Will Weir
		pian	Director General of DoP	•	
			Lismore City Council	Kevin Trustum	Kevin Trustum
2.0	December 2017	Noise and Blast Management Plan	ERM Australia	Louis Penny	Paul Douglass
			Secretary of DPE	*	•
		SERVICE ROOMS C	Lismore City Council	Kevin Trustum	Kevin Trustum
3.0	March 2018	Noise and Blast Management Plan	ERM Australia	Nathan Lynch	Paul Douglass
			Secretary of DPE		
		Noise and Blast	Lismore City Council	Eleisha Went	Phil Klepzig
3.1	August 2018	Management Plan - Monitoring Location	ERM Australia	Louis Penny	Paul Douglass
		Update	Secretary of DPE		8

This management plan is considered a dynamic document and will be reviewed as part of the annual review process. The management plan and any subsequent revisions must be approved by the relevant Lismore City Council manager. Initial approval of the management plan must also be obtained from the Secretary (or delegate), NSW Department of Planning and Environment in accordance with the Minister's Conditions of Approval. Subsequent management plan revisions do not require Secretary (or delegate) approval; however, a copy of the revised management plan will be submitted for information.



# Blakebrook Quarry Noise & Blast Management Plan

for Lismore City Council

This disclaimer, together with any limitations specified in the report, apply to use of this report. This report was prepared in accordance with the contracted scope of services for the specific purpose stated and subject to the applicable cost, time and other constraints. In preparing this report, ERM relied on: (a) client/third party information which was not verified by ERM except to the extent required by the scope of services, and ERM does not accept responsibility for omissions or inaccuracies in the client/third party information; and (b) information taken at or under the particular times and conditions specified, and ERM does not accept responsibility for any subsequent changes. This report has been prepared solely for use by, and is confidential to, the client and ERM accepts no responsibility for its use by other persons. This report is subject to copyright protection and the copyright owner reserves its rights. This report does not constitute legal advice.

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### **ABBREVIATIONS**

Abbreviation	Meaning
вом	Bureau of Meteorology
CoA	Conditions of Approval
DP	Deposited Plan
DPE	Department of Planning and Environment
EAR	Environmental Assessment Report
EM Strategy	Environmental Management Strategy
EMP	Environmental Management Plan
EMS	Environmental Management System
EPL	Environmental Protection Licence
ERM	Environmental Resources Management
INP	Industrial Noise Policy
LCC	Lismore City Council
LEP	Local Environmental Plan
LGA	Local Government Area
NBM	Noise and Blast Management Plan

#### 1 INTRODUCTION

This Noise and Blast Management Plan (NBMP) has been prepared by Environmental Resources Management Australia Pty Ltd (ERM), on behalf of Lismore City Council in order to manage noise and blast impacts at Blakebrook Quarry, located as shown in *Figure 1.1*.

#### 1.1 PURPOSE

The purpose of this NBMP is to provide procedures to avoid or minimise the noise, vibration and blasting impacts associated with the quarry operation.

#### The NBMP will:

- describe how Lismore City Council will manage and control risks associated with noise, vibration and blasting during the expansion of the quarry;
- ensure that the relevant stakeholders including Lismore City Council, Environmental Protection Agency (EPA), and Department of Planning & Environment (DPE) are involved in the formulation and implementation of this NBMP;
- address the requirements of applicable legislation and any ongoing approvals as they are applicable to the expansion of the quarry;
- meet the Minister's Conditions of Approval (CoA);
- meet the existing Environment Protection Licence (EPL) requirements for noise at Blakebrook Quarry; and
- address the requirements of the Environmental Assessment Report (EAR) (ERM, 2009).

#### 1.2 OBJECTIVES

The objectives of the NBMP are:

- to identify environmental obligations and legislative requirements applicable to Noise, Vibration and Blasting Monitoring during the period of the quarry expansion;
- to describe the specific environmental management requirements and strategies for environmental elements, define objectives and set targets for environmental performance;
- to provide ongoing monitoring of noise, vibration and blasting levels in the vicinity of the quarry, to allow prompt identification of any increased impacts;

- to demonstrate how any potential impacts on surrounding residential receivers will be managed and mitigated;
- to consult with the relevant parties during the preparation and implementation (as required) of this NBMP; and
- to define key roles and responsibilities.

### 1.3 REVIEW SCHEDULE

In accordance with the CoA for the Blakebrook Quarry expansion, this NBMP will be formally reviewed internally within Lismore City Council by the end of March each year. At a minimum an updated Plan will be submitted to the DPE every three years, unless a revision is required due to the outcomes of the yearly review.

Accordingly, the next reviews of the NBMP are listed in Table 1.1.

#### Table 1.1 Review Schedule

No.	Date	Review Type	Reviewer
R2	18-Dec-2017	Submission of Amended NBMP	Lismore City Council / DPE
R3	23-Mar-2018	Submission of NBMP	Lismore City Council / DPE
R4	18-Dec-2018	Internal Review	Lismore City Council
R5	18-Dec-2019	Internal Review	Lismore City Council
R6	18-Dec-2020	Internal Review	Lismore City Council
R7	18-Dec-2021	External Review	Lismore City Council / DPE



### 1.4 QUARRY OPERATIONS

The Blakebrook Quarry development consent limits production to 500,000 tonnes per annum and transport of 600,000 tonnes of quarry materials from the site per calendar year, or dispatch more than 100 laden trucks from the site on any calendar day. Production at the quarry has remained at or below the allowable rate over the life of the current consent. The quarry has also maintained compliance with all other relevant conditions of consent over the current life.

#### 1.5 BACKGROUND

Blakebrook Quarry has an identified resource of approximately 13.6 million tonnes which, based on an extraction rate of 600,000 tonnes per annum, would allow for quarrying for approximately 22 years. The maximum proposed extraction rate was not expected be achieved in all years of quarrying. Project approval was therefore sought for an area sufficient for 30 years of quarrying with maximum extraction rate of 600,000 tonnes per annum, continuing in the existing main pit (referred to as the 'North Pit') and a new smaller pit (herein also referred to as the 'South Pit') located to the south of the existing pit.

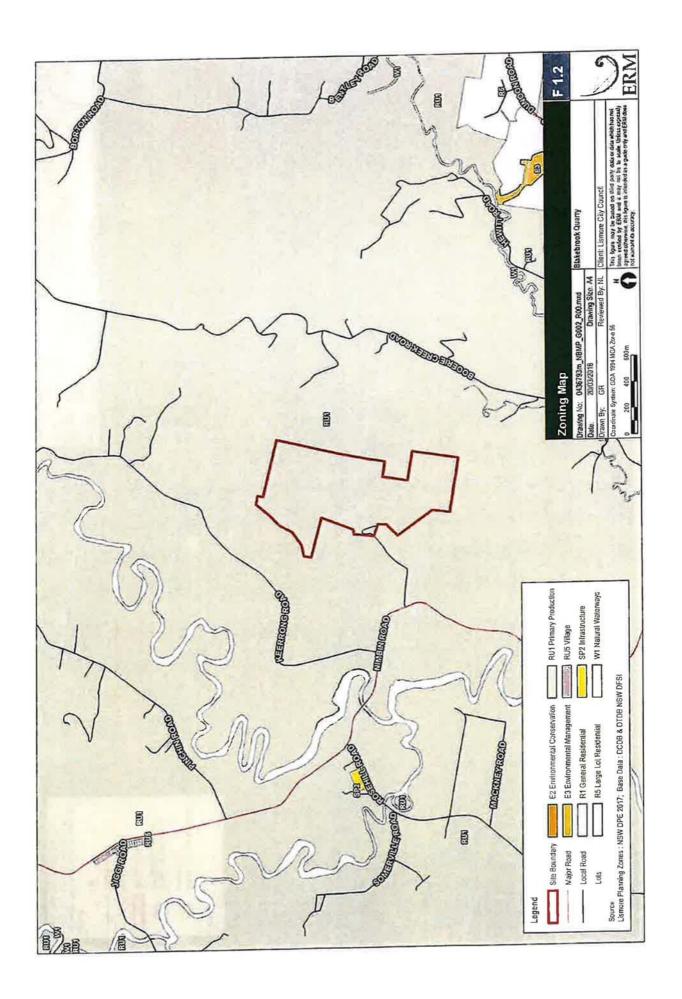
In August 2017, Lismore City Council submitted a Modification Application to the DPE seeking to mine the first 10 metres of the cap rock in the South Pit at Blakebrook Quarry. The South Pit was previously unable to be mined until late 2018, at the completion of the detailed groundwater assessment. On 18 September 2017, approval was granted to Lismore City Council to undertake these works, in accordance with revised CoA.

### 1.6 AREA OF OPERATION

The site is located approximately seven kilometres north west of Lismore on the Nimbin Road on Lot 102 DP 817730 and Lot 1 DP 845473 (184 and 184A Keerrong Road) Lismore (see Figure 1.1 in Section 1.0), and zoned RU1 'Primary Production' as outlined in Figure 1.2. Nearby potentially sensitive receptors have also been identified as part of this management plan and are outlined in Figure 1.3.

#### 1.7 OPERATIONAL OVERVIEW

Quarrying has initially commenced laterally in the existing main pit before extraction in the southern pit occurs, in order to ensure continued demands for the hard rock material can be met. Council has purchased mobile crushing and screening plant for operation in the quarry pits, which will result in a significant reduction in plant noise. It is expected that over the initial 10 years of the 30-year life of the quarry that production will average approximately 450,000 tonnes per annum including extraction of high quality product from the southern pit. The production is expected to increase beyond 10 years to the maximum 600,000 tonnes per annum.





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## 2 STATUTORY REQUIREMENTS

### 2.1 LEGISLATION & POLICIES

The applicable legal and other requirements related to noise, vibration and blasting and environmental management for the quarry expansion are outlined in *Table 2.1*.

## Table 2.1 Legislation & Policies of Relevance

#### Legislation and Policies

#### Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

### New South Wales Legislation

Environmental Planning and Assessment Act 1979

Protection of the Environment Operations Act 1997

Protection of the Environment Operations (General) Regulations 2009

Protection of the Environment Operations (Noise Control) 2017

EPA NSW Noise Policy for Industry

#### Regional Planning Documents

North Coast Regional Plan 2036

#### **Local Government Documents**

Lismore Local Environmental Plan 2012

#### 2.2 APPROVAL CONDITIONS

### Minister's Conditions of Approval

Pursuant to section 75B(1) of the Environmental Planning and Assessment Act 1979 (EP&A Act), the quarry expansion was declared to be a project under Part 3A of the Act and Project Approval has been granted by the Minister for Planning.

Schedule 3, Conditions #1 to #9 of the CoA outline the requirements for transport associated with Blakebrook Quarry. The relevant conditions are provided as follows:

#### NOISE

#### Hours of Operation

The Proponent must comply with the operating hours set out in Table 1.

### Table 1: Operating hours

Activity	Permissible Hours	
Quarrying operations including loading and dispatch of laden trucks	7 am to 6 pm Monday to Friday 7 am to 3 pm Saturday	
supplied by made trucks	At no time on Sundays or public holidays	
Blasting	10 am to 3 pm Monday to Friday (except public holidays)	
	At no time on Sundays or public holidays	
Maintenance	May be conducted at any time, provided that these activities are not audible at any privately-owned residence	

- 2. The following activities may be carried out outside the hours specified in condition 1 above:
  - (a) delivery or dispatch of materials as requested by Police or other public authorities; and
  - (b) emergency work to avoid the loss of lives, property or to prevent environmental harm.

In such circumstances, the Proponent must notify the Secretary and affected residents prior to undertaking the activities, or as soon as is practical thereafter.

3. The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately-owned land.

Table 2: Noise criteria dB(A)

Keceiver	Day		
	L <sub>Ary</sub> (15 minute)		
Location 2	36		
All other locations	35		

Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy. Appendix 5 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, the noise criteria in Table 2 do not apply if the Proponent has an agreement with the relevant landowner to exceed the noise criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

#### **Operating Conditions**

- 4. The Proponent must:
  - (a) implement best practice management to minimise the construction, operational and road transportation noise of the project;
  - (b) minimise the noise impacts of the project during meteorological conditions when the noise criteria in this approval do not apply (see Appendix 5);

- (c) carry out noise monitoring (at least every 3 months or as otherwise agreed with the Secretary) to determine whether the project is complying with the relevant conditions of this approval; and
- (d) regularly assess noise monitoring data and modify and/or stop operations on site to ensure compliance with the relevant conditions of this approval, to the satisfaction of the Secretary.

Note: Required frequency of noise monitoring may be reduced if approved by the Secretary.

#### Noise Management Plan

- 5. The Proponent must prepare a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:
  - (a) be prepared in consultation with the EPA;
  - (b) be submitted to the Secretary within 3 months of the determination of Modification 1, unless otherwise agreed by the Secretary;
  - (c) describe the measures to be implemented to ensure:
    - compliance with the noise criteria and operating conditions of this approval;
    - best practice management is being employed; and
    - the noise impacts of the project are minimised during meteorological conditions under which the noise criteria in this approval do not apply (see Appendix 5);
  - (d) describe the proposed noise management system; and
  - (e) include a monitoring program to be implemented to measure noise from the project against the noise criteria in Table 2.

The Proponent must implement the Noise Management Plan as approved from time to time by the Secretary.

#### BLASTING

### Blasting Impact Assessment Criteria

6. The Proponent must ensure that blasting on site does not cause any exceedance of the criteria in Table 3.

Table 3: Blasting Criteria

Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
120	10	0%
		5% of the total number of
115	5	blasts over a period of 12 months
	overpressure (dB(Lin Peak)) 120	overpressure vibration (dB(Lin Peak)) (mm/s)  120 10

However, these criteria do not apply if the Proponent has a written agreement with the relevant owner to exceed the limits in Table 3, and the Proponent has advised the Department in writing of the terms of this agreement.

#### Blasting Frequency

7. The Proponent may carry out a maximum of 2 blasts per month, unless an additional blast is required following a blast misfire. This condition does not apply to blasts required to ensure the safety of the quarry or workers on site.

Note: For the purposes of this condition, a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the quarry.

#### Operating Conditions

- 8. During blasting operations, the Proponent must:
  - (a) implement best practice management to:
    - protect the safety of people and livestock;
    - protect public or private infrastructure and property from damage; and
    - minimise the dust and fume emissions;
  - (b) operate a suitable system to enable the local community to get up-to-date information on the proposed blasting schedule on site; and
  - (c) carry out regular monitoring to determine whether the project is complying with the relevant conditions of this approval, to the satisfaction of the Secretary.

#### Blast Management Plan

- 9. The Proponent must prepare a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must:
  - (a) be submitted to the Secretary for approval within 3 months of the determination of Modification 1, unless otherwise agreed by the Secretary;
  - (b) describe the measures to be implemented to ensure compliance with the blast criteria and operating conditions of this approval;
  - (c) include measures to manage flyrock to ensure the safety or people and livestock and to protect property;
  - (d) include a monitoring program for evaluating and reporting on compliance with the blasting criteria in this approval;
  - (e) include local community notification procedures for the blasting schedule, in particular to nearby residences; and
  - (f) include a protocol for investigating and responding to complaints related to blasting operations.

The Proponent must implement the Blast Management Plan as approved from time to time by the Secretary.

#### Other Conditions

The Environment Protection Licence No 3384 (EPL) for Blakebrook Quarry has in place existing conditions for noise, air blast overpressure and vibration levels which are as follows:

L6.1 Noise from the premises must not exceed:

(a) 35dB(A) LAeq(15 minute) during the day (7am to 6pm) Monday to Saturday;

Where LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L6.2 The air blast overpressure level from blasting operations in or on the premises must not exceed:

- (a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
- (b) 120 dB (Lin Peak) at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L6.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:

- (a) 5mm/s for more than 5% of the total number of blasts carried out on the premises during each reporting period; and
- (b) 10 mm/s at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.

### 2.3 GUIDELINES & STANDARDS

Relevant environmental standards, policies and guidelines, applicable to this management plan are provided in *Table 2.2*.

# Table 2.2 Environmental Standards, Policies and Guidelines

#### Standards and Guidelines

Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration.

NSW Environment Protection Authority (EPA) - NSW Environmental Noise Management - Industrial Noise Policy (INP), January 2000 and relevant application notes.

NSW Department of Environment, Climate Change and Water - NSW Road Noise Policy (RNP), March 2011 (the former being the Environmental Criteria for Road Traffic Noise, 1999)

### Standards and Guidelines

Standards Australia AS 2436-2010™ (AS2436) - Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

Standards Australia AS1055-1997™ (AS1055) - Description and Measurement of Environmental Noise.

Standards Australia AS IEC 61672.1-2004<sup>TM</sup> (AS61672) - Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990<sup>TM</sup> (AS1259) - Acoustics - Sound Level Meters - Integrating/Averaging as appropriate to the device.

Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard<sup>TM</sup> – Electroacoustic – Sound Calibrators.

# 2.4 RELATED MANAGEMENT PLANS

This NBMP forms part of an overarching EM Strategy for Blakebrook Quarry. Where relevant, reference should also be made to the other management plans, as listed in *Table 2.3*.

# Table 2.3 Blakebrook Quarry Management Plans

Reference No.	Management Plan	
EMS	Environmental Management Strategy	
EMS-MP2	Air Quality Management Plan	
EMS-MP3	Soil and Water Management Plan	
EMS-MP4	Biodiversity and Rehabilitation Management Plan	
EMS-MP5	Aboriginal Heritage Management Plan	
EMS-MP6	Traffic Management Plan	
EMS-MP7	Ground Water Management Plan	

#### 3 EXISTING ENVIRONMENT

#### 3.1 BASELINE CONDITIONS

Quantifying the existing noise environment (via measurement) at the closest and/or potentially most affected receptors situated within the potential area of influence of a site is a key feature of assessing and managing potential noise impacts. This was achieved throughout the Noise Assessment prepared by ERM in 2009, as outlined below.

A detailed Noise Assessment (ERM, 2009) was undertaken to understand the existing acoustic environment and to assess the potential noise impacts associated with the proposed expansion of Blakebrook Quarry on the surrounding environment, using noise modelling. The Noise Assessment (ERM, 2009) has been summarised below, and considered the following:

- potential noise and vibration impact at noise assessment locations from existing and proposed operational noise from the quarry, including blasting;
   and
- potential noise impact at noise assessment locations due to increased traffic flows to and from the quarry expansion.

#### Assessment Guidelines

The Noise Assessment was prepared with due regard and in accordance with the following guidelines, which were applicable at the time of completion:

- Environmental Criteria for Road Traffic Noise (ECRTN) (1999).
- NSW Environment Protection Authority (EPA) NSW Environmental Noise Management – Industrial Noise Policy (INP), January 2000 and relevant application notes.
- Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990).

### Assessment Methodology

Six residential properties were identified as being potentially affected by noise associated with the quarry expansion and were therefore used as noise assessment locations (referred to as noise assessment locations 1 to 6) in the Blakebrook Quarry Noise Assessment (ERM, 2009). These locations formed the basis of the noise modelling scenarios, outlined below.

Noise modelling was conducted using Environmental Noise Model (ENM) software; which is widely accepted as a reliable method of predicting noise levels from industrial sources (as the time in which the Noise Assessment was completed). Noise modelling conservatively assumes concurrent operation of

all equipment during each stage as described in Section 5.2 of the Noise Assessment (ERM, 2009).

Four noise modelling scenarios were created for the Blakebrook Quarry assessment, which were:

- Existing Operation models the noise currently generated by the existing operations and provides a useful baseline scenario for comparative purposes;
- Proposed Overburden Stripping models the future noise generated by a
  combination of existing and proposed equipment, including overburden
  stripping equipment. This represents the worst case scenario noise levels as
  overburden stripping plant typically operate at the surface without shielding
  or bunding. Overburden stripping is conservatively estimated to be
  undertaken for periods of two weeks at a time;
- Proposed Central Operation models future noise generated by a
  combination of existing and proposed equipment. Proposed additional
  equipment includes mobile screening and crushing plant that will be located
  centrally in the main pit; and extractive machinery, such as an excavator that
  will be added to the proposed southern pit; and
- Proposed Northern Operation models identical equipment to the Proposed Central Operation with the proposed equipment located at the northern end of the pit.

#### Assessment Results

Noise Modelling

The predicted noise levels for noise assessment locations 1, 3, 4 and 6 are in compliance with project specific criteria for all modelled operating scenarios. Both noise assessment locations 2 and 5 are deemed compliant for the majority of the modelled operating scenarios.

At location 2 the noise levels are comparable to existing levels as the dominant noise source is the existing jaw crusher.

The resultant noise levels at location 5 are being driven by the plant equipment at the (new) southern pit. As this equipment has been modelled at or near the surface, these results are considered conservative. The predicted 'Overburden Stripping' noise level at location 5 is above the nominated criteria. The predicted operational noise is comparable to existing noise at some of the assessment locations and given the limited duration, noise impact is not considered significant.

Although predicted levels due to the quarry expansion marginally exceed existing noise levels at noise assessment locations 1, 2 and 5 it is important to note that the INP addresses 'Existing Situation' in Chapter 10 and states:

"Where existing noise emissions exceed the project-specific noise level, the regulatory authorities and the noise-source manager need to negotiate achievable noise limits for the site. The project-specific noise levels should not be applied as mandatory noise limits.....achievable noise limits result from applying all feasible and reasonable noise control measures."

#### Construction Noise

There will be no significant construction activities that are likely to add to received noise levels at residences.

### Road Traffic Noise

Based on 2006 daily traffic volumes of 3,200 vehicles per day and a linear growth rate of 2.2%, non-site related traffic on Nimbin Road is forecast at 4,100 vehicles per day for the year 2018. This volume of traffic is equivalent to a noise level of 65dB(A) Leq15hr. This complies with former DECCW criteria as site related traffic noise on Nimbin Road will increase existing road traffic noise by 1dB on average over a 15 hour period, which is under the 2dB recommendation.

### Blasting Noise and Vibration

As Blakebrook Quarry is currently undertaking changes to its blasting regime, historic reports were not felt to be representative of new blasting scenarios. An indicative assessment was therefore undertaken by ERM.

Vibration and overpressure levels for the Blakebrook Quarry were found to be within the accepted guidelines for nearby residences. As blasting will be carried out for the life of the quarry, each blast will be carefully designed and monitored to ensure that PPV and overpressure criteria continue to be met at residential locations. This applies to the anticipated changes to the blasting regime mentioned above and throughout the Noise Assessment (ERM, 2009).

# 4 ENVIRONMENTAL IMPACTS & RISK ANALYSIS

# 4.1 ENVIRONMENTAL IMPACTS

The Quarry activities that are most likely to have the potential to result in noise and vibration impacts on residential receivers will be quarrying activities including operating machinery, blasting, and transport of materials on and off site for the expansion of the quarry.

### 4.2 RISK ANALYSIS

Given that the activities undertaken at Blakebrook Quarry have the potential to impact on the surrounding environment, the commensurate level of risk associated with these impacts is required to be identified in order to better ensure that it can be mitigated and managed to an acceptable level via means of this management plan.

Accordingly, Table 4.1 summaries the likely risk level associated with each of the prospective noise, vibration, and blasting impacts, assuming that no mitigation measures or controls are put in place to manage the impacts. The risk assessment process is in accordance with that described in the EM Strategy for Blakebrook Quarry.

As previously stated, the risk rating assigned in *Table 4.1* assumes no mitigation or control measures are in place to respond to the identified environmental impact. By implementing the measures outlined in this NBMP, these traffic impacts and associated risks can be managed to an acceptable level, such that the risk would be considered negligible.

Table 4.1 Noise, Vibration & Blasting Impact Risk Analysis

ID	Aspect	Impact	Risk			
N1	Quarrying Activities including excavation and crushing of material		Low			
N2	Blasting to expand Quarry	Increase in vibration and noise impacts on residential receivers	Low			
N3	Transport of material on and off site	Increase in traffic movements increasing noise on surrounding roads	Low			
Note:		8				
Risk Rat	o , T and pote	High (serious impacts and potential repercussions)  Medium (significant impacts and potential repercussions)				
	Low (minor impacts and poten	nd potential repercussions) tial repercussions)				

# 5 PERFORMANCE CRITERIA & INDICATORS

The intention of this NBMP is to ensure that quarry expansion works do not have an adverse impact on the identified sensitive receptors as a result of general operational noise emissions and blasting activities.

In order to achieve this intent, the following Performance Criteria and Indicators have been developed to guide noise management for Blakebrook Quarry based on the following (refer to *Table 5.1*).

Table 5.1 Performance Criteria and Indicators

Performance Criteria	Performance Indicator	Management/ Control
C1: No significant impacts on sensitive receptors due to noise emissions.	II.1: Comply with operating hours set out in Condition 1 in Schedule 3 of Project Approval (MP 07_0020).	Refer to Section 7.2 & 7.3
	II.2: Noise generated by the quarry expansion does not exceed the criteria nominated in Condition 3 in Schedule 3 of Project Approval (MP 07_0020).	Refer to Section 7.2 & 7.3
C2: No significant impacts on sensitive receptors due to blasting activities.	12.1: Ensure blasting activities does not cause any exceedance of the criteria identified in Condition 6 in Schedule 3 of Project Approval (MP 07_0020).	Refer to Section 7.2 & 7.3
	12.2: carry out a maximum of 2 blasts per month, unless an additional blast is required following a blast misfire.	Refer to Section 7.2 & 7.3
	I2.2 The air blast overpressure level from blasting operations in or on the premises must not exceed the criteria identified in L6.2 of the EPL No 3384.	Refer to Section 7.2 & 7.3

# 6 MANAGEMENT & MITIGATION CONTROLS

# 6.1 "BEST PRACTICE" MANAGEMENT APPROACH

In managing the Blakebrook Quarry, Lismore City Council is seeking to ensure that a "Best Practice" management approach is used across all areas of potential impact management. This approach involves incorporating a suite of site-specific mitigation measures and management controls (like those provided in the sections below) in accordance with the most relevant guidelines and standards to minimise, mitigate and manage noise and blasting impacts associated with the quarry expansion.

Such guidelines, policies and standards include:

- NSW Environment Protection Authority (EPA) NSW Environmental Noise Management - Industrial Noise Policy (INP), January 2000 and relevant application notes.
- Standards Australia AS1055-1997™ (AS1055) Description and Measurement of Environmental Noise: Parts 1, 2 and 3.
- NSW Department of Environment, Climate Change and Water NSW Road Noise Policy (RNP), March 2011.

# 6.2 PROPOSED MANAGEMENT CONTROLS

The list of the work practices that will be used to control environmental impacts during quarry expansion are provided in *Table 6.1*.

# Table 6.1 Management Strategies & Work Practices

Issue		Strategy/Practice
Expansion of quarry increases traffic movement	•	Ensure all vehicles leaving site are maintained and noise levels are within equipment specifications.
Increase in noise impacts at residential receptors from quarrying activities	•	Mitigation measures as outlined in Section 6.3 are implemented. Monitoring of compliance with criteria as per Section 8.0. Non-compliance to result in consideration of further mitigation measures.
Increase in vibration and noise impacts on residential receivers from blasting activities	•	Blasting impacts will be assessed in accordance with the recommended ANZECC criteria. These criteria are used to assess human annoyance, discomfort and potential property impacts from blasting activities. Assessments will identify quarrying areas that may require additional management of blasting practices to reduce potential blast and vibration impacts. Vibration monitoring to confirm conformance with criteria in EPL.

#### 6.3 PROPOSED MITIGATION MEASURES

Several noise mitigation measures are currently in place at Blakebrook Quarry and will continue to be employed throughout the proposed expansion. These measures are summarised as follows:

- Ensure that works on site are limited to the approved quarry operating hours (between 7am and 6pm Monday to Friday, and 7:00am to 3:00pm on Saturday).
- Ensure that all significant noise generating plant and equipment are procured, maintained and managed to reduce noise and that mitigation is applied where feasible, reasonable and necessary.
- Avoid concentrations of equipment in sensitive work areas e.g. on top of the dump or bund.
- Road traffic noise created by the haul trucks accessing the site is ameliorated by imposing a speed limit of 40km/h in the site and compression braking is prohibited whilst on-site.
- Avoid trucks congregating along internal haul roads.
- Instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas.
- Ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines will be repaired or removed from the site.
- All mechanical plant and equipment will be silenced by the best practical means using current technology. Mechanical plant, including noisesuppression devices, will be maintained to the manufacturer's specifications.
- Ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.
- The location of activities, plant and equipment will optimise attenuation effects through measures such as topography, natural and purpose built barriers.
- Combine predictive meteorological forecasting and noise monitoring data to guide the daily planning of quarrying operations during noise-enhancing meteorological conditions.
- A site specific induction will be provided to all site personnel, contractors and sub-contractors with an emphasis on understanding and managing noise impacts form the work activities being undertaken.

- Plant equipment audits will be undertaken on an annual basis for compliance purposes.
- If any validated noise complaints are received, operator attended noise measurements will be undertaken to measure and compare the site noise level contributions (LAeq, 15 minute) to the criteria outlined in the CoA.
- Carry out noise compliance monitoring in accordance with Appendix 5 of the Modified CoA (MOD 1) to ensure the quarry expansion works are complying with the relevant conditions of this approval. Details of the compliance monitoring plan are outlined in Chapter 7.

Noise experienced at sensitive receivers is expected to be progressively reduced as the quarry expansion proceeds, as plant will be relocated to greater pit depths throughout the life of the quarry, in turn progressively reducing noise at nearby receivers.

Implementation of the above mentioned mitigation measures will assist in controlling noise levels emanating from the Blakebrook Quarry.

#### 6.4 BLASTING

Blasting will be limited to the approved quarry operating hours (between 7am and 6pm Monday to Friday, and 7:00am to 3:00pm Saturday) and must not take place on Sundays or public holidays without the written approval of NSW EPA.

In accordance with CoA (MOD\_1) a maximum of two blasts per month are permitted, unless an additional blast is required following a blast misfire. This condition does not apply to blasts required to ensure the safety of the quarry or workers on site.

Best practice management must be implemented during blasting operations and blasting design to ensure that the suitable charge masses (or maximum instantaneous charge, MIC) presented in Table 7.1 of the Noise Assessment (ERM, 2009) are adhered to. Compliance with the ANZEC 1990 guideline is contingent on the blast event location and the charge used; both of which are easily managed by good blasting practices.

In accordance with CoA (MOD\_1), the local community will receive with upto-date information on the proposed blasting schedule on site.

Blast event monitoring will also be undertaken to determine whether the project is complying with the relevant criteria. Details of the blast monitoring are outlined in Chapter 7.

#### 7 MONITORING PLAN

This Monitoring Plan will be adhered to during quarry operations to ensure compliance with the relevant Conditions of Approval.

### 7.1 MONITORING OBJECTIVES

The noise measurement procedures employed throughout the monitoring program shall be guided by the requirements of AS 1055-1997 "Acoustics - Description and Measurement of Environmental Noise" and the NSW EPA Noise Policy for Industry (EPA, 2017).

Vibration and air blast overpressure measurement and procedures employed throughout the monitoring program shall be guided by the requirements of AS 60068.3.8-2004 "Supporting Documentation and Guidance – Selecting Amongst Vibration Tests" and the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration.

Noise, vibration and blasting monitoring will:

- ensure the quarry is operating as anticipated with respect to impacts of noise,
   vibration and blasting on residential receptors;
- gauge the impact (if any) of the extraction activities on the noise and vibration level across the site;
- identify any unforeseen noise or vibration impacts from the quarry operations on residential receptors;
- implement measures to prevent any as yet unforeseen impacts from the proposed expansion of the quarry; and
- verify that the quarry is achieving its environmental objectives.

#### 7.2 MONITORING LOCATIONS

The Noise Assessment (ERM, 2009) included seven noise monitoring locations that were used throughout the assessment, based on proximity to nearby potentially sensitive receptors. Given the proximity between monitoring locations and the location of anticipated noise-generating plant and equipment, the monitoring locations have been revised and separated into primary and supplementary acoustic monitoring locations for the purposes of this NBMP.

Primary and supplementary acoustic monitoring locations are identified in *Figure 1.3*. Primary acoustic monitoring locations consist of locations 2, 4 and 8, with the remainder consisting of supplementary acoustic monitoring locations.

An agreement was reached with the landowner located along Nimbin Road (previously identified as location 8, ERM 2009) in April 2016, wherein the landowner has agreed to exceedances in noise levels from quarry operations. As such the location has been removed as a primary acoustic monitoring location, and a new monitoring location selected.

Primary monitoring locations will be utilised during noise compliance monitoring and are considered representative in determining compliance with the relevant Conditions of Approval.

In the event that additional monitoring is required (for example, during blasting events) then additional monitoring will be undertaken at the most practical supplementary acoustic monitoring locations, as well as at the primary acoustic monitoring locations.

#### 7.3 SCHEDULE

Noise monitoring shall be conducted every three months for period of 12 months (and in response to any complaints) and will consist of operator attended noise monitoring and spot checks of equipment. The frequency of monitoring will be reviewed after the first 12 months of operation to determine future monitoring requirements.

Air blast overpressure and ground vibration levels must be measured at the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative level - for all blasts carried out in or on the premises. The primary acoustic monitoring locations identified above are considered representative of nearby sensitive receivers, however supplementary locations can be considered in the event that an additional range of monitoring is required.

### 7.4 METHODOLOGY

#### Noise

Operator attended noise measurements shall be conducted at all primary acoustic measurement locations (Locations 2, 4 and 9 - refer *Figure 1.3*) to quantify and characterise the maximum (LAmax), the energy equivalent (LAeq), and background (LA90) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the LAeq (Period) noise contribution during day time activities from each of the quarrying operations, as well as the overall level of ambient noise.

During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS 1259.2-1990, "Sound Level Meters".

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding  $\pm 0.5$  dBA.

#### Blasting

To measure blasting events, a blast monitor will be employed that records air blast and vibration levels once triggered by an electronic trigger connected to shot firing switch. That is, when the shot is fired, the monitor will be triggered by means of a hardwire switch and will start recording and capture the blast event. This will ensure that the event captured is the blast, significantly reducing the influence of other extraneous sources that could affect the measurement.

Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard 2187.2 - 2006.

#### 7.5 METEOROLOGICAL PARAMETERS

Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3m/s or temperature inversions, however wind speeds above 5m/s (and rainfall) have the potential to generate extraneous and erroneous noise events, which reduce the accuracy and confidence in measured data.

As such, meteorological parameters will be evaluated prior to undertaking works on site, to gain an understanding of the weather conditions and the potential for variations in noise levels.

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period. Rainfall data will be collected from the rain gauge located on-site. All other weather data for the monitoring period will be purchased from the Bureau of Meteorology (BoM) website for the Lismore Observation Station, which is programmed to continuously record the meteorological parameters as shown in *Table 7.1*.

Table 7.1 Meteorological Measurement Parameters

Measured l'arameter	Unit	Sample Interval
Mean Wind Speed	m/s	15 minutes
Mean Wind Direction	degrees	15 minutes
Aggregate Rainfall	Mm	15 minutes
Mean Air Temperature	C°	15 minutes

### 7.6 PLANT & EQUIPMENT

During the attended noise measurements, the operator shall record any significant quarry generated noise sources (i.e. haul trucks, dozers, etc.). In addition, the operator shall obtain copies of the relevant fixed plant and mobile equipment shift logs to be included in the noise monitoring report.

#### 7.7 MONITORING CRITERIA

The purpose of the noise and blast-monitoring program is to track potential impacts of operations over time as quarrying continues, to demonstrate that quarrying is not impacting on residential receptors.

Currently the EPL No 3384 for Blakebrook Quarry has in place existing conditions for noise, blasting and vibration levels. These are provided in Section 3.2.2.

The assessment criteria for noise, vibration and blasting for the expanded operations will initially remain the same as stipulated in the EPL. The need for calculating site specific trigger levels would be reviewed after two years of operations once a data set is available.

# Accounting For Annoying Noise Characteristics (Low Frequency Noise)

The INP states that a noise source may exhibit a range of particular characteristics that increase annoyance, such as tones, impulses, low frequency noise and intermittent noise.

Where this is the case, an adjustment ("modifying factor" penalty) is applied to the source noise level received at an assessment point before it is compared with criteria to account for the additional annoyance caused by the particular characteristic.

Application of these modifying factors is described in Section 4 of the INP. The INP provides the following definitions to support the modifying factor corrections:

- Tonal Noise containing a prominent frequency and characterised by a definite pitch.
- Low Frequency Noise containing major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.
- Impulsive Noise having a high peak of short duration or a sequence of such peaks.
- Intermittent Noise the level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dB.

The modifying factor corrections (and how they are applied) are presented in Table 4.1 of the INP and vary depending on the noise characteristic being assessed. All noise levels generated by the quarry, which may generate tonal or low frequency content, will be assessed as part of the NBMP monitoring with due regard to these modifying factor penalties, and in accordance with the requirements presented in the INP.

Impulsive and intermittent noise, as defined by the INP, are not typical characteristics of the quarry hence tonal and low frequency noise (LFN) are most relevant to the quarry and those modifying corrections are reproduced in *Table 7.2* below.

Table 7.2 Meteorological Measurement Parameters

Factor	Assessment and Measurement	When to Apply	Correction	Comment
Tonal Noise	One-third octave or narrow band analysis.	<ul> <li>Level of one-third octave band exceeds the level of the adjacent bands on both sides by:</li> <li>5 dB or more if the centre frequency of the band containing the tone is above 400 Hz.</li> <li>8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive.</li> <li>15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.</li> </ul>	5 dB	Narrow- band frequency analysis may be required to precisely detect occurrence.
Low Frequency Noise	Measurement of C-weighted and A- weighted level.	Measure/assess C and A weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more.	5 dB	C- weighting is designed to be more responsive to low- frequency noise.

# 7.8 RECORDING OF MONITORING RESULTS

### Recording of Results

Upon receipt of each round of monitoring results, a suitably qualified person (in this case, the Blakebrook Quarry Manager or nominated representative) will enter all results into a spreadsheet/s that compiles all historical data. The results will be reviewed for any obvious trends or exceedances of the relevant assessment criteria.

### Abnormalities or Exceedance Protocol

In the event of any abnormalities or exceedances being identified, and depending on the specific circumstances, the response will include some or all of the following procedures:

- discuss the occurrence with an acoustics specialist or environmental scientist with acoustic experience, to assess the consequence of the exceedance;
- discuss the occurrence with relevant authorities and formulate a plan of action (if required);
- investigate the nature of the abnormality or exceedance;
- assess likely reasons for the occurrence;
- identify the potential impacts and consequence of the exceedance;
- resample and reanalyse if the results are questionable; and
- develop and implement mitigation strategies to prevent future exceedances.

# 8 ENVIRONMENTAL & OPERATIONAL PERFORMANCE

### 8.1 ROLES & RESPONSIBILITIES

The Blakebrook Quarry Manager will be responsible for the implementation of this NBMP under the direction of the Manager (Commercial Services).

All quarry personnel and contractors are accountable through conditions of employment or contracts with each individual responsible for ensuring that their work complies with the procedures outlined in this NBMP. Further details of the responsibilities of personnel are provided in *Table 8.1*. A diagram outlining the organisational structure for implementing this NBMP is provided at *Figure 8.1*.

Table 8.1 Roles and Responsibilities

Manager (Commercial Services)				
Action No.	Action	Timing		
NVBM.MCS.01	Ensure that CoA, Project Commitments and any other approval conditions are adhered to when working in designated quarry expansion areas.	At all times		
NVBM.MCS.02	Provide Lismore City Council, Environmental Protection Authority (EPA) and the Department of Planning & Environment (DPE) (and other relevant stakeholders) with the opportunity to contribute to the development of the Noise and Blast Management Plan.	Prior to commencement of construction		
NVBM.MCS.03	Ensuring all staff and contractors are provided with induction regarding the significance of noise, vibration and lasting impacts as part of general environmental management site induction and ensuring that they know of agreed management and mitigation.	Prior to commencement of construction		
NVBM.MCS.04	Ensuring all monitoring commitments made as part of the NBMP are executed	As detailed in NBMP		
NVBMLMCS.05	Ensuring monitoring is completed in response to any complaints regarding noise and /or vibration.	When required		

Blakebrook Quarry Manager				
Action No.	Management Procedure	Timing		
NVBM.OC.01	Ensure that CoA, Project Commitments and any other approval conditions are adhered to when conducting quarry operations.	At all times		
NVBM.OC.02	Notifying the Manager of Commercial Services before undertaking any blasting works.	Prior to commencement of works		
NVBM.OC.03	Ensuring all residential receptors are informed of all planned blasting works prior to commencement of works	Prior to commencement of works		

Blakebrook Quarry Manager		
Action No.	Management Procedure	Timing
NVBM.OC.04	If complaints are received regarding noise or vibration, stop works that have the potential to impact further and contact the Manager of Commercial Services immediately.	When and if required

Quarry Personnel and Contractors			
Action No.	Management Procedure	Timing	
NVBM.QP.01	Ensure approval has been given by the Blakebrook Quarry Manager prior to undertaking any blasting works.	Prior to commencemen	

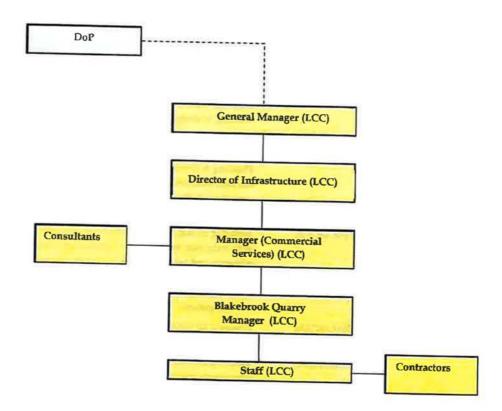


Figure 8.1 Organisational Structure

# 8.2 STAKEHOLDER CONSULTATION SCHEDULE

The CoA prescribes the regulatory authorities and community groups to be consulted in the preparation of the NBMP. These requirements are summarised in *Table 8.2*.

# Table 8.2 NBMP Consultation Requirements

Regulatory Authority	Interest
Department of Planning & Environment (DPE)	DPE is the lead agency in ensuring compliance with the requirements of the CoA, and will review and approve amendments to the NBMP.
Environmental Planning Authority (EPA)	The EPA is to be involved in the preparation and revision of the NBMP to ensure that it complies with the requirements of the CoA and other
3	NSW legislation, policy, and technical requirements.

Draft copies of the NBMP will be provided to the appropriate authorities and community groups, with a final version prepared taking into consideration comments received. Any amendments or updates to NBMP will follow the same process.

#### 8.3 TRAINING & AWARENESS

Lismore City Council will provide training to its employees with respect to the expansion works for Blakebrook Quarry. The objective of the training will be to provide a base level understanding of their individual role in complying with the NBMP. Training will also be provided for specific tasks to ensure employees are competent to perform their required duties.

As part of the general site induction process, all quarry personnel will be made aware of potential noise and vibration activities, including blasting, that could impact on residential receptors. Those personnel specifically involved in clearing, grubbing and ground disturbance works including topsoil removal and excavation in close proximity to residents will be made aware of their location and an assessment of the need for mitigation measures completed prior to works commencing.

In accordance with the EM Strategy, Lismore City Council will also undertake the following with respect to training and awareness:

- · Hold daily pre-start talks;
- Hold "Toolbox" training/meetings; and
- Issue Project Environmental Alerts (if required)

### 8.4 RECORD KEEPING & DOCUMENT CONTROL

Records are to be maintained for all noise, vibration, and blasting management measures and monitoring. All records shall be kept for a minimum of seven years, with record keeping and document control managed in accordance with the requirements set forth in the EM Strategy.

To ensure that the correct procedures and plans are used on site, issue of the EM Strategy, CoA, and/or other relevant document, and any associated amendments that may be required, will be controlled using a document register. The register will be retained at the site office.

#### 8.5 SITE INSPECTIONS

Weekly inspections will be conducted by the Blakebrook Quarry Manager to monitor work practices and identify non-conforming areas and activities or work practices which could lead to potential environmental harm.

A Quarry Conditions Checklist will be used to record and report any improvements required. The purpose of the inspections is to:

- provide a surveillance tool to ensure that safeguards are being implemented;
- identify where problems might be occurring (or have the potential to occur);
- identify where sound environmental practices are not being implemented;
   and
- facilitate the identification and early resolution of problems.

### 8.6 EXTERNAL COMMUNICATION & NOTIFICATION

General information regarding the environmental performance of the quarry and contact details regarding complaints will be available at all times through Lismore City Council's website.

Community Meetings will be held at least once per annum, where information regarding the activities being undertaken at Blakebrook Quarry as well as environmental performance information will be detailed.

Authorities will be kept informed regarding the operation and environmental performance of the quarry through the Annual Reporting requirements of the CoA.

# 8.7 COMPLAINT INVESTIGATION & RESPONSE CONTROL

Complaints regarding the Blakebrook Quarry will be received through the existing Lismore City Council complaints handling process. Complaints

regarding the quarry, whether received via email, telephone or written communications are to be entered into a Complaints Register by Council staff.

Details that are to be logged by Council staff include:

- complainants name;
- telephone number/email address/postal address;
- date of contact;
- nature of complaint; and
- date transferred to Lismore City Council Commercial Services Compliance division for response. A response will be provided within five (5) days of receipt of the complaint.

The details of the complaint will be passed on to the Lismore City Council Commercial Services Compliance division, with a response being provided within five (5) days of receipt of the complaint. Management commits to rectifying an activity that has caused a complaint as soon as practicable.

The Lismore City Council Commercial Services Compliance division will respond to all complaints within five (5) days of receipt of the complaint, and undertake actions to identify and initiate appropriate action in response to complaint and follow-up contact with complainant as soon as practicable. A record of discussion will be kept. Problems and/or issues will be reviewed and procedures modified as appropriate. If the problem cannot be resolved by the Blakebrook Quarry Manager, the Manager (Commercial Services) will become involved to resolve the dispute.

Records of all complaints received are to be kept within Lismore City Council's Complaints Management System.

All quarry staff are responsible for reporting any complaints to the Blakebrook Quarry Manager. Complaints must be made through the correct channel to Lismore City Council in order to initiate follow-up action and contact with complainant.

### 8.8 DISPUTE RESOLUTION PROCESS

In the case that a dispute between the complainant and Lismore City Council arises with respect to the management and/or outcomes of the Complaint Investigation and Response Protocol (Section 9.6), either party may refer to the matter to the DPE for resolution.

If a matter is referred to the DPE, and the DPE is satisfied that the dispute is genuine, the DPE will then commence an independent dispute resolution process in order mediate between the two parties, in order to arrive at an agreed outcome.

### 9 REVIEW & REPORTING

Annual review and reporting is required to assess the outcomes of the NBMP, review its effectiveness, and consider works undertaken against annual budgets and targets.

Any issues noted regarding the success of management works will be relayed to the site manager on an ongoing basis so that relevant improvements can be made.

### 9.1 EXTERNAL REPORTING

All external reporting required by the CoA or other obligation for Blakebrook Quarry will be approved by the Manager (Commercial Services). This includes management and monitoring documentation associated with this NBMP.

# 9.2 NON-COMPLIANCE REPORTING PROTOCOL

All non-compliance will be reported in accordance with the requirements of the CoA that relate to incident reporting. The CoA require that where there is an exceedance of the limits/performance criteria in the CoA that the DPE and relevant agencies being informed within 24 hours.

In addition, within seven days of the date of the incident, a written report is to be provided to the DPE and other relevant agencies detailing the following:

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

Lismore City Council will meet the requirement of the DPE to address the cause or impact of any incident within the required period as defined by the DPE. Lismore City Council will maintain a register of accidents and incidents.

# 9.3 CONTINGENCY PLANNING & PROTOCOL

Should at any time the management and/or monitoring results of the NBMP be determined to be negatively impacting a sensitive areas identified in the EAR (ERM, 2009) for the Blakebrook Quarry expansion (e.g. endangered ecological community) then the NBMP will be intensified to allow better identification and understanding of the impacts, and facilitate design of appropriate mitigation measures.

Before any changes are made to the NBMP, Lismore City Council will consult with DPE and obtain their approval. Subsequent to receipt of DPE approval, the NBMP will be revised in line with any approved changes.

# 9.4 Noise, Air Blast Overpressure & Vibration Monitoring Report

All routine monitoring results will be documented and reported with four weeks of receiving monitoring results.

Monitoring reports will consist of the following information:

- Summary of attended noise monitoring results;
- Summary of vibration and air blast overpressure monitoring results;
- Predicted noise levels at each assessment location from the compliance noise model completed as part of the detailed Noise Assessment undertaken by ERM (summarised in Section 3 above);
- Measured/ calculated and/or operator estimated quarry LAeq(Period) contributed noise levels for each monitoring location; and
- Details of any complaints relating to noise, blasting and/or vibration and their state of resolution.

### 9.5 ANNUAL REVIEWS

#### Content of Annual Reviews

The results of the Monitoring Plan will be reviewed annually and reported in the Annual Environmental Management Report (AEMR). With regard to Noise, Vibration and Blasting monitoring, the AEMR will:

- include a summary of monitoring results;
- include an analysis of these monitoring results against the relevant assessment criteria, monitoring results from previous years and predictions from noise modelling;
- identify any trends in the monitoring results over the life of the development;
- draw conclusions about the possible causes of any trends and recommend follow up investigation if required. If an identifiable cause is found, recommend appropriate remedial action;
- identify any non-compliance during the previous year; and
- describe what actions were, or are being taken to ensure compliance.

Currently the Environment Protection Licence (EPL) for the site requires reporting of the results of the air blast overpressure and ground vibration levels as part of the Annual Return.

# Environmental Performance Review

In accordance to the Minister's CoA, an annual environmental performance review is to be prepared to the satisfaction of the DPE. The review will be submitted by the end of March and in accordance with CoA Schedule 5, Condition #11.

Should the monitoring show consistent results that demonstrate quarrying is not impacting noise, vibration and air blast overpressure, a reduction of the frequency of monitoring and range of analyses may be justified.

# 9.6 INDEPENDENT ENVIRONMENTAL AUDIT

Within three years of quarrying operation, and every three (3) years thereafter, a major review of all monitoring data would be undertaken by a suitably qualified person to assess what, if any, impacts to noise, vibration and air blast overpressure have occurred as a result of the expanded operations.

#### 10 REFERENCES

Department of Infrastructure, Planning and Natural Resources, 2004, Guidelines for the Preparation of Environmental Management Plans.

Environmental Resources Management Australia Pty Ltd (ERM), 2009, Blakebrook Quarry Expansion Environmental Assessment Report.

Annex A

Acoustic Glossary

# A.1 GLOSSARY – ACOUSTICAL CONCEPTS AND TERMINOLOGY

#### What Is Noise And Vibration?

#### Noise

Noise is often defined as a sound, especially one that is loud or unpleasant or that causes disturbance<sup>1</sup> or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

#### Vibration

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

## What Factors Contribute To Environmental Noise?

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- How loud the activity is?
- How far away the activity is from the receiver?
- What type of ground is between the activity and the receiver location e.g. concrete, grass, water or sand?
- How the ground topography varies between the activity and the receiver?
   For example, is it flat, hilly, mountainous? Blocking the line of sight to a noise source will generally reduce the level of noise.
- Any other obstacles that block the line of sight between the source to receiver e.g. buildings or purpose built noise walls.

<sup>&</sup>lt;sup>1</sup> Copyright © 2011 Oxford University Press

#### How to Measure and Describe Noise?

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of  $10^7$  Pascals (Pa), from the threshold of hearing at  $20\mu\text{Pa}$  to the threshold of pain at 200Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise.

To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

- 0 dB represents the threshold of human hearing (for a young person with ears in good condition).
- 50 dB represents average conversation.
- 70 dB represents average street noise, local traffic etc.
- 90 dB represents the noise inside an industrial premises or factory.
- 140 dB represents the threshold of pain the point at which permanent hearing damage may occur.

# Human Response to Changes in Noise Levels

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- Differences in noise levels of less than approximately 2 dB are generally imperceptible in practice, an increase of 2 dB is hardly perceivable.
- Differences in noise levels of around 5 dB are considered to be significant.
- Differences in noise levels of around 10 dB are generally perceived to be a
  doubling (or halving) of the perceived loudness of the noise. An increase
  of 10 dB is perceived as twice as loud. Therefore an increase of 20 dB is four
  times as loud and an increase of 30 dB is eight times as loud etc.
- The addition of two identical noise levels will increase the dB level by about 3 dBA. For example, if one car is idling at 40 dB and then another identical car starts idling next to it, the total dB level will be about 43 dB.
- The addition of a second noise level of similar character which is at least 8 dB lower than the existing noise level will not add significantly to the overall dB level.
- A doubling of the distance between a noise source and a receiver results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road) and a 6 dB decrease for a point source (for example, the idling car discussed above).

 A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

# Terms to Describe the Perception of Noise

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- Inaudible / Not Audible the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured LA90 background noise level, potentially by 10 dB or greater.
- Barely Audible the noise source and/or event are difficult to define by
  the operator, typically masked by extraneous noise sources not associated
  with the source. If a source is 'barely audible' its noise level may be
  quantified as being 5 7 dB below the measured Lago or Lag noise level,
  depending on the nature of the source e.g. constant or intermittent.
- Just Audible the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.
- Audible the noise source and/or event may be easily defined by the
  operator. There may be a number of extraneous noise sources contributing
  to the measurement. The noise level should be quantified based on
  instantaneous noise level contributions, noted by the operator.
- Dominant the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- Constant this indicates that the operator has noted the noise source(s)
  and/or event to be constantly audible for the duration of the noise
  measurement e.g. an air-conditioner that runs constantly during the
  measurement.
- Intermittent this indicates that the operator has noted the noise source(s)
  and/or event to be audible, stopping and starting intervals for the duration
  of the noise measurement e.g. car pass-bys.
- Infrequent this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or

at intervals for the duration of the noise measurement e.g. a small number of aircraft are noted during the measurement.

## How to Calculate or Model Noise Levels?

There are two recognised methods which are commonly adopted to determine the noise at particular location from a proposed activity. The first is to undertake noise measurements whilst the activity is in progress and measure the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical in terms of cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in may be obtained from the manufacturer or from ERM's database of measured noise emissions.

# Acoustic Terminology & Statistical Noise Descriptors

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- Decibel (dB is the adopted abbreviation for the decibel) The unit used
  to describe sound levels and noise exposure. It is equivalent to 10 times the
  logarithm (to base 10) of the ratio of a given sound pressure to a reference
  pressure.
- dBA unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear.
- dBC unit used to measure 'C-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans.

- dBZ or dBL unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear.
- Hertz (Hz) the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
- Octave a division of the frequency range into bands, the upper frequency limit.
- 1/3 Octave single octave bands divided into three parts.
- Leq this level represents the equivalent or average noise energy during a
  measurement period. The Leq, 15min noise descriptor simply refers to the Leq
  noise level calculated over a 15 minute period. Indeed, any of the below
  noise descriptors may be defined in this way, with an accompanying time
  period (e.g. L10, 15 minute) as required.
- Lmax the absolute maximum noise level in a noise sample.
- LN the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis.
- L10 the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels.
- L90 the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes.
- Sound Power Level (Lw) this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment.
- Sound Pressure Level (Lr) the level of sound pressure; as measured at a
  distance by a standard sound level meter with a microphone. This differs
  from Lw in that this is the received sound as opposed to the sound
  'intensity' at the source.
- Background noise the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor.
- Ambient noise the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the LAeq descriptor.
- Cognitive noise noise in which the source is recognised as being annoying.

Masking – the phenomenon of one sound interfering with the perception
of another sound. For example, the interference of traffic noise with use of
a public telephone on a busy street.

Industrial Noise Policy (INP) Terminology

The following terminology is from the NSW Environment Protection Authority - NSW Environmental Noise Management - Industrial Noise Policy (INP), January 2000 and relevant application notes:

- Assessment Background Level (ABL) is defined in the INP as a single figure background level representing each assessment period (day, evening and night). Its determination is by the tenth percentile method (of the measured Lago statistical noise levels) described in Appendix B on the INP.
- Rating Background Level (RBL) is defined in the INP as the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24 hour period used for the ABL). This is the level used for assessment purposes. It is defined as the median value of:
  - All the day assessment background levels over the monitoring period for the day;
  - All the evening assessment background levels over the monitoring period for the evening; or
  - All the night assessment background levels over the monitoring period for the night.
- Extraneous noise noise resulting from activities that are not typical of the
  area. Atypical INP activities may include construction, and traffic
  generated by holiday periods and by special events such as concerts or
  sporting events. Normal daily traffic is not considered to be extraneous.
- Most affected location(s) locations that experience (or will experience)
  the greatest noise impact from the noise source under consideration. In
  determining these locations, one needs to consider existing background
  levels, exact noise source location(s), distance from source (or proposed
  source) to receiver, and any shielding between source and receiver.
- Noise criteria the general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (for example, noise levels for various land uses).
- Noise limits enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.

- Project Specific Noise Levels target noise levels for a particular noise
  generating facility. They are based on the most stringent of the intrusive
  criteria or amenity criteria. Which of the two criteria is the most stringent
  is determined by measuring the level and nature of existing noise in the
  area surrounding the actual or propose noise generating facility.
- Compliance the process of checking that source noise levels meet with the noise limits in a statutory context.
- Non-compliance development is deemed to be in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit by more than 2 dB.
- Feasible and Reasonable measures feasibility relates to engineering considerations and what is practical to build. reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:
  - Noise mitigation benefits (amount of noise reduction provided, number of people protected);
  - Cost of mitigation (cost of mitigation versus benefit provided);
  - Community views (aesthetic impacts and community wishes); and
  - Noise levels for affected land uses (existing and future levels, and changes in noise levels).
- Meteorological Conditions wind and temperature inversion conditions.
- Temperature Inversion an atmospheric condition in which temperature increases with height above the ground.
- Adverse Weather weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

## **Operator Attended Noise Measurements**

Table A.1 below presents typical abbreviations that are used to describe common noise sources that may be noted during environmental noise measurements.

Table A.1 General Field Note Abbreviations

Noise Source	Abbreviation
Wind-blown vegetation'	WBV
'Car pass-by'	СР
'Operator Noise'	OP
'Animal Noise'	AN
'Distant Traffic'	DT
'Near Traffic'	NT
'Aircraft Noise'	AN
Metal on Metal contact'	MMC

During operator attended noise measurements, the sound level meter will present the instantaneous noise level and record acoustical and statistical parameters. In certain acoustical environments, where a range of noise sources are audible and detectable, the sound level meter cannot measure a direct source noise level and it is often necessary to account for the contribution and duration of the sources.

Noted Percentile Contribution – *Table A.2* presents noise level deductions that are typically applied based on the percentage contribution of a noise source(s). Noted Time Contribution – *Table A.3* presents noise level deductions that may be applied based on the percentage of time that a noise source(s) is audible during a 15 minute measurement.

Where the noise emission from a source is clearly detectable and the contribution can be measured, these deductions are not necessary.

Table A.2 Noise Level Deductions - Noted Percentile Contribution

Percentage Contribution	Noise Level Adjustment, dBA
5%	-13.0
10%	-10.0
15%	-8.2
20%	-7.0
25%	-6.0
30%	-52
35%	-4.6
40%	-4.0
45%	-3.5
50%	-3.0
55%	-2.6
60%	-2.2
65%	-1.9

Percentage Contribution	Noise Level Adjustment, dBA
70%	-1.5
75%	-1.2
80%	-1.0
85%	-0.7
90%	-0.5
95%	-0.2
100%	0.0

EXAMPLE: the measured LAeq, 15 minute noise level is 49 dB and the site contribution
was observed to be 10% of this level (extraneous noise sources were noted to dominate
the measurement), therefore the LAeq, 15 minute noise level deduction is 10 dB, with a
resultant noise level contribution of approximately 39 dB.

Table A.3 Noise Level Deductions - Noted Time Contribution

Event Duration (minutes)	Noise Level Adjustment, dBA
1	-11.8
2	-8.8
3	-7.0
4	-5.7
5	-4.8
6	-4.0
7	-3.3
8	-2.7
9	-2.2
10	-1.8
11	-1.3
12	-1.0
13	-0.6
14	-0.3
15	0.0

EXAMPLE: the measured LAeq, 15 minute noise level contribution of an excavator was noted to be 56 dB, however it was only audible for 6 minutes during the 15 minute measurement period, therefore the LAeq, 15 minute noise level deduction is 4 dB, with a resultant noise level contribution of approximately 52 dB.

# A.2 VIBRATION - GLOSSARY OF TERMS, DEFINITIONS AND METHODOLOGY

# How to Measure and Control Vibration

Vibration refers to the oscillating movement of any object. In relation to construction projects, ground-borne vibration is the most likely outcome of works and potentially has three (3) effects on vibration sensitive receivers, these are:

- Ground-borne vibration that may cause annoyance.
- Ground-borne vibration that may have adverse effect on a structure e.g. a building.
- Regenerated noise due to ground-borne vibration.

Each of these potential effects can be assessed in accordance with the relevant standard. Perceptible levels of vibration often create concern for the surrounding community at levels well below structural damage guideline values; this issue needs to be managed as part of the vibration monitoring program.

Vibration is typically measured using specific devices that record the velocity or acceleration at a designated receiver location – usually being the closest premises to works. Modern vibration monitoring devices will typically capture amplitude data for the three (3) orthogonal axes being, the transverse, longitudinal and vertical and also the frequency at which the measured vibration event occurs.

Monitoring of this level of detail enables analysis of significant vibration events to determine compliance with relevant guidelines such as the NSW Department of Environment and Conservation – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW vibration guideline), February 2006 and the German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150-3) – Structural Vibration – Effects of Vibration on Structures.

Vibration propagates in a different manner to noise and can be difficult to control depending on the frequency of the source in question, although identifying the strategy best suited to controlling vibration follows a similar approach to that of noise. This includes elimination, control at the source, control along the propagation path and control at the receiver and/or a combination of these, such as no work/respite periods.

#### Vibration Descriptors

The following terms are often used to describe measured vibration levels.

- Parameter an attribute with a value for example, weighting.
- Particle Velocity the instantaneous value of the distance travelled by a
  particle per unit time in a medium that is displaced from its equilibrium
  state by the passage of a sound or vibration wave.
- Peak Component Particle Velocity (PCPV) is the highest (maximum or peak) particle velocity which is recorded during a particular vibration event over the three (3) axes. PCPV is measured in the unit, mm/s.
- Phase the relative position of a sound wave to some reference point, the
  phase of a wave is given in radians, degrees, or fractions of a wavelength.
- Acceleration the change in velocity over time. Acceleration is dependent
  on the velocity and the frequency of the vibration event (velocity is a
  vector), as such acceleration changes in two ways magnitude and/or
  direction. Acceleration is measured in the unit, m/s².

- Perceptible vibration levels that a receiver of building occupant may 'feel'. 0.2mm/s is typically considered to be the human threshold for perception of vibration.
- Geophone or accelerometer the transducer/device typically used to measure vibration.
- Damage is defined in DIN 4150-3 to include minor non-structural effects such as cosmetic damage or superficial cracking in paint or cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.
- Vibration Dose Value (VDV) a concept outlined in the NSW vibration guideline, which is a calculative approach to assessing the impact of intermittent vibration or extended periods of impulsive vibration. VDV require the measurement of the overall weighted RMS (Root Mean Square) acceleration levels over the frequency range 1Hz to 80Hz. To calculate VDV the following formula (refer Section 2.4.1 of the guideline) is used:

$$VDV = \left[\int_{0}^{T} a^{4}(t)dt\right]^{0.25}$$

Where VDV is the vibration dose value in  $m/s^{1.75}$ , a(t) is the frequency-weighted RMS of acceleration in  $m/s^2$  and T is the total period of the day (in seconds) during which vibration may occur.

- MIC Maximum Instantaneous Charge or explosive charge mass (kg) detonated per delay (any 8ms interval).
- SD (m) The scaled distance for air-blast and ground vibration from the charge to the receiver.

Annex B

EPA Correspondence

#### Louis Penny

From:

Louis Penny

Sent: To:

Monday, 20 August 2018 5:15 PM 'Janelle.Bancroft@epa.nsw.gov.au'

Cc:

'Eleisha Went'; Paul Douglass

Subject:

0436793 Blakebrook Quarry - Noise & Blast Management Plan - EPA Review

(Condition #5, Schedule 3)

Attachments:

0436793 Blakebrook Quarry\_NBMP\_v3.1\_02Aug18\_\_[FINAL].pdf

ERM Reference: 0436793

Good afternoon Janelle,

It was good to talk with you this afternoon regarding the Blakebrook Quarry Noise & Blast Management Plan (NBMP).

As discussed, the NBMP for Blakebrook Quarry is required to be prepared in consultation with the EPA - as per Condition #5, Schedule 3 of the Minister's Conditions of Approval.

Accordingly, please now find attached of the updated NBMP for EPA review, and agreement.

If you would like to discuss, please do not hesitate to let me know.

Thanking you,

Louis

**Louis Penny** 

Principal Town & Environmental Planner | Qld Planning Team Lead

Level 4, 201 Leichhardt Street | Spring Hill | QLD 4000 PO Box 1400 | Spring Hill | QLD 4004 T +61 7 3839 8393 | Dir +61 7 3007 8433 E louis.penny@erm.com | W www.erm.com

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Annex C

Noise Monitoring Results (2017)

# **Ambience Audio Services**

Acoustic Measurement and Analysis

15 Tamarind Close Richmond Hill NSW 2480

Phone: 02 6625 1733 Mobile: 0429 405 070

# **Results of Noise Monitoring**

Blakebrook Quarry 186A Keerrong Road Blakebrook NSW 2480

Prepared for

Northern Rivers Quarry & Asphalt 186A Keerrong Road Blakebrook NSW 2480

> Prepared by Garry Hall November 14<sup>th</sup> 2017

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#### 1 INTRODUCTION

Ambience Audio Services conducted noise monitoring of quarry operations for Northern Rivers Quarry & Asphalt at Blakebrook via Lismore, northern NSW. The noise monitoring was requested by the Commercial Services Co-ordinator for NRQA, Mr Kurt Bezjak, to measure and report on quarry operational noise levels at the closest affected residential receiver locations.

Noise monitoring was conducted on the 7<sup>th</sup> and 9<sup>th</sup> of November 2017 with full quarry operating conditions and suitable weather conditions. Measurements were conducted over 2 days due to excessive wind on the 7<sup>th</sup> being unable to complete all receiver locations. Measurements were also attempted on the 2<sup>nd</sup> but a breakdown occurred so measurements without the quarry operating were conducted at one of the receiver locations.

Quarry operations while noise monitoring was conducted included crushing and stockpiling on the eastern side of the quarry floor, asphalt production at the mobile plant at the top of the quarry and trucks and loaders on the internal haul roads. A diagram of equipment operating on the quarry floor during noise monitoring at residential receivers is provided in Appendix D

To assist with the interpretation of some of the terminology used in this report, Appendix A provides definitions of acoustic terms. Appendix B is a chart of everyday sound pressure levels.

#### 2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 6.2 of the Noise, Vibration and Blasting Sub Plan 08/04/11 prepared by Environmental Resources Management Australia (ERM).

Extracts of the relevant parts are copied below.

# 6.2.2 Noise and Vibration and Blasting Monitoring Locations

Noise, vibration and blasting monitoring will be undertaken at the nearest residential receptors marked as locations 1 to 6 on Figure 6.1.

# 6.2.4 Noise, Vibration and Blasting Monitoring Methodology

Operator - attended noise measurements shall be conducted at Locations 1 to 4, Location 6 and Location 9 (refer Figure 6.1) to quantify and characterise the maximum (LAmax), the energy equivalent (LAeq), and background (LA90) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the LAeq(Period) noise contribution during day time activities from each of the quarrying operations, as well as the overall level of ambient noise.

During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS 1259.2-1990, "Sound Level Meters".

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding  $\pm 0.5$  dBA.

To measure blasts a blast monitor will be employed that records air blast and vibration levels once triggered by an electronic trigger connected to shot firing switch. That is, when the shot is fired, the monitor will be triggered by means of a hardwire switch and will start recording and capture the blast event. This will ensure that the event captured is the blast, significantly reducing the influence of other extraneous sources that could affect the measurement.

#### 6.2.5 Meteorological Parameters

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period.

#### 6.2.7 Assessment Criteria

The purpose of the noise, vibration and blasting monitoring program is to track potential impacts of operations over time as quarrying continues, to demonstrate that quarrying is not impacting on residential receptors.

Currently the EPL No 3384 for Blakebrook Quarry has in place existing conditions for noise, blasting and vibration levels which are as follows:

1.6.1 Noise from the premises must not exceed:

(a) 35dB(A) LAeq(15 minute) during the day (7am to 6pm) Monday to Saturday;

Where LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

The closest noise sensitive receivers and required noise monitoring locations are indicated in figure 6.1 from the ERM Noise, Vibration and Blasting Sub Plan, which is copied on the following page.

Noise monitoring at locations 1,2,3 and 4 were conducted within 30m of the residential dwelling in the direction of the quarry. Location 6 was conducted at the road frontage.

In April 2016, the owner and permanent resident at Location 9 provided the NSW Department of Planning and Environment a signed letter confirming a private agreement between Blakebrook Quarry and Sensitive Receiver No.9, that they agree to exceedances in noise levels from quarry operations. No noise monitoring was conducted at Location 9.

Table 2.1 Noise Monitoring Receiver Locations

Receiver Location	Street Address
1	28 Keerrong Rd Blakebrook
2	166 Keerrong Rd Blakebrook
3	190 Keerrong Rd Blakebrook
4	365 Booerie Creek Road Booerie Creek
6	289 Booerie Creek Rd Booerie Creek

#### Note:

Some street addresses on Keerrong Road have been changed from the previous assessments due to updated surveying.

Receiver 1 was 122 now 28

Receiver 2 was 126 now 166

Figure 2.1 Noise Monitoring Locations

Ambience Audio Services 14/11/2017 Blakebrook Quarry Noise Monitoring Results – November 2017

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# 3 MEASUREMENT PROCEDURE AND RESULTS

#### 3.1 Instrumentation

Table 3.1 Instrumentation for Noise Monitoring

Instrument	Serial #	Calibration Date
Brűel and Kjær 2250 Sound Level Meter	2449940	October 2016
Brüel and Kjær 2250 Sound Level Meter	3006868	September 2017
Brüel and Kjær Acoustical Calibrator model 4231	2292735	October 2017

The sound level meters (SLM) used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as type 1 precision sound level meters and have an accuracy suitable for both field and laboratory use. The meters' calibrations were checked before and after the measurement periods with a Brüel and Kjær acoustical calibrator model 4231. No significant system drift occurred over the measurement periods.

The SLMs and calibrator have been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates. The internal test equipment used is traceable to the National Measurement Laboratory at CSIRO, Lindfield, NSW.

#### 3.2 Measurement Procedures

Measurements were made in general accordance with procedures laid down in:

- Australian Standard AS 1055.1-1997: 'Acoustics Description and measurement of environmental noise - General procedures';
- 2. The NSW Government Industrial Noise Policy (2000) EPA 00/1 (INP).

The microphone of a B&K 2250 SLM was mounted on a 1.5m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was located on a flat area of land above the cliff face where the working equipment was used, to monitor noise levels while measurements were being conducted at the receiver locations (see Appendix D). The SLM was set to record continuously for the duration of receiver monitoring with 1 second samples. A sound recording was conducted simultaneously.

The microphone of another B&K 2250 SLM was mounted on a 1.5m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was used at the various receiver locations to monitor noise levels while the quarry was operating under full load conditions. The noise monitoring location was within 30m of the residential dwelling in the general direction of the quarry depending on vegetation and cattle in paddocks.

A 15 minute period was recorded at each location with 1 second samples with a simultaneous sound recording.

Ambience Audio Services 14/11/2017
Blakebrook Quarry Noise Monitoring Results – November 2017

## 3.3 Weather Conditions

Weather conditions were generally good for acoustic measurements. Observations were taken at each receiver location.

Table 3.2 Observed Weather Conditions at Receiver Locations

		Weathe	er Condit	ions at Rec	eiver Locat	ions No	v 201	7
Date Time	Receiver	Temp	Relative Humidity	Wind	Wind Dir	201	Cloud	
			r	%	Speed			Cover
					(m/s)			
2-Nov	9:05am	4	22	70	Calm		2/8	Scattered bish alared
2-Nov	10:30am	4	24	64	Calm		3/8	Scattered high cloud
7-Nov	8:15am	4	21	80	Calm		7/8	Scattered high cloud
7-Nov	8:45am	6	22	75	1 - 1.5	ssw	7/8	Low Clouds
7-Nov	9:00am	6	22	75	1-2	ssw	7/8	Low Clouds
7-Nov	9:40am	1	23	66	2 - 3.5	SSE	8/8	Low Clouds
3-Nov	8:10am	2	20	60	0 - 1	SE		Low Clouds
-Nov	8:50am	3	21	65	0.5 - 1.5	SW	0/8	
-Nov	9:15am	1	22	55	1.5 - 2.5	S	1/8	Scattered high cloud Scattered high cloud

The meteorological data for Lismore Airport (approximately 7kms to the south) for the monitoring period was downloaded from the Bureau of Meteorology website and is provided in Tables 3.3 and 3.4.

Table 3.3 Weather Observations at Lismore Airport 07/11/2017

	Lismore A	irport Tuesday 07/11/	2017		
				Wind	
Date /Time	Temp C	Rel. Humidity %	Dia	Spe	ed
			Dir.	km/h	m/s
07/10:00am	22.9	65	SSE	26	7.2
07/09:30am	21.6	69	SSE	26	7.2
07/09:00am	21.4	73	SSE	22	6.1
07/08:30am	21.3	81	S	19	5.3
07/08:00am	20.6	82	S	19	5.3

Table 3.4 Weather Observations at Lismore Airport 09/11/2017

	/2017	Wind				
Data /Time	Temp	τ	Rel. Humidity %		Spe	ed
Date /Time	Temp	ŭ	Kei. Hamilery	Dir.	km/h	m/s
07/10:00am	20.1		65	sw	13	3.6
07/09:30am	18.9		67	sw	17	4.7
07/09:00am	19.1		68	ssw	19	5.3
07/08:30am	17.7		68	SSE	17	4.7
07/08:00am	16.7		70	ssw	15	4.2

# 3.3 Measurement Results

The measurements were conducted over 3 days due to equipment breakdown and inclement weather.

Table 3.5 Measurement Results

Receiver and Measurement #	Date	Start time	Elapsed time	L <sub>AFmax</sub> [dB]	L <sub>Ceq</sub> [dB]	L <sub>Aeq</sub> [dB]	L <sub>Ceq</sub> - L <sub>Aeq</sub> [dB]	L <sub>AF10</sub> [dB]	L <sub>AF90</sub> [dB]
R1 M1	07/11/2017	09:39:18 AM	0:15:00	67.6	67.0	49.0	18.0	51.7	43.2
R1 M2	09/11/2017	09:18:38 AM	0:15:00	56.5	57.8	43.2	14.6	45.7	38.0
R2	09/11/2017	08:11:54 AM	0:15:00	61.8	55.8	45.4	10.5	48.9	32.7
R3	09/11/2017	08:46:47 AM	0:15:00	66.6	63.1	44.7	18.4	45.7	34.9
R4 M1	02/11/2017	09:02:11 AM	0:15:00	59.8	48.1	39.5	8.5	42.5	31.2
R4 M2	02/11/2017	10:19:33 AM	0:15:00	51.1	47.9	37.6	10.3	41.4	31.5
R4 M3	07/11/2017	08:14:32 AM	0:15:00	64.7	53.2	44.7	8.5	44.7	34.3
R6 M1	07/11/2017	08:45:35 AM	0:15:00	74.2	52.7	44.5	8.2	45.1	35.5
R6 M2	07/11/2017	09:00:54 AM	0:15:00	66.4	56.9	45.5	11.4	46.4	35.7

#### Note:

The above results are the ambient noise levels and includes noise from the rural surroundings and quarry noise if audible. No tonal, low frequency or impulsive noise characteristics from the quarry operations were observed at the receiver locations.

Table 3.6 Noise Observations at Receiver Locations

Receiver and Measurement #	Date	Start time	Observed Noise Sources	Quarry Noise
R1 M1	07/11/2017	09:39:18 AM	Birds, distant traffic on Nimbin Road, local traffic on Keerrong Rd, dog barking, wind in trees, cattle	Quarry, audible at times – rock crusher – breeze dependant
R1 M2	09/11/2017	09:18:38 AM	Birds, distant traffic on Nimbin Road, local traffic on Keerrong Rd, dog barking, wind in trees	Quarry not audible
R2	09/11/2017	08:11:54 AM	Birds, local traffic on Keerrong Rd, distant cattle, distant overhead aircraft	Quarry just barely audible
R3	09/11/2017	08:46:47 AM	Birds, local traffic on Keerrong Rd, distant overhead aircraft, insects, wind in trees	Quarry just audible occasionally
R4 M1	02/11/2017	09:02:11 AM	Birds, distant overhead aircraft, insects, very distant noise to south from roadworks	Quarry not operating
R4 M2	02/11/2017	10:19:33 AM	Birds, distant overhead aircraft, insects, distant people talking	Quarry not operating
R4 M3	07/11/2017	08:14:32 AM	Birds, distant overhead aircraft, insects, very distant road noise at times	Quarry not audible
R6 M1	07/11/2017	08:45:35 AM	Birds, wind in trees, distant people talking	Quarry not audible
R6 M2	07/11/2017	09:00:54 AM	Birds, local traffic on Booerie Creek Rd, distant dog barking, wind in trees, cattle, distant overhead aircraft	Quarry not audible

#### 4 DISCUSSION OF RESULTS

The measurements were undertaken while the quarry was operating under normal operating conditions (see Appendix D for diagram for location of equipment). A second noise logger was located above the quarry floor as a reference for quarry crushing operations noise levels.

The measured results in Table 3.5 are from the combined noise of the quarry (if audible) and the ambient noises.

At Receiver 1, a second recording was conducted on the 9<sup>th</sup> as the wind had picked up on the 7<sup>th</sup> and wind in trees noise levels were higher. The background noise levels (Lago,15min) were lower on the 9<sup>th</sup> but distant traffic from Nimbin Road was underlying for most of the time. There was audible quarry noise (rock crusher) on the 7<sup>th</sup> with changes in breezes and possibly larger rocks being crushed for several brief periods 10 -15 seconds during the 15 minute monitoring period. It was observed that noise levels were 40 – 45 decibels for these brief periods. The quarry was not audible at other times. It is estimated that the quarry Laeq,15 min is below the Project Specific Noise Level of 35 dB(A).

At Receiver 2, quarry noise was just barely audible when no other noises were present. It is estimated that the quarry LAeq,15 min is below 33dB(A).

At Receiver 3, quarry noise was just audible occasionally. Observed levels were 35 – 40 dB(A). Quarry noise appeared to be tipping at the overburden stockpile. It is estimated that the quarry LAEQ,15 min is below 33dB(A).

At Receiver 4, two 15 minute periods were recorded on the 2<sup>nd</sup> when equipment was broken down and the crushing was not operating. The wind conditions were calm and background was 31.2 and 31.5. The quarry was not audible on the 7<sup>th</sup> when the quarry was operating under load conditions. The Lago,15min had increased approximately 3 decibels to 34.3. It is estimated that the quarry Laeq,15 min is below 33dB(A).

At Receiver 6, the quarry was not audible. LA90,15min was 35.5 and 35.7 due to moving foliage. It is estimated that the quarry LAeq,15 min is below 35dB(A).

#### 5 SUMMARY

A noise monitoring survey was conducted to assess compliance of quarry operational noise levels at the Northern Rivers Quarry and Asphalt quarry at Blakebrook. Measurements were undertaken with calibrated noise monitoring equipment and conducted in general accordance with procedures laid down in Australian Standard AS 1055.1-1997 and the NSW Industrial Noise Policy.

The Blakebrook Quarry operates under EPL No. 3384. Condition L6.1 stipulates that noise from the premises must not exceed 35dB(A) L<sub>Aeq,15min</sub> during the day (7am to 6pm) Monday to Saturday.

Measurements were conducted at 5 receiver locations while the quarry was operating under load conditions. The quarry was not audible at Receiver locations 4 and 6. The quarry was just barely audible at Receiver location 2 and just audible for brief periods at Receiver locations 1 and 3.

The quarry operational noise levels (LAeq.15min) were not able to be accurately assessed at residential receiver monitoring locations as the quarry noise was not audible or just audible for short periods of time.

It is estimated from the recorded Lago, 15 min levels and observations that the quarry noise levels are below the Project Specific Noise Level of 35 dB(A)  $L_{eq,15mins}$  at Receiver locations 1, 2, 3, 4 and 6.

Garry Hall

Acoustic Consultant

Ambience Audio Services

# APPENDIX A Definitions of Terms

**Sound pressure level (SPL)**: A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure. Sound pressure levels are measured in decibels.

Decibels (dB): a ratio of energy flows. When used with sound measurement, it is the ratio between a measured quantity and an agreed reference level. The dB scale is logarithmic and uses the threshold of hearing of 20  $\mu$ Pa (micro pascals) as the reference level. This reference level is defined as 0 dB.

One useful aspect of the decibel scale is that it gives a much better approximation to the human perception of relative loudness than the Pascal scale. This is because the ear reacts to a logarithmic change in level, which corresponds to the decibel scale where 1 dB is the same relative change every on the scale. Refer Appendix B

Tonality: Noise containing a prominent frequency and characterized by a definite pitch.

Spectral characteristics: The frequency content of noise.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. The symbols for the noise parameters often include the letter "A" (e.g., LAeq, dBA) to indicate that frequency weighting has been included in the measurement.

Fast, Slow and Impulse time weightings: Standardised response times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. Slow helps average out the fluctuations and is used to for better visual indication of the noise source. Environmental assessment standards usually specify the time weighting (F, S, or I) to use.

L<sub>Aeq</sub>: The A-weighted continuous noise level. A widely used noise parameter that calculates a constant level of noise with the same energy content as the varying noise signal being measured. The time in minutes, which the measurement was sampled, is indicated with a following number. e.g. L<sub>Aeq15</sub> is a 15 minute sample.

Lan: The A-weighted sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. Laso is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. Laso is commonly used to describe the background noise level for community noise assessments.

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the  $L_{A90}$  descriptor.

Intrusive Noise: Refers to noise that intrudes above the background level by more than 5 decibels

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References:

Brüel and Kjær Sound & Vibration Measurements A/S Measuring Sound Bri September 1984

Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

140 dB 100 000 000 130 120 10 000 000 110 100 000 000 90 80 100 000 70 60 10 000 50 40 1 000 30 20 100 10 20 SOUND

APPENDIX B Comparison of Sound Pressure Levels

Our hearing covers a wide range of sound pressures - a ratio of over a million to one. The dB scale makes the numbers manageable.

## Reproduced from

Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

14/11/2017 Ambience Audio Services Blakebrook Quarry Noise Monitoring Results - November 2017

SOUND

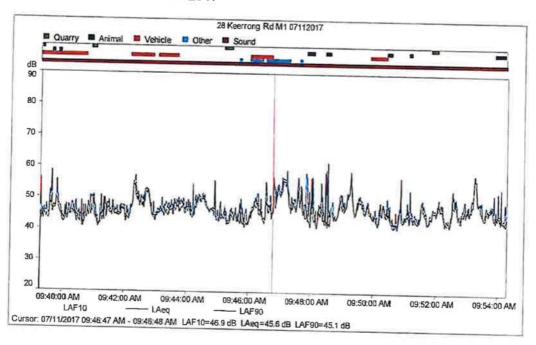
**PRESSURE** 

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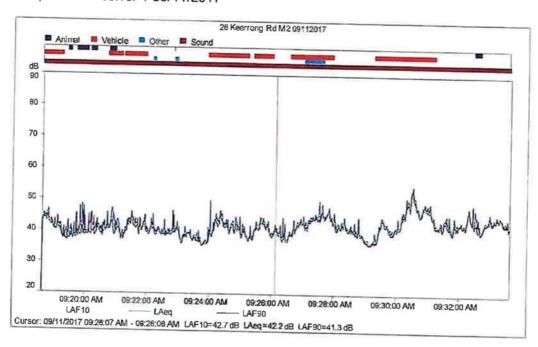
PRESSURE LEVEL

## APPENDIX C Logged Levels at Receiver Locations – Graphs

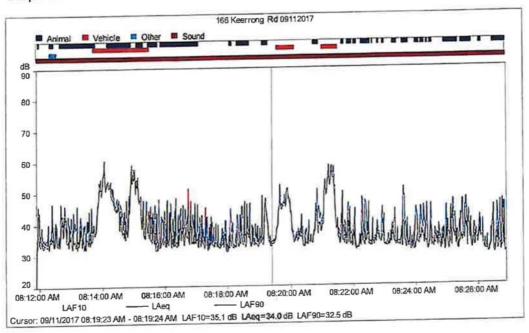
Graph C.1 Receiver 1 07/11/2017



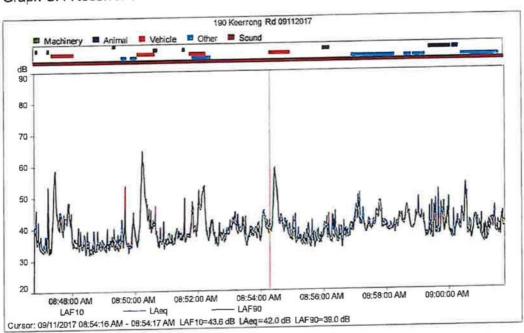
Graph C.2 Receiver 1 09/11/2017



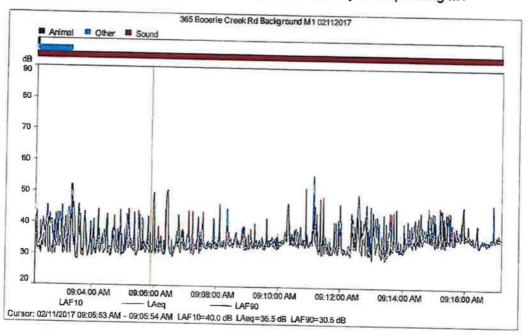
Graph C.3 Receiver 2 09/11/2017



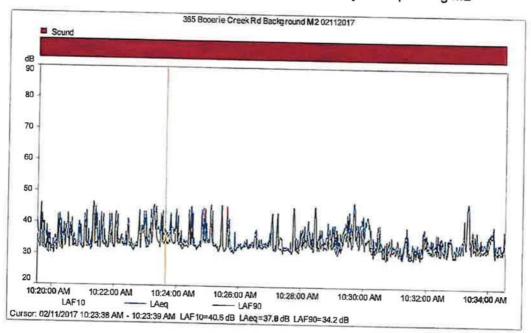
Graph C.4 Receiver 3 09/11/2017



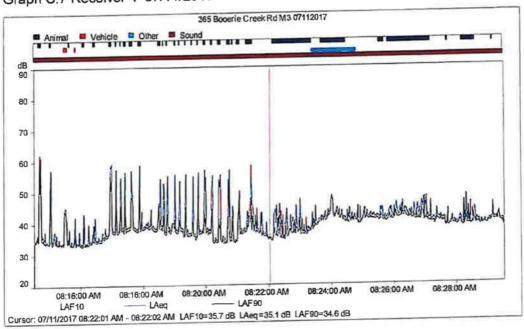
Graph C.5 Receiver 4 02/11/2017 Background - Quarry Not Operating M1



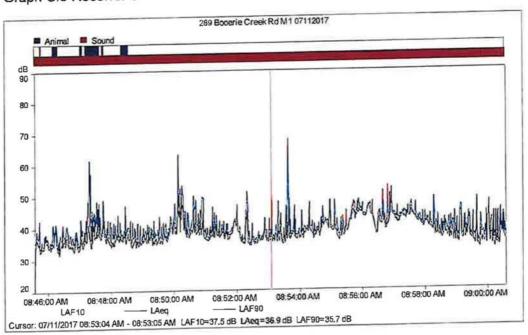
Graph C.6 Receiver 4 02/11/2017 Background - Quarry Not Operating M2



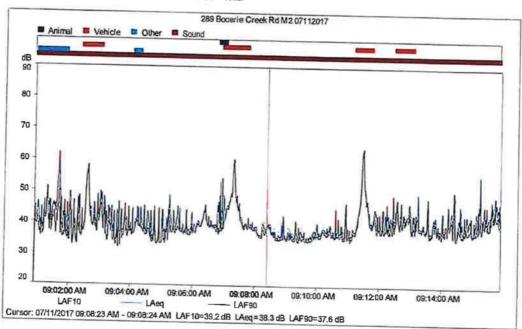
Graph C.7 Receiver 4 07/11/2017



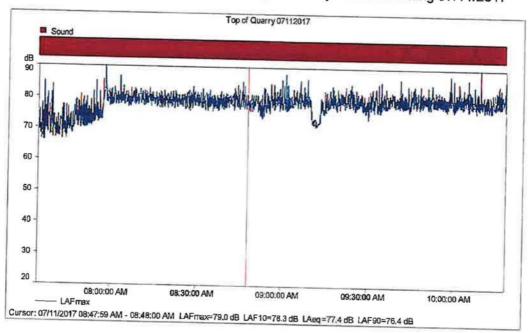
Graph C.8 Receiver 6 07/11/2017 M1



# Graph C.9 Receiver 6 07/11/2017 M2



Graph C.10 Measured Noise Levels at Top of Quarry Above Crushing 07/11/2017



Top of Quarry 09112017 ■ Sound dB 90 60 50 40 30 09:20:00 AM 09:40:00 AM 08:40:00 AM 09:00:00 AM 08:20:00 AM 08:00:00 AM 07:40:00 AM - LAFmax Cursor: 09/11/2017 08:08:53 AM - 08:08:54 AM LAFmax=80.6 dB LAF10=79.6 dB LAeq=78.5 dB LAF90=77.8 dB

Graph C.11 Measured Noise Levels at Top of Quarry Above Crushing 09/11/2017

Appendix D Quarry Operations 7<sup>th</sup> and 9<sup>th</sup> November 2017



Source – Google Earth – Image Date 17/02/2017

Note: Aerial photo not of operations on 7th and 9th of November 2017

# Crushing Operations 07, 09 November 2017

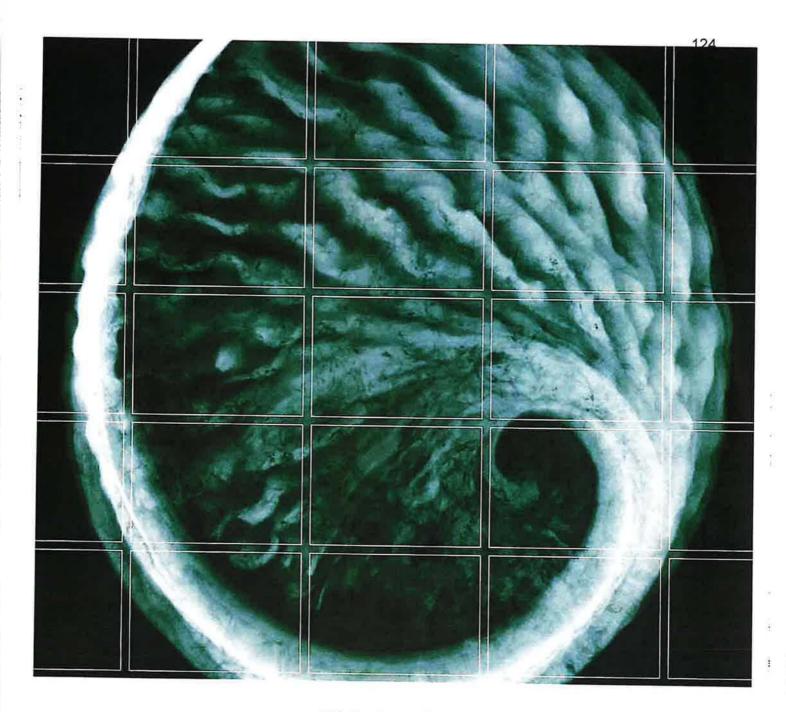


- 2 jaw crushers
- 4 screen decks
- 1 cone crusher
- 1 VSI crusher
- 4 excavators
- 2 dump trucks
- 2 front end loaders
- various haul trucks

# Mobile Asphalt Plant November 2017



# ANNEXURE E – BLAKEBROOK QUARRY NOISE, VIBRATION AND BLAST MONITORING SUB PLAN



# **Blakebrook Quarry Expansion**

Noise, Vibration and Blasting Monitoring Sub-plan

for Lismore City Council

April 2011

0066641 www.erm.com



### FINAL REPORT

Lismore City Council

Blakebrook Quarry Expansion

Noise, Vibration and Blasting Monitoring Sub-plan

April 2011

Environmental Resources Management Australia Suite 3/146 Gordon Street PO Box 5711 Port Macquarie, NSW 2444 Telephone +61 2 6584 7155 Facsimile +61 2 6584 7160 www.erm.com

levisio	on History and	Approval:			
Rev	Date	Description	Ву	Review	Approved
1.0	May 2010	Final Draft Noise, Vibration and Blasting Monitoring Sub-plan	Lismore City Council	Phil Klepzig	
			ERM Australia	Steve O'Connor	5.0km
Rev A Ji			Lismore City Council	Phil Klepzig	
	June 2010	Noise, Vibration and Blasting Monitoring Sub- plan	ERM Australia	Steve O'Connor	5.00
**			DECCW		
			Director General of DoP		
		Noise, Vibration and	Lismore City Council	Phil Klepzig	
Rev B	February 2011	Blasting Monitoring Sub- plan	ERM Australia	Will Weir	200
			Director General of DoP		

This Sub Plan is considered a dynamic document and will be reviewed as part of the annual review process (see Section 8 of EMS). The Sub-Plan and any subsequent revisions must be approved by the relevant Lismore City Council manager. Initial approval of the Sub-Plan must also be obtained from the Director-General (or delegate), NSW Department of Planning in accordance with the Minister's Conditions of Approval. Subsequent Sub-plan revisions do not require Director-General (or delegate) approval; however, a copy of the revised Sub-plan will be submitted for information.

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### **ABBREVIATIONS**

Term	Definition
ANZECC	Australian and New Zealand Environment Conservation Council
BoM	Bureau of Meteorology
CoA	Conditions of Approval
DECCW	Department of Environment Climate Change and Water (formerly Department of Environment and Climate Change (DECC)
DoP	Department of Planning
EA	Environmental Assessment
ECRTN	Environmental Criteria for Road Traffic Noise
EMP	Environmental Management Plan
EMS	Environmental Management System
ENM	Environmental Noise Model
EPA	Environment Protection Authority
ERM	Environmental Resources Management
INP	Industrial Noise Policy
KPI	Key Performance Indicator
LCC	Lismore City Council
OHS	Occupational Health and Safety

### 1 BACKGROUND

Lismore City Council (LCC) has been granted Project Approval by the NSW Minister for Planning under Section 75J of the Environmental Planning & Assessment Act 1979 to expand its existing quarrying operations (the Project) at Blakebrook to supply the Northern New South Wales area and local markets with high quality hard rock for road construction and building materials.

The approved expansion is to increase the extraction rate at the quarry from 182,000 tonnes per annum to 600,000 tonnes per annum and the use of mobile crusher plant within the quarry pit. This increased extraction will be sourced from within the existing quarry pit, and from the approved expansion area.

The Blakebrook Quarry is located approximately 7 kilometres north west of Lismore on the Nimbin Road on Lot 102 DP 817730 and Lot 1 DP 845473 (184 and 184A Keerrong Road) Lismore. As outlined in the Environmental Management System (EMS), the Project has undergone a number of investigations as part of detailed Environmental Assessment (EA) in order to evaluate the extent of impact of the noise, vibration and blasting from the proposed quarry expansion on the environment.

# 1.1 SUMMARY OF PREVIOUS NOISE ASSESSMENTS AND INVESTIGATIONS

A detailed Noise Assessment was undertaken by ERM to assess the potential noise impacts of the proposed expansion of Blakebrook Quarry on the surrounding environment. This report is summarised below and a complete copy is provided in *Annex A*.

### 1.1.1 Introduction

The noise assessment considered the following:

- potential noise and vibration impact at noise assessment locations from existing and proposed operational noise from the quarry, including blasting; and
- potential noise impact at noise assessment locations due to increased traffic flows to and from the quarry expansion.

Noise modelling was conducted in accordance with the Environmental Noise Model (ENM). Guidelines for the noise assessment are those stipulated by the NSW Department of Environment, Climate Change and Water (DECCW) (formerly Department of Environment and Climate Change (DECC)) in the Environmental Criteria for Road Traffic Noise (ECRTN) (1999) and the Industrial Noise Policy (INP) (2000), and in the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) in the Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration.

### 1.1.2 Methodology

Six residential properties were identified as being potentially affected by noise associated with the quarry expansion and were therefore used as noise assessment locations (referred to as noise assessment locations 1 to 6) in the Blakebrook Quarry Noise Assessment (ERM, 2008b). Their locations are illustrated on Figure 2.1 within the abovementioned report.

Four noise modelling scenarios were created for the Blakebrook Quarry assessment, which were:

- Existing Operation models the noise currently generated by the existing operations and provides a useful baseline scenario for comparative purposes;
- Proposed Overburden Stripping models the future noise generated by a
  combination of existing and proposed equipment, including overburden
  stripping equipment. This represents the worst case scenario noise levels
  as overburden stripping plant typically operate at the surface without
  shielding or bunding. Overburden stripping is conservatively estimated to
  be undertaken for periods of two weeks at a time;
- Proposed Central Operation models future noise generated by a combination of existing and proposed equipment. Proposed additional equipment includes mobile screening and crushing plant that will be located centrally in the main pit; and extractive machinery, such as an excavator that will be added to the proposed southern pit; and
- Proposed Northern Operation models identical equipment to the Proposed Central Operation with the proposed equipment located at the northern end of the pit.

#### 1.1.3 Results

Noise Modelling

The predicted noise levels for noise assessment locations 1, 3, 4 and 6 are in compliance with project specific criteria for all modelled operating scenarios. Both noise assessment locations 2 and 5 are deemed compliant for the majority of the modelled operating scenarios.

At location 2 the noise levels are comparable to existing levels as the dominant noise source is the existing jaw crusher.

The resultant noise levels at location 5 are being driven by the plant equipment at the (new) southern pit. As this equipment has been modelled at or near the surface, these results are considered conservative. The predicted

'Overburden Stripping' noise level at location 5 is above the nominated criteria. The predicted operational noise is comparable to existing noise at some of the assessment locations and given the limited duration, noise impact is not considered significant.

Although predicted levels due to the quarry expansion marginally exceed existing noise levels at noise assessment locations 1, 2 and 5 it is important to note that the INP addresses 'Existing Situation' in Chapter 10 and states:

"Where existing noise emissions exceed the project-specific noise level, the regulatory authorities and the noise-source manager need to negotiate achievable noise limits for the site. The project-specific noise levels should not be applied as mandatory noise limits.....achievable noise limits result from applying all feasible and reasonable noise control measures."

#### Construction Noise

There will be no significant construction activities that are likely to add to received noise levels at residences.

#### Road Traffic Noise

Based on 2006 daily traffic volumes of 3,200 vehicles per day and a linear growth rate of 2.2%, non site related traffic on Nimbin Road is forecast at 4,100 vehicles per day for the year 2018. This volume of traffic is equivalent to a noise level of 65dB(A) Leq15hr. This complies with DECCW criteria as site related traffic noise on Nimbin Road will increase existing road traffic noise by 1dB on average over a 15 hour period, which is under the 2dB recommendation.

### Blasting Noise and Vibration

As Blakebrook Quarry is currently undertaking changes to its blasting regime, historic reports were not felt to be representative of new blasting scenarios. An indicative assessment was therefore undertaken by ERM.

Vibration and overpressure levels for the Blakebrook Quarry were found to be within the accepted guidelines for nearby residences. As blasting will be carried out for the life of the quarry, each blast should be carefully designed and monitored to ensure that PPV and overpressure criteria continue to be met at residential locations.

### 2 PURPOSE AND OBJECTIVES

#### 2.1 PURPOSE

The primary purpose of this Noise, Vibration and Blasting Monitoring Sub-Plan (NVBM Sub-Plan) is to provide procedures to:

- describe how Lismore City Council (LCC) will manage and control risks associated with noise, vibration and blasting during the expansion of the quarry;
- ensure that the relevant stakeholders including LCC, Department of Environment, Climate Change and Water (DECCW) and Department of Planning (DoP) are involved in the formulation and implementation of this NVBM Sub-Plan;
- address the requirements of applicable legislation and any ongoing approvals as they are applicable to the Project;
- meet the Project Conditions of Approval (CoA)
- meet the existing Environment Protection Licence requirements for noise at Blakebrook Quarry; and
- address the requirements of the Project Environmental Assessment Report (EA) (ERM, 2009).

This plan provides procedures and actions that may need to be implemented to avoid or minimise the Project noise, vibration and blasting impacts.

### 2.2 OBJECTIVES

Noise, Vibration and Blasting Monitoring Sub-Plan (NVBM Sub-Plan) objectives established for the Project works are to:

- identify environmental obligations and legislative requirements applicable to Noise, Vibration and Blasting Monitoring during the Project;
- describe the specific environmental management requirements and strategies for environmental elements, define objectives and set targets for environmental performance;

- to provide ongoing monitoring of noise, vibration and blasting levels in the vicinity of the quarry, to allow prompt identification of any increased impacts;
- to demonstrate how any potential impacts on surrounding residential receivers will be managed and mitigated;
- consult with the DECCW, DoP and LCC during the preparation and implementation (as required) of this NVBM Sub-Plan; and
- define key roles and responsibilities.

# 3 NOISE, VIBRATION AND BLASTING IMPACTS AND LEGISLATIVE OBLIGATIONS

#### 3.1 ENVIRONMENTAL IMPACTS

The Project activities that are most likely to have the potential to result in noise and vibration impacts on residential receivers will be quarrying activities including operating machinery, blasting, and transport of materials on and off site for the expansion of the quarry. *Table 3.1* summarises the activities and potential impacts, and provides a risk analysis assuming no mitigation measures or control are put in place. The risk assessment process is described in *Section 3.3* of the Project EMS.

Table 5.1 provides a summary of the key potential risks for noise, vibration and blasting along with appropriate mitigation measures to manage those risks. Risks are summarised according to their potential to impact residential receivers and are assessed for likelihood on a scale of low, medium or high.

Table 3.1 Environmental Impacts and Risk Analysis (assuming no mitigation)

ID		Aspect	Impact	Risk
N1		Activities including nd crushing of material	Increase in noise impacts at residential receptors	Low
N2	Blasting to ex	spand Quarry	Increase in vibration and noise impacts on residential receivers	Low
N3	Transport of site	material on and off	Increase in traffic movements increasing noise on surrounding roads	Low
Note:	Risk Rankings	High - Serious impacts and potential repercussions Moderate - Significant impacts and potential repercussions Low - Minor impacts and potential repercussions		

As stated, the above risk ranking assumes no mitigation or control measures are in place in response to the identified risk. By implementing the measures outlined in this NVBM Sub-Plan the identified risks will be able to be managed to an acceptable level, such that that the risk would be considered negligible.

#### 3.2 LEGISLATION AND POLICIES

The applicable legal and other requirements related to noise, vibration and blasting and environmental management for the Project are outlined in *Table* 3.2.

### Table 3.2 Legal and Other Requirements for Environmental Management

#### Legislation and Policies

#### Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

#### State Legislation

Environmental Planning and Assessment Act 1979

Protection of the Environment Operations Act 1997

Protection of the Environment Operations (General) Regulations 2009

Protection of the Environment Operations (Noise Control) 2008

#### Regional Planning Document

North Coast Regional Environmental Plan 1988 (NCREP)

#### Local Government

Lismore Local Environmental Plan 2000 (Lismore LEP)

### 3.3 MINISTER'S CONDITIONS OF APPROVAL

Pursuant to section 75B(1) of the EP&A Act, the Project was declared to be a project under Part 3A of the Act and project approval has been received from the Minister for Planning.

The Minister's Conditions of Approval specifically relating to noise and blasting are as follows:

#### Noise Mitigation

- The proponent shall install noise amenity bunds as described in the EA within 1
  month of the date of the approval of the Landscape and Biodiversity Management
  Plan (see condition 27 of schedule 3).
- 3. The proponent shall replace all reverse alarm beepers with low frequency 'duck quack' beepers prior to 31 December 2010.

#### Impact Assessment Criteria

4. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 1.

Table 1 Noise impact assessment criteria dB(A) LAeq (15min)

Location	Day	
Location	36	
All other locations	35	
Notes:		
<ul> <li>To interpret the locations referre</li> </ul>	d to above, see the figure in Appendix 3 of MCOA	A.s.

Location Day

- Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.
- The noise limits do not apply if the Proponent has an agreement with the relevant owner/s of these
  residences/land to generate higher noise levels, and the Proponent has advised the Department in
  writing of the terms of this agreement.

### Operating Hours

The Proponent shall comply with the operating hours in Table 2

Table 2 Operating Hours

Activity	Day
Quarrying Operations	Monday to Friday
	Saturday
	Sunday and Public Holidays

#### Notes:

- Maintenance activities may be conducted outside the hours in Table 3 provided that the activities are not audible at any privately-owned residence.
- This condition does not apply to delivery of material if that delivery is required by police or other
  authorities for safety reasons, and/or the operation or personnel or equipment are endangered. In such
  circumstances, notification is to be provided to DECCW and the affected residents as soon as possible,
  or within a reasonable period in the case of emergency.

#### Noise Monitoring

- 6. The Proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the Director-General. This program must:
  - a) be submitted to the Director-General for approval prior to 30 June 2010;
  - b) include annual attended noise monitoring;
  - c) include details of how the noise performance of the project would be monitored; and
  - d) include a noise monitoring protocol for evaluating compliance with the noise criteria in this approval.

### Airblast Overpressure Limits

 The Proponent shall ensure that the airblast overpressure level from blasting at the project does not exceed the criteria in Table 3 at any residence on privatelyowned land.

Table 3 Airblast overpressure impact assessment criteria

Airblast overpressure level (dB(Lin Peak))	Allowable exceedance
115	5% of the total number of blasts in a 12 month period
120	0%

#### Notes:

- The overpressure values in Table 3 apply when the measurements are performed with equipment
  having a lower cut-off frequency of 2 Hz or less. If the instrumentation has a higher cut-off frequency
  a correction of 5dB should be added to the measured value. Equipment with a lower cut-off frequency
  exceeding 10 Hz should not be used.
- The airblast overpressure noise limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences/land to generate higher airblast overpressure noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

### Ground Vibration Impact Assessment Criteria

8. The Proponent shall ensure that the ground vibration level from blasting, or any other activity at the project, does not exceed the levels in Table 4 at any residence on privately-owned land.

Table 4 Ground vibration impact assessment criteria

Peak particle velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts in a 12 month period
10	0%

#### Note:

 The ground vibration limits do not apply if the Proponent has an agreement with the relevant owner/s of these residences/land to generate higher ground vibration levels, and the Proponent has advised the Department in writing of the terms of this agreement.

### Blasting Hours

 The Proponent may only carry out blasting on site between 10 am and 3 pm Monday to Friday, with no blasting on weekends or public holidays.

#### Blasting Frequency

10. The Proponent shall not carry out more than 2 blasts a month on site, averaged over a 1 year period.

#### Property Inspections

11. Prior to 30 June 2010, the Proponent shall advise all landowners within 2 km of proposed blasting activities, and any other landowner nominated by the Director-General, that they are entitled to a property inspection to establish the baseline condition of the property.

- 12. If the Proponent receives a written request for a property inspection from any such landowner, the Proponent shall:
  - (a) commission a suitably qualified person, whose appointment has been approved by the Director- General, to inspect and report on the condition of any building or structure on the land, and recommend measures to mitigate any potential blasting impacts; and
  - (b) give the landowner a copy of this property inspection report.

Note: It is preferable for the property inspection to be carried out prior to the commencement of blasting activities on the site, and the Proponent should facilitate this occurring wherever possible

#### Property Investigations

- 13. If any landowner within 2 km of proposed blasting activities, or any other landowner nominated by the Director-General, claims that his/her property, including vibration-sensitive infrastructure such as water supply or underground irrigation mains, has been damaged as a result of blasting at the project, the Proponent shall within 3 months of receiving this request:
  - (a) commission a suitably qualified person whose appointment has been approved by the Director-General to investigate the claim and prepare a property investigation report; and
  - (b) give the landowner a copy of the report.

If this independent investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damage to the satisfaction of the Director-General.

If the Proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.

#### Monitoring

14. Prior to 30 June 2010, the Proponent shall prepare and implement a detailed Blast Monitoring Program for the project, in consultation with DECCW, and to the satisfaction of the Director-General.

This report addresses the abovementioned requirements.

### 3.4 EXISTING ENVIRONMENT PROTECTION LICENCE (EPL) CONDITIONS

The DECCW Environment Protection Licence No 3384 (EPL) for Blakebrook Quarry has in place existing conditions for noise, air blast overpressure and vibration levels which are as follows:

- L6.1 Noise from the premises must not exceed:
  - (a) 35dB(A) LAeq(15 minute) during the day (7am to 6pm) Monday to Saturday;

Where LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

- L6.2 The air blast overpressure level from blasting operations in or on the premises must not exceed:
  - (a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
  - (b) 120 dB (Lin Peak) at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

- L6.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
  - (a) 5mm/s for more than 5% of the total number of blasts carried out on the premises during each reporting period; and
  - (b) 10 mm/s at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.

This report has considered the existing EPL conditions in this Plan.

### 3.5 RELATED MANAGEMENT PLANS

This Noise, Vibration and Blasting Monitoring Sub-plan forms part of an overarching Environmental Management System (EMS) for the Project. Where relevant, reference should also be made to the other Sub-Plans for the Project listed in *Table 3.3*.

Table 3.3 Relevant Project Sub-Plans

Number	Environmental Sub-Plan
EMSP 2	Air Quality Monitoring Program
EMSP 3	Groundwater Monitoring and Management Program
EMSP 4	Soil and Water Management
EMSP 5	Landscape and Biodiversity Management
EMSP 6	Aboriginal Cultural Heritage Management
EMSP 7	Traffic Management

### 3.6 GUIDELINES AND STANDARDS

The guidelines referenced in relation to the noise, vibration and blasting management for the Project are listed in *Table 3.4*. Preparation of this NVBM Sub-Plan has been based on the requirements provided in these documents.

### Table 3.4 Environmental Standards, Policies and Guidelines

Environmental Risk Issue	Standards and Guidelines
Noise, vibration and blasting	Environmental Criteria for Road Traffic Noise, 1999 (DECCW)
	NSW Industrial Noise Policy, 2000 (DECCW)
	Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration, 1990 (ANZECC)

### 4 ROLES AND RESPONSIBILITIES

All quarry personnel and contractors are accountable through conditions of employment or contracts with each individual responsible for ensuring that their work complies with the stated EMS procedures.

An organisational structure for the Project is provided in *Section 6.1* of the EMS. For the purpose of implementing the NVBM Sub-Plan, the roles and responsibilities of the key players are provided in *Table 4.1* below.

Table 4.1 Roles and Responsibilities

	Manager of Commercial Services	Timing
Action No.	Action	At all times.
NVBM.MCS.01	Ensure that Conditions of Project Approval (CoA), Project Commitments and any other approval conditions are adhered to when working in designated Project areas. Provide Lismore City Council (LCC), Department of Environment Climate Change and Water	At all times.
NVBM.MCS.02	(DECCW) and Department of Planning (DoP) and other relevant stakeholders with the opportunity to contribute to the development of the NVBM Sub- Plan.	Prior to commencement of construction
NVBM.MCS.03	Ensuring all staff and contractors are provided with induction regarding the significance of noise, vibration and blasting impacts as part of general environmental management site induction and ensuring that they know of agreed management and mitigation.	Prior to commencement of construction
NVBM.MCS.04	Ensuring all monitoring commitments made as part of the NVBMS are executed	As detailed in the NVBMS
NVBM.MCS.05	Ensuring monitoring is completed in response to any complaints regarding noise and /or vibration.	When required
	Quarry Operations Coordinator	
Action No.	Management Procedure	Timing
NVBM.OC.01	Ensure that CoA, Project Commitments and any other approval conditions are adhered to when working in designated Project areas.	At all times
NVBM.OC.02	Notifying the Manager of Commercial Services before undertaking any blasting works.	Prior to commencement of works
NVBM.OC.03	Ensuring all residential receptors are informed of all planned blasting works prior to commencement of works	Prior to commencement of works
NVBM.OC.04	If complaints are received regarding noise or vibration, stop works that have the potential to impact further and contact the Manager of Commercial Services immediately.	When and if required
	Quarry Personnel and Contractors	
Action No.	Management Procedure	Timing

NVBM.QP.01 Ensure approval has been given by the Quarry Operations Coordinator prior to undertaking any blasting works.

Figure 4.1 below provides the EMS management structure that also applies for Noise, Vibration and Blasting Monitoring.

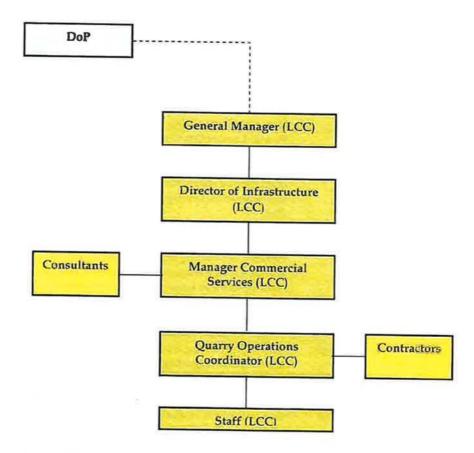


Figure 4.1 Noise, Vibration and Blasting Monitoring Sub-Plan Organisational Chart

### MANAGEMENT STRATEGIES AND MITIGATION

5

The list of the work practices that will be used to control environmental impacts during quarry expansion phase of the Project are provided in *Table 5.1*. This table provides a summary of the key potential risks of noise, vibration and blasting on residential receptors along with appropriate mitigation measures to manage those risks. Risks are summarised according to their potential to impact residential receptors and are assessed for likelihood on a scale of low, medium or high.

The relevant procedural guidelines are also shown in the table which contain the detailed actions for each of the environmental issues and should be referred to during the Project.

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Table 5.1 Noise, Vibration and Blasting Risk Assessment and Management Actions

Management	Ensure all plant leaving site are maintained and noise levels arc within equipment specifications.	Mitigation measures as outlined in Section 5.2 are implemented. Monitoring of compliance with criteria as per Section 6. Non-compliance to result in consideration of further mitigation measures.	Blasting impacts will be assessed in accordance with the recommended ANZECC criteria. These criteria are used to assess human annoyance, discomfort and potential property impacts from blasting activities. Assessments will identify quarrying areas that may require additional management of blasting practices to reduce potential blast and vibration impacts. Vibration monitoring to confirm conformance with criteria in EPL.
Consequence		ndation  - quarry is below Medium - assessment of N ing land however predicted noise from it pit is located near expansion of quarry indicates S il receptor overburden activities in fi	
Likelihood	Low – assessment of predicted Low – any increases in traffic noise from increased traffic movements will be minor movements indicates an increase of 1dB on average over a 15 hour period, which is under the 2dB	recomme Medium surround southern residentia	Medium – could happen
Identified Risk	Expansion of quarry increases traffic movement	Increase in noise impacts at residential receptors from quarrying activities	Increase in vibration and noise impacts on residential receivers from blasting activities

ENVIRONMENTAL RESOURCES MANAGEMENT AUSTRALIA 0066641 NOISE, VIBRATION AND BLASTING MONITORING SUB-PLAN

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### 5.1 STAKEHOLDER CONSULTATION

Consultation with DECCW, the DoP and LCC has been undertaken throughout the planning process of the Project. A Copy of the NVBM Sub-Plan was provided to the DECCW, the DoP and LCC for comment. Responses received are included in *Annex B* with a summary of concerns/comments and responses outlined in *Table 5.2*.

### Table 5.2 Stakeholder Consultation

Group	Documents Sent	Concern/Comment	Response
epartment of nvironment, limate hange and	Framework EMS & NVBM Sub- Plan	Awaiting reply.	Awaiting reply.
Vater Department of Planning	EMS & NVBM Sub-	Awaiting reply.	Awaiting reply.

Should further responses be received following the approval of this Sub-Plan, all reasonable and feasible actions will be incorporated into the Sub-Plan.

### 5.2 MITIGATION MEASURES

Several noise mitigation measures are currently in place at the Blakebrook Quarry and will continue to be employed throughout the proposed expansion. These measures are summarised as follows:

- the operating hours of the quarry are restricted to between 7am and 6pm Monday to Friday, and 7:00am to 3:00pm on Saturdays;
- road traffic noise created by the haul trucks accessing the site is ameliorated by imposing a speed limit of 40km/h in the site and compression braking is prohibited whilst on-site;
- a 4m earth bund is located adjacent to overburden stripping plant that is not shielded by permanent bunding. (This was not included in the modelled results); and

 attended noise monitoring (encompassing noise assessment locations) and plant equipment audits will be undertaken on an annual basis for compliance purposes.

Noise experienced at sensitive receivers is expected to be progressively reduced as the quarry expansion proceeds, through implementation of the following measures:

- plant will be relocated to greater pit depths throughout the life of the quarry to further reduce noise at receiver locations; and
- no additional noise producing activities, plant or equipment will be introduced at the site.

Implementation of the above mentioned mitigation measures will control noise levels emanating from the Blakebrook Quarry.

### 5.3 TRAINING AND AWARENESS

As part of the general site induction process, all Project personnel will be made aware of potential noise and vibration activities, including blasting, that could impact on residential receptors.

Those personnel specifically involved in clearing, grubbing and ground disturbance works including topsoil removal and excavation in close proximity to residents will be made aware of their location and an assessment of the need for mitigation measures completed prior to works commencing. This will be undertaken as part of the induction process and will be followed up by toolbox talks prior to working in areas outside of the existing quarry footprint.

Awareness will also be raised, as part of the tool box talk process, that on receipt of any complaints for noise or vibration, works are to cease and the environmental coordinator informed.

### 6 INSPECTION AND MONITORING

#### 6.1 INSPECTIONS

### 6.1.1 Site Inspections

Routine inspections of work areas will be conducted by the Quarry Operation Coordinator to monitor work practices and identify non-conforming areas and activities or work practices which could lead to potential increase to noise and/or vibration levels.

Where a non-compliance with nominated performance goals is detected, an Incident Notice will be raised by the Quarry Operations Coordinator as outlined in the EMS.

## 6.2 NOISE, VIBRATION AND BLASTING MONITORING

### 6.2.1 Objectives

The noise measurement procedures employed throughout the monitoring program shall be guided by the requirements of AS 1055-1997 "Acoustics - Description and Measurement of Environmental Noise" and the NSW Industrial Noise Policy.

Vibration and air blast overpressure measurement and procedures employed throughout the monitoring program shall be guided by the requirements of AS 60068.3.8-2004 "Supporting Documentation and Guidance – Selecting Amongst Vibration Tests" and the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration.

Noise, vibration and blasting monitoring will:

- ensure the quarry is operating as anticipated with respect to impacts of noise, vibration and blasting on residential receptors;
- gauge the impact (if any) of the extraction activities on the noise and vibration level across the site;
- identify any unforseen noise or vibration impacts from the quarry operations on residential receptors;

- implement measures to prevent any as yet unforseen impacts from the proposed expansion of the quarry; and
- verify that the quarry is achieving its environmental objectives.

# 6.2.2 Noise and Vibration and Blasting Monitoring Locations

Noise, vibration and blasting monitoring will be undertaken at the nearest residential receptors marked as locations 1 to 6 on *Figure 6.1*.

# 6.2.3 Noise, Vibration and Blasting Monitoring Schedule

Noise, shall be conducted on an annual basis and/or in response to any complaints and consist of operator attended noise monitoring and spot checks of equipment. The frequency of monitoring will be reviewed after the first 12 months of operation to determine future monitoring requirements.

Air blast overpressure and ground vibration levels must be measured at the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative level - for all blasts carried out in or on the premises.





 Client:
 Lismore City Council

 Project:
 Blakabrook Quarry

 Drawing No:
 0056641pm\_GIS11

 Date:
 02/05/2010
 Drawing Size:
 A4

 Drawn By:
 AM
 Reviewed By:
 MM

Source:

Scale: Refer to Scale Bar (approximate only)



Figure 6.1 Noise and Vibration Sensitive Receptor Locations

Environmental Resources Management Australia Pty Ltd PO Box 5711, Port Macquarie, NSW, 2444 Telephone +61 2 6584 7155



### 6.2.4 Noise, Vibration and Blasting Monitoring Methodology

Operator - attended noise measurements shall be conducted at Locations 1 to 4, Location 6 and Location 9 (refer *Figure 6.1*) to quantify and characterise the maximum (LAmax), the energy equivalent (LAeq), and background (LA90) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the LAeq(Period) noise contribution during day time activities from each of the quarrying operations, as well as the overall level of ambient noise.

During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS 1259.2-1990, "Sound Level Meters".

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding  $\pm 0.5$  dBA.

To measure blasts a blast monitor will be employed that records air blast and vibration levels once triggered by an electronic trigger connected to shot firing switch. That is, when the shot is fired, the monitor will be triggered by means of a hardwire switch and will start recording and capture the blast event. This will ensure that the event captured is the blast, significantly reducing the influence of other extraneous sources that could affect the measurement.

Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard 2187.2 - 2006.

#### 6.2.5 Meteorological Parameters

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period.

Meteorological measurements shall be guided by the requirements of AS 2923-1987 "Ambient Air-Guide for Measurements of Horizontal Wind for Air Quality Applications" and the DECCW. Rainfall data will be collected from the rain gauge located on-site. All other weather data for the monitoring period will be purchased from the Bureau of Meteorology (BOM) website for the Lismore Observation Station which is programmed to continuously record the meteorological parameters as shown in *Table 6.1*.

#### Table 6.1 Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean wind speed	m/s	15 minute
Mean wind direction	Degrees	15 minute
Aggregate rainfall	mm	15 minute
Mean air temperature	C°	15 minute

### 6.2.6 Plant and Equipment Observations and Log

During the attended noise measurements, the operator shall record any significant quarry generated noise sources (i.e. haul trucks, dozers, etc). In addition, the operator shall obtain copies of the relevant fixed plant and mobile equipment shift logs to be included in the noise monitoring report.

#### 6.2.7 Assessment Criteria

The purpose of the noise, vibration and blasting monitoring program is to track potential impacts of operations over time as quarrying continues, to demonstrate that quarrying is not impacting on residential receptors.

Currently the EPL No 3384 for Blakebrook Quarry has in place existing conditions for noise, blasting and vibration levels which are as follows:

### L6.1 Noise from the premises must not exceed:

(a) 35dB(A) LAeq(15 minute) during the day (7am to 6pm) Monday to Saturday;

Where LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L6.2 The air blast overpressure level from blasting operations in or on the premises must not exceed:

- (a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
- (b) 120 dB (Lin Peak) at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative overpressure level.

L6.3 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:

- (a) 5mm/s for more than 5% of the total number of blasts carried out on the premises during each reporting period; and
- (b) 10 mm/s at any time.

At the most affected residence or noise sensitive location that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative ground vibration level.

The assessment criteria for noise, vibration and blasting for the expanded operations will initially remain the same as stipulated in the EPL. The need for calculating site specific trigger levels would be reviewed after two years of operations once a data set is available.

### 6.3 REVIEW AND REPORTING OF MONITORING RESULTS

### 6.3.1 Review of Monitoring Results

Upon receipt of each round of monitoring results, a suitably qualified person will enter all results into a spreadsheet/s that compiles all historical data. The results will be reviewed for any obvious trends or exceedances of the relevant assessment criteria. In the event of any abnormalities or exceedances being identified, and depending on the specific circumstances, the response might include some or all of the following procedures:

- discuss the occurrence with an acoustics specialist or environmental scientist with acoustic experience, to assess the consequence of the exceedance;
- discuss the occurrence with relevant authorities (e.g. DECCW) and formulate a plan of action (if required);
- investigate the nature of the abnormality or exceedance;
- assess likely reasons for the occurrence;
- identify the potential impacts and consequence of the exceedance;
- resample and reanalyse if the results are questionable; and
- develop and implement mitigation strategies to prevent future exceedances.

# 6.3.2 Noise, Air Blast Overpressure and Vibration Monitoring Report

All routine monitoring results will be documented and reported with four weeks of receiving monitoring results.

Monitoring reports should consist of the following information.

- Summary of attended noise monitoring results;
- Summary of vibration and air blast overpressure monitoring results;
- Predicted noise levels at each assessment location from the compliance noise model completed as part of the detailed Noise Assessment undertaken by ERM (refer Annex A);
- Measured/ calculated and/or operator estimated quarry LAeq(Period) contributed noise levels for each monitoring location; and
- Details of any complaints relating to noise, blasting and/or vibration and their state of resolution.

## 6.3.3 Annual Review

The results of the Noise, Vibration and Blasting Monitoring Program would be reviewed annually and reported in the Annual Environmental Management Report (AEMR). With regard to Noise, Vibration and Blasting monitoring, the AEMR will:

- include a summary of monitoring results;
- include an analysis of these monitoring results against the relevant assessment criteria, monitoring results from previous years and predictions from noise modelling;
- identify any trends in the monitoring results over the life of the development;
- draw conclusions about the possible causes of any trends and recommend follow up investigation if required. If an identifiable cause is found, recommend appropriate remedial action;
- identify any non-compliance during the previous year; and
- describe what actions were, or are being taken to ensure compliance.

Currently the Environment Protection Licence (EPL) for the site requires reporting of the results of the air blast overpressure and ground vibration levels as part of the Annual Return.

#### Major Review 6.3.4

After two years of quarrying operation, a major review of all monitoring data would be undertaken by a suitably qualified person to assess what, if any, impacts to noise, vibration and air blast overpressure have occurred as a result of the expanded operations.

Should the monitoring show consistent results that demonstrate quarrying is not impacting noise, vibration and air blast overpressure, a reduction of the frequency of monitoring and range of analyses might be justified.

#### Contingency 6.3.5

Conversely to above, should the monitoring results at any time indicate that quarrying may be impacting noise, vibration and air blast overpressure levels, then the monitoring program may need to be intensified to allow better identification and understanding of those impacts and allow for the formulation and design of appropriate mitigation measure as may be deemed necessary.

Before any changes are made to the monitoring program, LCC would consult with DoP and obtain their approval.

The NVBM Sub-Plan would be revised in line with any approved changes to the monitoring and reporting programs.

#### Reporting Non-compliances 6.3.6

In the event of a potential exceedance of the relevant noise, vibration and/or air blast overpressure emission criteria, the respective operations' Environmental Officer shall be promptly informed of the location, the margin of exceedance and the source of emission, if it has been identified. The monitoring results, weather and relevant operating data shall be documented and forwarded to the respective Environmental Officer so that the matter can be investigated and appropriate actions undertaken accordingly.

Additional noise measurement methods such as near field monitoring or unattended directional noise monitoring may be utilised to investigate noise emissions in relation to noise complaints, or to determine compliance with the approval conditions where potential non-compliances have been measured or are difficult to quantify from operator-attended or unattended noise measurements.

## 6.3.7 Community information & Complaints

In the event of a complaint, additional noise monitoring may be required to be undertaken. Depending on the type of complaint and location, several measurement methods and techniques can be utilised to identify the noise source causing the complaint. Such methods may be:

- Operator attended measurement at the affected location combined with audio recordings or at an alternate representative location;
- Unattended noise monitoring;
- Real-time noise monitoring combined with audio recordings;
- By calculation from near field measurements; and
- A combination of any or all the methods shown.

### 7 REFERENCES

Department of Infrastructure, Planning and Natural Resources, 2004, Guidelines for the Preparation of Environmental Management Plans.

Environmental Resources Management Australia Pty Ltd (ERM), 2009, Blakebrook Quarry Expansion Environmental Assessment Report.

Annex A

Noise Assessment Report (ERM, 2009)

## FINAL REPORT

Lismore City Council

Blakebrook Quarry Noise and Blasting Assessment

July 2009

Reference: 0066641RP1

Environmental Resources Management Australia Building C, 33 Saunders Street Pyrmont, NSW 2009 Telephone +61 2 8584 8888 Facsimile +61 2 8584 8800

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#### FINAL REPORT

Lismore City Council

## Blakebrook Quarry Noise and Blasting Assessment

July 2009

Reference: 0066641RP1

For and on behalf of

Environmental Resources Management

Australia

Approved by: Steve O'Connor

5.0cm

Signed:

Position: Partner

ate July 2009

This report has been prepared in accordance with the scope of services described in the contract or agreement between Environmental Resources Management Australia Pty Ltd ACN 002 773 248 (ERM) and Lismore City Council. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by Lismore City Council. Furthermore, the report has been prepared solely for use by Lismore City Council and ERM accepts no responsibility for its use by other parties

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#### 1 INTRODUCTION

This report has been prepared for Lismore City Council, to assess environmental noise associated with the proposed expansion of the Blakebrook quarry.

This assessment considers the following:

- Potential noise and vibration impacts at noise assessment locations from existing and proposed operational noise from the quarry, including blasting; and
- Potential noise impacts at noise assessment locations due to increased traffic flows to and from the quarry expansion.

Noise modelling has been conducted with Environmental Noise Model (ENM) software; which is widely accepted as a reliable method of predicting noise levels from industrial sources. Noise modelling conservatively assumes concurrent operation of all equipment during each stage as described in *Section 5.2*, the noise modelling results section of this report.

Guidelines for this noise assessment are those stipulated by the NSW Department of Environment and Climate Change (DECC) in the Environmental Criteria for Road Traffic Noise (ERCTN) (1999) and the Industrial Noise Policy (INP) (2000), and in the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) in the Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

#### 1.1 PROJECT DESCRIPTION

The proposed development involves increasing the depth of the existing hard rock quarry (main pit) and creating an additional pit to the south of the main pit. Figure 1.1 shows the proposed operating areas, including quarry benches.

The existing 1995 Blakebrook Quarry consent limits production to 95,800m³ or 182,000 tonnes per annum plus a 2.5% production increase over 25 years to a maximum 337,500 tonnes per annum. The current approved production rate as of 2006 is in the order of 232,975 tonnes per annum. The proposed expansion will involve a progressive increase in the production rate to 600,000 tonnes per annum over a period of 30 years. The expansion will also include the use of mobile crushing equipment in the main quarry pit and continued use of existing quarry infrastructure. Additionally, material extracted from the southern pit area will be trucked to the existing crushing plant for processing. The site is to be progressively rehabilitated.

The proposed operating hours for the quarry are from 7.00am to 5.00pm during the weekdays and from 7.00am – 12.00pm on Saturdays.

#### 1.2 GLOSSARY

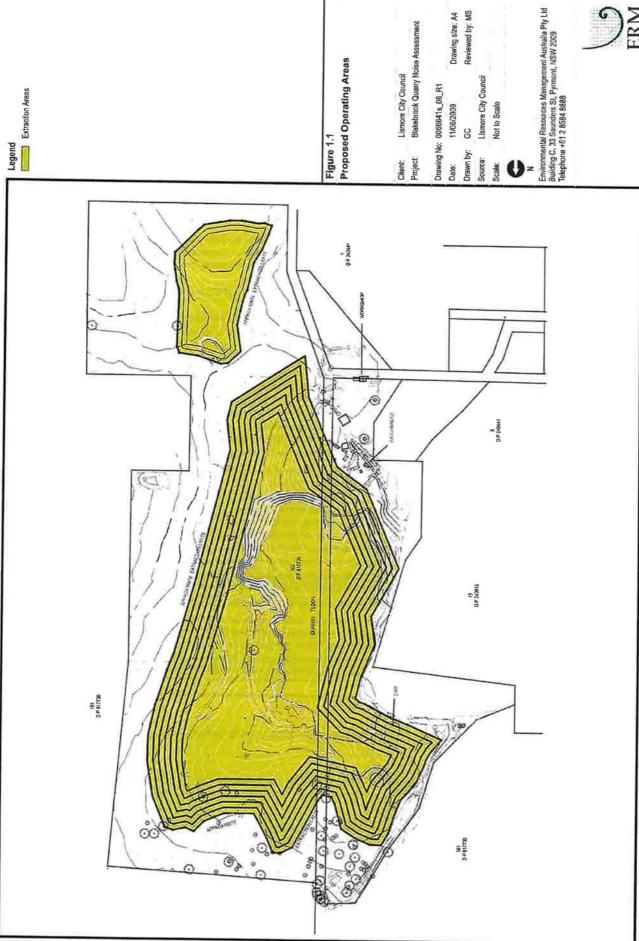
A number of technical terms used in this report describe various noise levels from the mine. These are explained in *Table 1.1*.

Table 1.1 Glossary of Terms

Term	Description
ABL	Assessment Background Level (ABL) is defined in the <i>INP</i> as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L <sub>90</sub> statistical noise
	levels.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human car.
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting.
L1	The noise level exceeded for 1 % of a measurement period.
L10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
L90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
Leq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
Lmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
MIC <sub>8MS</sub>	Maximum Instantaneous Charge (with a minimum 8 milli-sec delay).
Peak Particle Velocity	The maximum velocity of a particle of the transmission medium, used in assessment of vibration.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's
RMS	Root Mean Square which is a measure of the mean displacement (velocity or acceleration) of a vibrating particle.
SI	Still isothermal (SI) refers to calm weather conditions (defined as no wind and standard temperature gradients).
sigma-theta (σ <sub>θ</sub> )	The standard deviation of horizontal wind fluctuation.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude to some height.

The following indicates what an average person perceives about noise levels in practice:

- noise differences of less than approximately 2 dB are generally imperceptible; and
- a difference of around 10 dB seems to be a doubling or halving of loudness.



## 2 THE EXISTING NOISE ENVIRONMENT

## 2.1 NOISE ASSESSMENT LOCATIONS

Seven residential properties have been identified as being potentially affected by the quarry expansion and therefore nominated as noise assessment locations. These are shown in *Table 2.1* and are illustrated in *Figure 2.1*.

Table 2.1 Assessment Locations Used for Modelling Purposes

Noise Assessment Locations	Street Address	GPS Coordinates		Location from Blakebrook Quarry Site Office	
		Easting	Northing	Compass Point	Distance
Location 1	Lot 18, 1 Nimbin Road, Blakebrook	523920	6817599	WSW	650
Location 2	Lot 15, 122 Keerrong Road, Blakebrook	523507	6818265	WNW	1,000
Location 3	Lot 4, 145 Pinchin Road, Goolmangar	522921	6820418	NW	2,900
Location 4	Lot 101, 190 Keerrong Road, Blakebrook	524173	6819040	NNW	1,125
Location 5	Lot 2, 365 Booerie Creek Road, Booerie Creek	525547	6818472	NE	1,195
Location 6	Lot 41, 210 Booerie Creek Road, Booerie Creek	525161	6817109	SE	1080
Location 7	Lot 3, 484 Nimbin Road, Blakebrook	524439	6817246	SSW	780

## 2.2 MEASUREMENT EQUIPMENT

Measurements were performed with the following calibrated instrumentation:

- 1 x Acoustic Research Laboratories (ARL) EL215 noise logger; and
- Brüel & Kjaer Calibrator.

The calibrator was used to calibrate the sound monitoring equipment prior to measurement and checked again at the end of measurements.

Legend

| Woise Logger

Woise Assessment Locations

Lismore City Council Client:

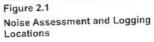
Blakebrook Quarry Noise Assessment Project:

Drawing No: 0066641s\_01\_R1

11/06/2009 Drawing size: A4 Date Reviewed by: MS Drawn by GC

Source

Not to Scale



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#### 2.3 BACKGROUND AND AMBIENT NOISE

A key element in assessing environmental noise impact from industry is to quantify the ambient and background noise, including any existing industrial noise where relevant. Unattended long term monitoring was used to evaluate the background and ambient noise at the assessment locations.

## 2.3.1 Unattended Noise Monitoring

Unattended continuous noise monitoring by means of one ARL 215 environmental noise loggers was conducted from 19th February 2008 to 11th March 2008 at 10 Jiggi Road, Goolmangar. The logging location is considered representative of the ambient noise conditions for noise assessment locations 1 and 2.

For the remaining noise assessment locations, the background noise criteria will be as stipulated in the current Environment Protection Licence (EPL) No. 3384, which is consistent with the INP's minimum recommended criterion of 35dB(A) Leq 15 minute.

To ensure traceability of results, noise measurements were conducted with NATA calibrated instrumentation. The calibration of the units were checked prior to measurement and again at the conclusion, with no difference noted between the two calibrations. Data was collected with the logger microphones at approximately 1.5m above ground level.

Figure 2.1 shows the noise logging location. Total summaries of the recorded data are presented in *Table 2.2*, which includes the Rating Background Level (RBL), ambient noise and a range of daytime maximum noise levels. Daily summaries are presented in *Table A.1* and charts of the data are presented in *Annex A*.

Table 2.2 Summary of Background and Ambient Noise Levels

Location		Rating Background Level (RBL), dB(A)			Ambient Noise Level, dB(A)Leq/period		
		Day*	Evening*	Night*	Day*	Evening*	Night*
Logge	r 1	33	40	35	52	59	48
Notes:	10p 2. N	m to 7am Voise data	(INP),	s of any rainfa		o 10pm; and Nigl	

The measurement data was analysed in accordance with the INP. All monitoring was conducted in accordance with Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'. Wind speed, direction and rainfall data were obtained from the NSW Bureau of Meteorology's nearest relevant weather station No. 058214 at Lismore Airport. This was used to identify times when rain occurred or when wind speeds

exceeded 5m/s at the logger's microphone. During such adverse weather conditions the corresponding data from the noise logger was disregarded.

From site observations, the dominant noise source for noise assessment location 1 and 2 is from traffic on Nimbin Road. This is demonstrated by higher evening noise levels as compared to the daytime. The night time RBL value was also higher than that for daytime due to unidentified sporadic elevated noise levels as can be seen in charts of *Annex A*. However, the daytime RBL is considered conservatively representative of the noise climate and will therefore be adopted.

### 2.4 PREVAILING WEATHER CONDITIONS

The efficiency of noise propagation over long distances can be significantly affected by the weather conditions. Of most interest are source to receiver winds and the presence of temperature inversions as both these conditions can enhance received noise levels. To account for these phenomena the DECC in their INP specify weather analysis procedures to determine the prevalent weather conditions that enhance noise propagation with a view to determining whether they can be described as a feature of the project area.

In this study, temperature inversions are not considered as the quarry operates only during the day and temperature inversions typically occur at night.

The prevailing wind directions are to be determined in accordance with the INP which requires that winds at or below 3m/s with an occurrence greater than 30% be assessed. As the quarry operates only during the day, only daytime wind occurrences are relevant to this study. Daytime wind roses have been created from data obtained from the NSW Bureau of Meteorology's nearest relevant weather station No. 058214 at Lismore Airport from the 23/11/2005 to 23/11/2007. This data indicates that winds at or below 3m/s do not occur in a particular direction for more than 30% of the time as shown in *Annex B*. Hence, noise levels under wind are not assessed in this study, although noise will be enhanced during adverse winds.

## 3 OPERATIONAL NOISE CRITERIA

#### 3.1 GENERAL CRITERIA

The DECC, in its INP, gives guidelines for assessing industrial facilities. Assessment criteria depend on the existing amenity of areas potentially affected by a proposed development as outlined below.

Assessment criteria for sensitive receivers near industry are based on the following objectives:

- protection of the community from excessive intrusive noise; and
- preservation of amenity for specific land uses.

In order to ensure that these objectives are met, two separate criteria are prescribed by the DECC, namely the intrusiveness criteria and the amenity criteria. A fundamental difference between the intrusiveness and the amenity criteria is that the former is applicable over 15 minutes in any period, while the latter covers the entire assessment period (day, evening and night).

#### 3.1.1 Intrusiveness

The intrusiveness criterion requires that  $L_{\text{Aeq,15min}}$  noise levels from a newly introduced source during the day, evening and night do not exceed the existing Rating Background Levels (RBL) by more than 5dB. This is expressed as:

$$L_{Aeg,15min} \le RBL + 5 - K$$

where  $L_{Aeq,15min}$  is the  $L_{eq}$  noise level from the source, measured over a 15 minute period and K is a series of adjustments for various noise characteristics. Where the RBL is less than 30 dB(A), a value of 30 dB(A) is used. For typical noise from a quarry, no adjustment factors are considered applicable.

Using the monitoring data obtained from the long term survey described in *Section 2.3.1*, the intrusiveness criteria derived for the proposed development are shown in *Table 3.1*.

Table 3.1 Intrusiveness Criteria for Noise Assessment Locations

ı	Noise Assessment Location	Daytime <sup>1</sup> L <sub>eq,15min</sub> Intrusiveness Noise Goals, dB(A)
	Location 1 and 2	38
	Location 3, 4, 5, 6 and 7	35
Notes:	1. Day is from 7am to 6pm	

#### 3.1.2 Amenity

The DECC's amenity criterion requires industrial noise to be within an acceptable level for the particular locality and land use. Where ambient noise is already high, the acoustic environment should not be deteriorated significantly. The strategy behind the amenity criterion is a holistic approach to noise, where all industrial noise (existing and future) received at a given location does not exceed the recommended goals.

Private residences potentially affected by the proposal are covered by the DECC's rural amenity categories. The DECC's definition for a rural area is:

"an acoustical environment that is dominated by natural sounds, having little or no road traffic".

Base amenity criteria for this category are given in *Table 3.2*. Adjustments to these target levels may apply where the environment has existing industrial noise (excluding the proposal) or high levels of road traffic noise. However, in this case such an adjustment does not apply as there are no other industrial sites in the near vicinity.

Table 3.2 EPA Base Amenity Criteria

Location	Indicative Area	Time	Recommended L <sub>eq</sub> period Noise Let dB(A)	
			Acceptable	Maximum
Residential	Rural	Day	50	55
		Evening	45	50
		Night	40	45

#### 3.2 PROJECT SPECIFIC NOISE GOALS

Project specific noise goals are presented in *Table 3.3*. Noise level criteria for noise assessment locations 3, 4, 5, 6 and 7 have been taken from the current Environment Protection Licence No. 3384. They are considered to be conservative, and are consistent with the INP's minimum recommendation.

Table 3.3 Project Specific Noise Limits Based on the Intrusiveness Criteria

<b>Day</b> 38 38
38
254
35*
35*
35*
35*
35*
ing the day, only the Day criterion is applic
i

2, \* - Criterion taken from the Environment Protection Licence No. 3384

#### 3.3 CUMULATIVE NOISE

The cumulative impact of more than one development can be compared against the base amenity criteria listed above (refer *Table 3.2*). This is consistent with the INP's holistic approach to industrial noise. However, no other industries are sufficiently near Blakebrook Quarry for cumulative noise to be a concern.

#### 3.4 ROAD TRAFFIC NOISE CRITERIA

The NSW DECC Environmental Criteria for Road Traffic Noise (ECRTN) recommends external and internal traffic noise goals.

For Nimbin Road, the policy suggests that the traffic noise criteria for the route match those for arterial roads. For developments with potential to increase traffic on arterial roads the ECRTN recommends the following criteria:

- DAYTIME: L<sub>eq,15hr</sub>60dB(A); and
- NIGHT TIME: L<sub>eq,9hr</sub>55dB(A).

For traffic noise assessment the ECRTN defines daytime and night time hours as 7am to 10pm and 10pm to 7am respectively. Only the daytime criterion is applicable for this assessment as the quarry does not operate at night.

#### The ECRTN also states:

"In call cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB."

This applies when existing traffic noise levels are already above the aforementioned criteria.

#### 3.5 SLEEP DISTURBANCE

As the quarry does not operate during the night period (10pm to 7am) when the residents are adjudged to be sleeping, sleep disturbance issues are not considered in this report.

#### 3.6 BLASTING

#### 3.6.1 Recommended Criteria

Recommended criteria for the assessment of noise and vibration from blasting are provided by the Australian and New Zealand Environment and Conservation Council (ANZECC) (1990) in its publication entitled *Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*. These criteria apply to minimise human annoyance and discomfort and were not developed to control possible structural damage. However, if ground vibration peak particle velocities (PPV) comply with criteria for minimising human annoyance and discomfort, they would also be below levels that may cause structural damage to buildings.

#### 3.6.2 Noise Overpressure

ANZECC (1990) guidelines specify that air-blast overpressure should not exceed 115 dB( $L_{\rm peak}$ ) for more than 5 % of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 120 dB( $L_{\rm peak}$ ) at any time. The dB( $L_{\rm peak}$ ) unit of sound measurement considers the low frequency sounds which are not audible to the human ear but can be 'felt'.

#### 3.6.3 Ground Vibration

The ANZECC guidelines specify that the PPV from ground vibration should not exceed 5 mm/s for more than 5% of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 10 mm/s at any time.

The ANZECC guidelines also recommend that a level of 2 mm/s be considered as the long-term regulatory goal for the control of ground vibration.

## 3.6.4 Time and Frequency of Blasting

The ANZECC guidelines state that blasting should generally be limited to the hours of 9.00 am to 5.00 pm Monday to Saturday and should not take place on Sundays or public holidays. The ANZECC guidelines recognise that under some circumstances or at certain mines, blasting cannot always be restricted to general working hours and achieve compliance with blast level limits. This may be due to prevailing winds being less favourable during these periods.

The guidelines recommend that when a temperature inversion is known to exist, blasting should be avoided if practical. These restrictions do not apply where the effects of blasting are not perceived at noise sensitive locations.

The guidelines recommend that except for minor blasts such as for clearing of crushers and feed chutes, blasting should generally be limited to once per day. In addition to the above criteria, general best practice procedures can be used to effectively minimise noise impacts.

#### 4 NOISE MODELLING

#### 4.1 MODELLING SCENARIOS

The four representative modelling scenarios that have been created for the Blakebrook Quarry are:

- Existing Operation models the noise currently generated by the existing operations. This will provide a useful baseline scenario for comparative purposes. This modelling scenario is graphically presented in Annex C, Figure C.1.
- Proposed Overburden Stripping models the future noise generated by a combination of existing and proposed equipment, including overburden stripping equipment. Overburden stripping plant are typically operating at or near the surface. This scenario also includes a 4 metre bund located north-east and south-west of the southern pit and a 5 metre bund located to the south of the Jaw Crusher. The proponent has committed to not operating the jaw crusher whilst overburden stripping occurs therefore it will be excluded from this modelling scenario. Overburden stripping is conservatively estimated to be undertaken for periods of 2 weeks at a time. Refer to Annex C, Figure C.2.
- Proposed Central Operation models future noise generated by a combination of existing and proposed equipment. Proposed additional equipment includes: mobile crushing and screening plant that will be located centrally in the main pit; and extractive machinery such as an excavator that will be added to the proposed southern pit. This scenario also includes a 4 metre bund located north-east and south-west of the southern pit and a 5 metre bund located to the south of the Jaw Crusher. This modelling scenario is graphically presented in Annex C, Figure C.3.
- Proposed Northern Operation models identical equipment to the Proposed Central Operation, but the proposed equipment located in the main pit relocated to the northern end of the pit. This scenario also includes a 4 metre bund located north-east and south-west of the southern pit and a 5 metre bund located to the south of the Jaw Crusher. This modelling scenario is graphically presented in Annex C, Figure C.4.

All equipment operating in the main pit has been modelled using the current pit depth. Noise levels are therefore expected to be progressively reduced as the pit depth is increased.

The existing jaw crusher has not been in operation since the July 2008 as mobile crushing plant is now operational in the central pit. From discussions with the proponent, the jaw crusher is anticipated to be in use for a total of six days per year in order to keep it in an operable state, so that it can be used when mobile plant undergoes maintenance. Therefore the inclusion of the jaw crusher in all modelling scenarios (except *Proposed Overburden Stripping Scenario*) is conservative.

## 4.2 PLANT NOISE LEVELS

Representative plant items used in the modelling scenarios and associated noise emission levels are summarised in *Table 4.1*. Noise spectra for plant items are also included in *Annex D*.

Table 4.1 Plant Sound Power Levels

Plant Item	Model	Source	Representative Leq,15minute Sound Power Level, dB(A)
Mobile Crushing and Screening Plant	Terex Pegson: XA400 primary crusher, 428 Trackpactor tertiary crusher, 2 x Chieftain 2100 Powerscreen.	Measured by ERM at Alstonville Quarry	110
Permanent Jaw Crusher	Permanent fixed plant (no known model)	Previous Acoustic Assessment	114
Front-End Loader	Caterpillar 966 or similar	ERM File Data	110
Excavator	Komatsu PC300 or similar	ERM File Data	106
Bull Dozer	Caterpillar D10N or similar	ERM File Data	109
Dump Truck	35 Ton or similar	ERM File Data	113
Asphalt Plant	Permanent fixed plant (no known model)	Measured by ERM on-site	106
Road Truck (Pass- by Level)	Scania 124L Truck and Dog or similar	ERM File Data	90

#### 5 PREDICTED NOISE LEVELS

#### 5.1 CALCULATION PROCEDURES

The ENM noise prediction software was used for modelling purposes. ENM takes into account distance, ground effect, atmospheric absorption and topographic detail. ENM is a DECC accepted noise prediction model as it gives consistently reliable predictions of environmental noise.

The model incorporated three-dimensional digitised ground contours for the quarry, as derived from quarry plans, and the surrounding land base topography, superimposed on each other. Plant and equipment was modelled at various locations and heights, representative of realistic operating conditions for the quarry.

The noise model predicts  $L_{eq}$  noise levels, based on equipment sound power levels determined from measurements conducted at similar operations. The results assume all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur. The results are therefore considered conservative.

#### 5.2 Noise Modelling

Noise modelling was carried out for the Blakebrook Quarry as detailed in *Section 4.1*. As wind is not pertinent to the noise assessment as discussed in *Section 2.4*, modelling was carried out only under calm weather conditions.

The noise modelling results are presented in Table 5.1.

Table 5.1 Noise Modelling Summary

Assessment Location		Predicte	ed Daytime L <sub>eq,1</sub>	5minute Noise L	evels, dB(A)
	Project Specific Criterion	Existing/ Approved Operation	Proposed Overburden Stripping Operation	Proposed Central Operation	Proposed Northern Operation
Location 1	38	.34	33	34	34
Location 2	38	30*	34	39*	39*
Location 3	35	<.70	<30	<30	<30
Location 4	35	<30	<30	<30	<30
Location 5	35	33	33	33	33
Location 6	35	<30	<30	<30	<30
Location 7	35	41	35	36*	36*

1. \* Deemed: Within industry standard of ±2dB.

Notes:

2. Bunds are located as per Section 4.1.

 The modelled location of the Jaw Crusher has been revised to more accurately reflect its on-site location.

The predicted noise levels for all noise assessment locations are in compliance with project specific criteria for all proposed operating scenarios. Noise assessment locations 2 and 7 are deemed compliant for the modelled operating scenarios with the jaw crusher operating.

The modelled scenarios demonstrate that the jaw crusher is one of the primary drivers of noise levels at the nearest residences. As the jaw crusher will only be used nominally 6 times per year, the results from the modelled scenarios that include the jaw crusher are considered to be an upper bound for noise levels. Typical quarry emissions are expected to be comparable or lower than those shown in the *Proposed Overburden Stripping* scenario.

#### 5.3 CONSTRUCTION ACTIVITIES

There will be no significant construction activities that are likely to add to received noise levels at residences.

## 6 ROAD TRAFFIC NOISE

The haul trucks enter and leave Blakebrook Quarry carrying extracted material. The Roadnet *Draft Traffic Impact Report* (2008) states the following:

"The Quarry Operator estimates that 5% of product is currently transported to the north. This amount is not expected to increase. All of the increased production will be transported to Lismore. Of the material transported to the south along Nimbin Road approximately 30% is taken along Terania Street. Approximately 70% of the material is transported along Wilson Street to the Bruxner Highway or Ballina Road east (about an even dispersion) and spread into the industrial area and CBD."

The existing operations have an average of 50 laden trucks leaving the quarry, 80% of which are truck and dog combinations and the remaining trucks are single unit tippers. The current quarry operations can generate as many as 95 laden trucks per day for large jobs. The proposed quarry expansion will typically see 100 laden trucks leaving the quarry per day (Source: Roadnet Draft Traffic Impact Report, 2008). Therefore peak traffic from the quarry is not expected to be significantly raised. The truck movements are between 7.00am and 5.00pm Weekdays and 7.00am and 12.00pm Saturdays, consistent with the operational hours of the quarry.

From observations made, the closest residences to Nimbin Road are located approximately 10 m from the road edge. Of the nominated noise assessment locations, only location 1 and 2 are potentially affected by increased traffic on Nimbin Road and are situated 125 metres and 220 metres from the road respectively. For residences close to Nimbin Road, the assessment location is 1m from its worst-affected façade facing the road. Section 3.4 stipulates the day criterion to be 60dB(A) Leq15hr

The following results have been calculated using the industry accepted traffic noise model algorithm found in the UK's Calculation of Road Traffic Noise (CoRTN). The results are also calculated based on traffic volumes projected for 10 years time, as per the ECRTN.

Based on 2006 daily traffic volumes of 3,200 vehicles per day and a linear growth rate of 2.2%, non-site related traffic on Nimbin Road is forecast at 4100 vehicles per day for the year 2018 (Source: Roadnet *Draft Traffic Impact Report*, 2008). This volume of traffic equates to a noise level of 65dB(A) Leq15hr at the nearest residences, 10m from the road. The contribution from site vehicles has been calculated at 60dB(A) Leq15hr at nearest residences, based on 95 laden trucks per day, which accounts for the traffic split going north and south from the quarry. The total combined road traffic noise level is 66dB(A) Leq15hr-This complies with DECC criteria as site related traffic noise on Nimbin Road will increase existing road traffic noise by 1dB on average over a 15-hour period, which is under the 2dB recommendation.

## 7 BLASTING NOISE AND VIBRATION

Blakebrook Quarry is currently undergoing change to its blasting regime and as such historic blasting reports were not felt to be representative of new blasting scenarios. An indicative assessment will therefore be provided.

It is understood that the frequency of blasts are in accordance with ANZECC guidelines.

The distances from the pit boundary to the residences are deemed to be the minimum blast separation distance and are presented in *Table 7.1*. The blast design, and hence corresponding air blast overpressure and ground vibration, is within the control of operators. The suitable charge masses (or maximum instantaneous charge, MIC) are presented in *Table 7.1*. These were derived from 95% formulae in Blastronics Pty Limited (1994) for monitoring data collected at mines in NSW. The results indicate that extreme care must be taken in blast design to ensure criteria are met at residences.

Table 7.1 Blasting Assessment

Noise Assessmen t Location	Blast to Location Distance, m	MIC <sub>8ms</sub> to Satisfy ANZECC 95 % Overpressure Limit of 115 dB(Lin), kg	MIC <sub>8ms</sub> to Satisfy Maximum Allowable Overpressure Limit of 120 dB(Lin), kg	MIC <sub>8ms</sub> to Satisfy ANZECC 95% Ground Vibration Limit of 5 mm/s (ppv), kg	MIC <sub>8ms</sub> to Satisfy Maximum Allowable Ground Vibration Limit of 10 mm/s (ppv),
1	620	12	49	127	331
-	850	30	127	239	622
2	2,150	480	2059	1530	3982
3	100000000	2	8	38	99
4	340		36	103	270
5	560	8	Eco.	107	279
6	570	9	38		36
7	205	1	2	14	

Notes. 1. These results are derived from the 95% equations contained in the *Drill and Blast Study, Mount Pleasant* prepared by Blastronics Pty Limited for CNA in September

2. In general, blast overpressure considerations limit MIC

Based on the extremely limited data that was available, vibration and overpressure levels appear to be consistent with the 50% formulae contained in Blastronics Pty Limited (1994) therefore the data contained in *Table 7.1*, which is based 95% formulae, is considered to be conservative.

Blasting will typically be carried out throughout the life of the quarry and will require monitoring for each blast to ensure that PPV and overpressure criteria are being met at residential locations.

## 8 MITIGATION MEASURES

Several noise mitigation measures are currently in place in Blakebrook Quarry and will continue to be employed throughout the proposed expansion operation. These measures are summarised as follows:

- The operating hours of the quarry are restricted to 7am to 5pm. This time restriction prevents noise emissions during the evening and night periods, at which time background noise levels are lower. It also avoids potential sleep disturbance to the residents.
- Road traffic noise created by the haul trucks accessing the site is ameliorated by imposing a speed limit of 40km/h and prohibiting haul trucks from using compression braking whilst on-site.
- Tonal reversing alarms have been removed and replaced with "duck quack" reverse alarms.
- A 5m earth bund to the south of the existing Jaw Crusher (as per Annex C, Figure C.3);
- 4m earth bunds to the north-east and south-west of the southern pit to provide shielding during overburden stripping (as per Annex C, Figure C.2);
- A 4m earth bund adjacent to overburden stripping plant that is not shielded by permanent bunding.
- For compliance purposes, attended noise monitoring (encompassing noise assessment locations) and plant equipment audits will be undertaken on an annual basis

Noise experienced at sensitive receivers is expected to be progressively reduced as the quarry expansion proceeds, through implementation of the following measures:

- Plant will be relocated to greater pit depths throughout the life of the quarry to further reduce noise at receiver locations.
- No additional noise producing activities, plant or equipment will be introduced at the site.

In these ways, noise levels emanating from the quarry are expected to be controlled.

## 9 CONCLUSION

This study considered the potential noise impacts of the extension of Blakebrook Quarry.

The study had the following features:

- long term ambient noise survey;
- noise criteria derived in accordance with the DECC's INP;
- meteorological data analysed in accordance with the DECC's INP;
- noise & blast modelling for the proposed quarry expansion that predicted the noise levels at the seven noise assessment locations; and
- road traffic noise assessment.

Noise assessment under windy conditions was not deemed to be necessary as wind roses indicated that wind speeds at or below 3m/s occurred for less than 30 percent of the time, in accordance with the DECC's INP. Hence, noise modelling was carried out under calm conditions.

Conservative noise modelling has shown site noise emissions are generally in compliance with project specific noise limits for all proposed operating scenarios with the exception of two worst case exceedances which are considered minor and acceptable given they are within the 2dBA limit.

Conservative calculations of road traffic noise associated with Blakebrook Quarry found that levels complied with stipulated criteria at potentially affected residences.

Conservative calculations show that Blast design must exercise care when blast locations are at their closest to residences.

In conclusion, given the implementation of the noise mitigation measures outlined in *Section 8* and given the proponents commitment to restrict the operation of the jaw crusher when overburden stripping is undertaken, noise levels at the nearest residences are predicted to be within the project specific noise limits. The noise levels will progressively reduce throughout the life of the proposed Blakebrook Quarry expansion operations.

#### 10 REFERENCES

Environment Protection Authority of NSW (January 2000), Industrial Noise Policy.

Environment Protection Authority (1994), Environmental Noise Control Manual (ENCM).

Environment Protection Authority of NSW (May 1999), Environmental Criteria for Road Traffic Noise (ECRTN).

Australian and New Zealand Environment and Conservation Council (ANZECC) (1990), "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration".

RTA Technology, Environmental Noise Model (ENM), Windows Version 3.06.

Blastronics Pty Ltd Drill & Blast Study, Mount Pleasant, prepared for CNA in September 1994.

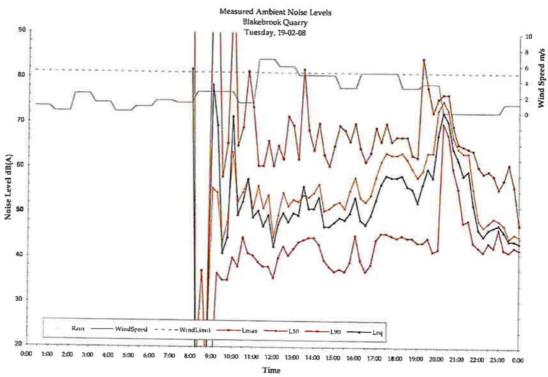
Annex A

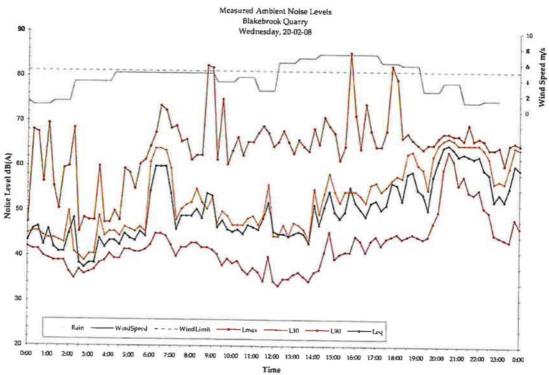
Unattended Long Term Monitoring

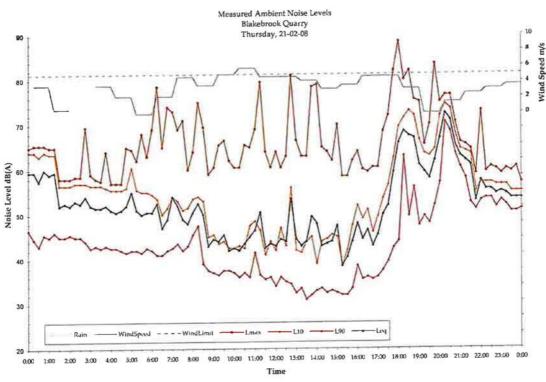
Table A.1 Noise Logger 1: Results table, Leq, dB(A)

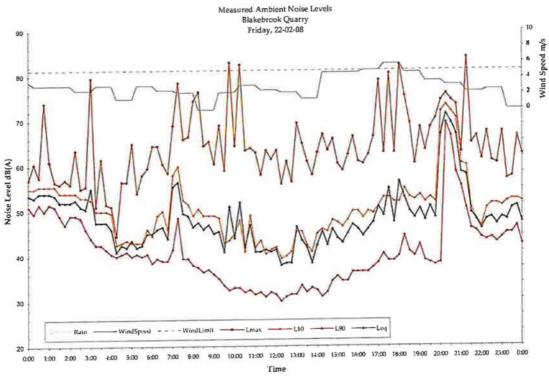
Date	ABL Day	ABL Evening	ABL Night
Tuesday, 19-02-08	0	0	0
Wednesday, 20-02-08	0	44	41.5
Thursday, 21-02-08	32.5	48	39.5
Friday, 22-02-08	31.5	38.5	39.5
Saturday, 23-02-08	0	42	39
Sunday, 24-02-08	0	37.5	39.5
Monday, 25-02-08	35	39.5	33
Tuesday, 26-02-08	0	0	0
Wednesday, 27-02-08	32	42	37
Thursday, 28-02-08	31.5	38	0
Friday, 29-02-08	0	37	37
Saturday, 01-03-08	38	40	31
Sunday, 02-03-08	0	40	0
Monday, 03-03-08	0	39	29.5
Tuesday, 04-03-08	0	40	28
Wednesday, 05-03-08	37	39	0
Thursday, 06-03-08	0	39	30
Friday, 07-03-08	31	43	0
Saturday, 08-03-08	36	40	0
Sunday, 09-03-08	0	38	0
Monday, 10-03-08	0	40.5	0
Tuesday, 11-03-08	0	0	0
/alues	33	40	37

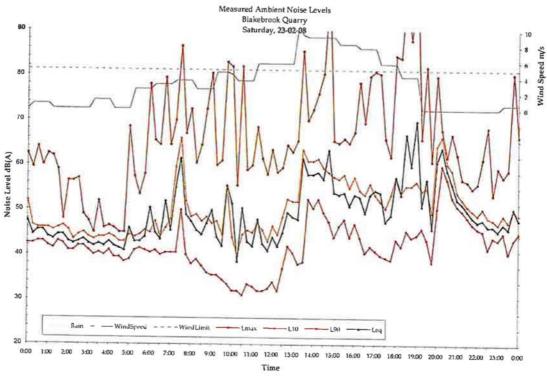
0 indicates periods with too few valid samples due to weather or logger operation. Sunday day time ABL's have been removed as the quarry does not operate on Sunday.

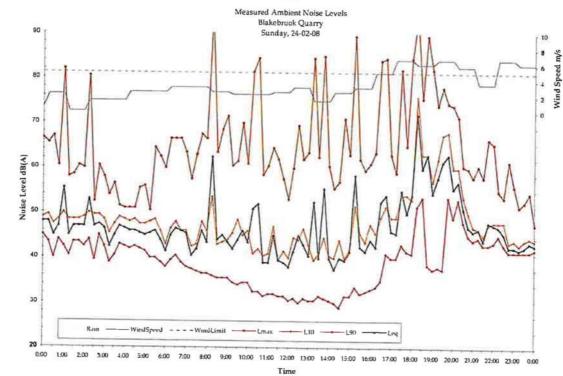


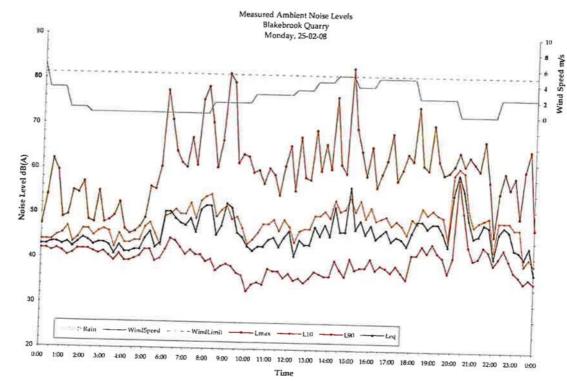


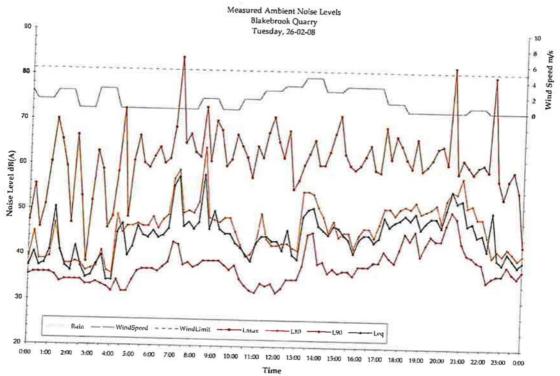


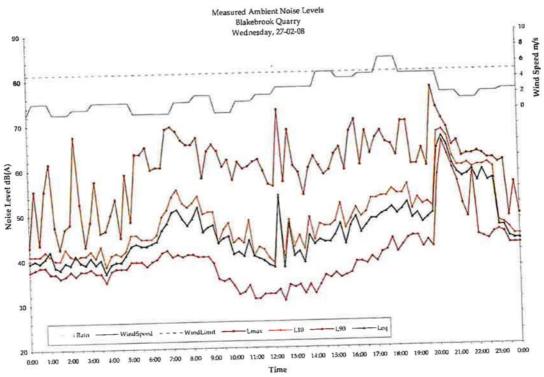


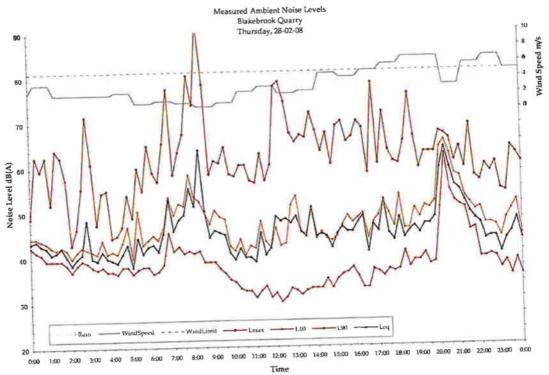


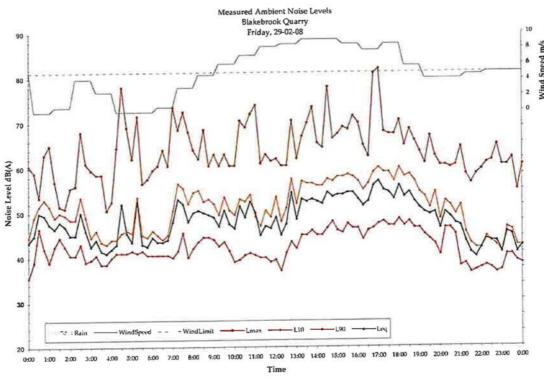


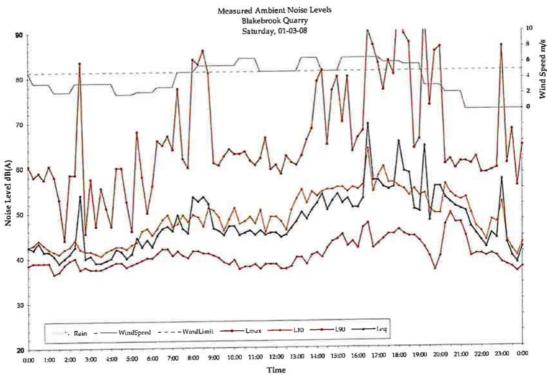




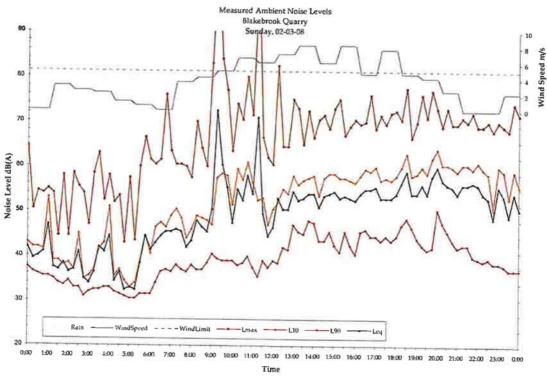


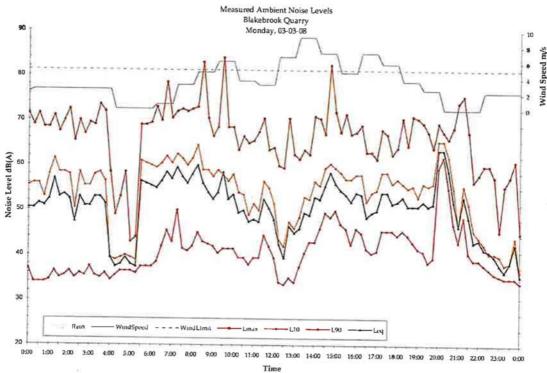


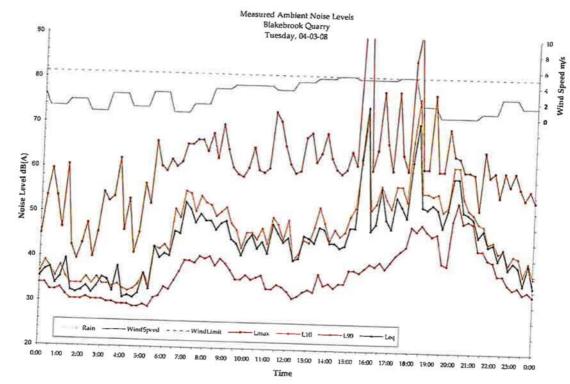


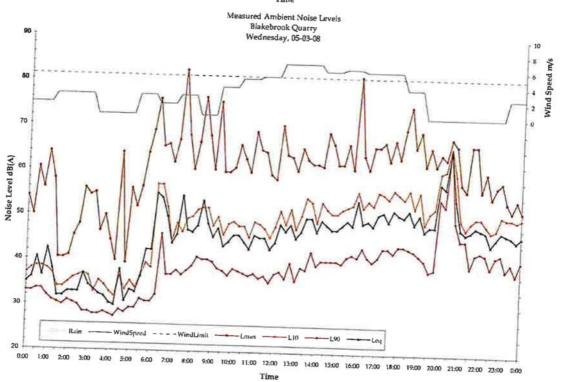


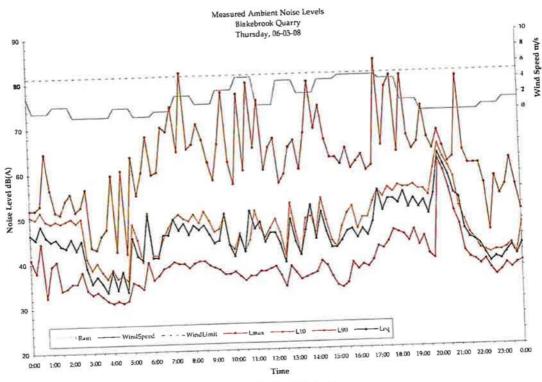
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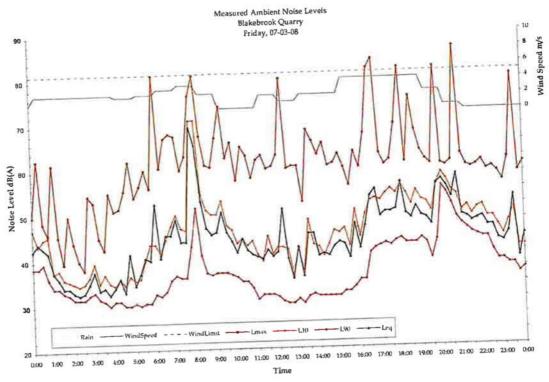


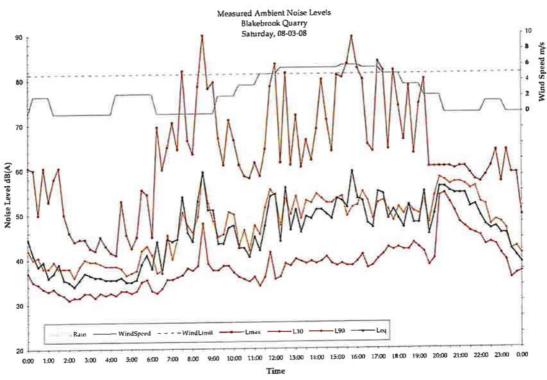


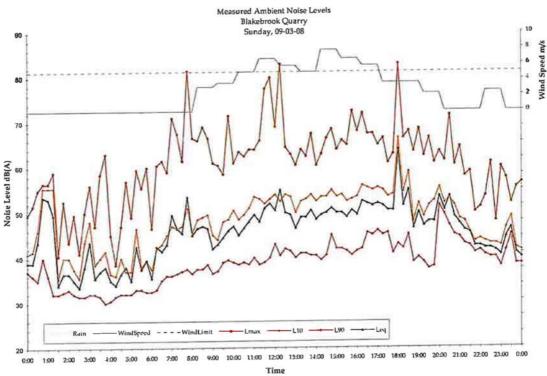




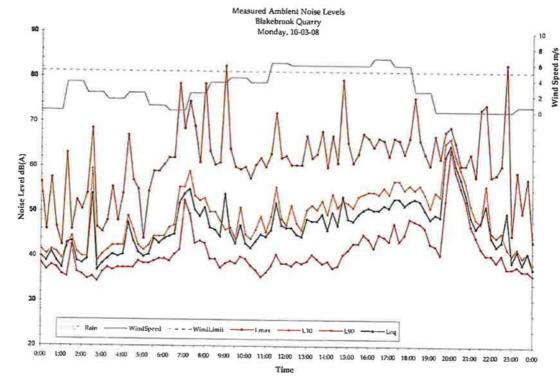


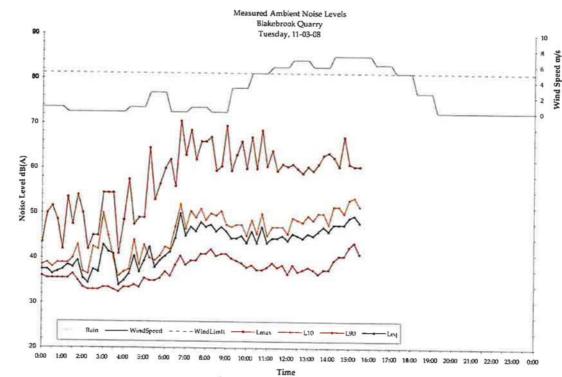






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Annex B

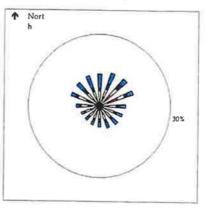
Vector Wind Roses Annual Hourly Wind Analysis

Day

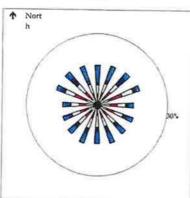
#### Summer

Nort

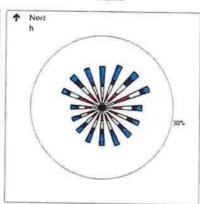
#### Spring



Winter



#### Autumn



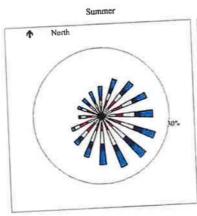
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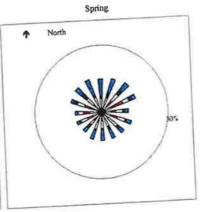
The segments of each arm represent the six valid wind speed classes, with increasing windspeed from the centre outwards.

The length of each arm represents the vector components (for each direction) of wind speeds 3m/s or below as a proportion of the total time for the period.

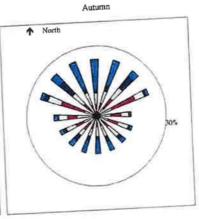
The circle represents the 30% occurrence threshold.

#### Evening



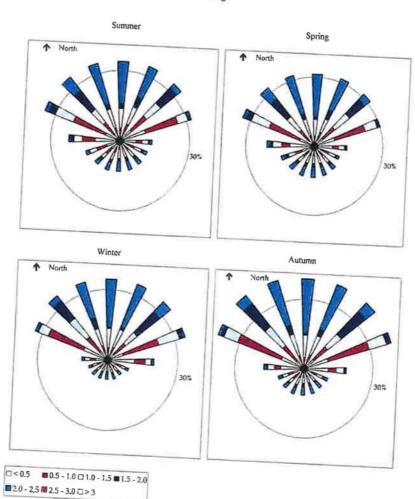


# Winter North



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#### Night



Annex C

Noise Modelling Scenarios



Lismore Cily Council Project: Blakebrook Quarry Noise Assessment Drawing No: 0065641s\_02\_R1 Date 11/06/2009 Drawing size: A4 Drawn by: Reviewed by: MS Source Sca'e Not to Scale

Figure C.1 **Existing Operation** 

Environmental Resources Management Australia Ply Ltd Building C, 33 Saunders St, Pyrmont. NSW 2009 Telephone +61 2 8584 8888



Client:







Mobile Crushing Plant

Project: Blakebrook Quarry Noise Assessment

Orawing No: 0066641s\_03\_R1

Date: 11/05/2009 Drawing size: A4

Orawn by: GC Reviewed by: MS

Source 
Scale: Not to Scale

Lismore City Council

Client:

Figure C.2 Proposed Overburden Stripping Operation

Environmental Resources Management Australia Pty Ltd Building C, 33 Saunders St, Pyrmont, NSW 2009 Telephone +61 2 8584 8888







Bull Dozer Mobile Crushing Plant Client: Lismore City Council
Project. Blakebrook Quarry Noise Assessment

 Drawing No.
 066641s\_04\_R1

 Date:
 11106/2009
 Drawing size. A4

 Drawn by:
 GC
 Reviewed by: MS

 Source.

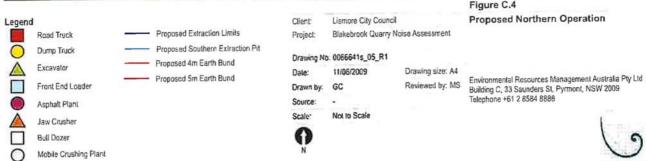
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Environmental Resources Management Australia Pty Ltd Building C, 33 Saunders St, Pyrmont, NSW 2009 Telephone +61 2 8584 8888









Annex D

Sound Power Spectral Data

Table D.1 Sound Power Spectral Data, dB

No.	Plant Item	31.5	63	125	250	200	1000	2000	4000	8000	16000	Linear	A-Weighted
	Mobile Crushing and Screening Plant	899	85.1	94.3	896	104.7	103.9	103.6	101.4	95.0	82.2	110	110
1				4		,	4 00 4	2	1000	1 200	c c	č	747
	Permanent Jaw Crusher	113.6	121.0	115,9	114.1	111,5	108,4	106.2	1027	60.0	0.0	129	114
**			1		,			0 000			0	*	
	Front-End Loader	62.5	73.6	91,5	101.6	102.8	107.4	102.9	97.3	91.4	0.0	111	110
3													
	Excavator	68.4	80.4	988.6	94.2	98,8	8.66	101.0	98.7	96.2	0.0	107	106
4													
	Bull Dozer	64.6	76.9	88,6	27.2	0°86	108.2	100.2	93.6	0.68	0.0	110	109
5													
	Dump Truck	65.5	76.6	94.5	104.6	105,8	110.4	105.9	100,3	94.4	g	114	113
9													
	Asphalt Plant	73.1	87.9	98.5	6*66	104.9	101,8	98.2	93.9	86.4	70.5	109	105
7													
	Road Truck (Pass-by Level)	42.5	26.7	73.0	80.7	83,4	83.9	86.0	79,0	72.1	0.0	8	8
*													

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#### **Environmental Resources Management**

Suite 3, 146-148 Gordon Street Port Macquarie NSW 2444 PO Box 5711,Port Macquarie NSW 2444

T: 61 2 6584 7155 F: 61 2 6584 7160 www.erm.com



Annex B

## Stakeholder Consultation Documents

#### Environmental Resources Management Australia

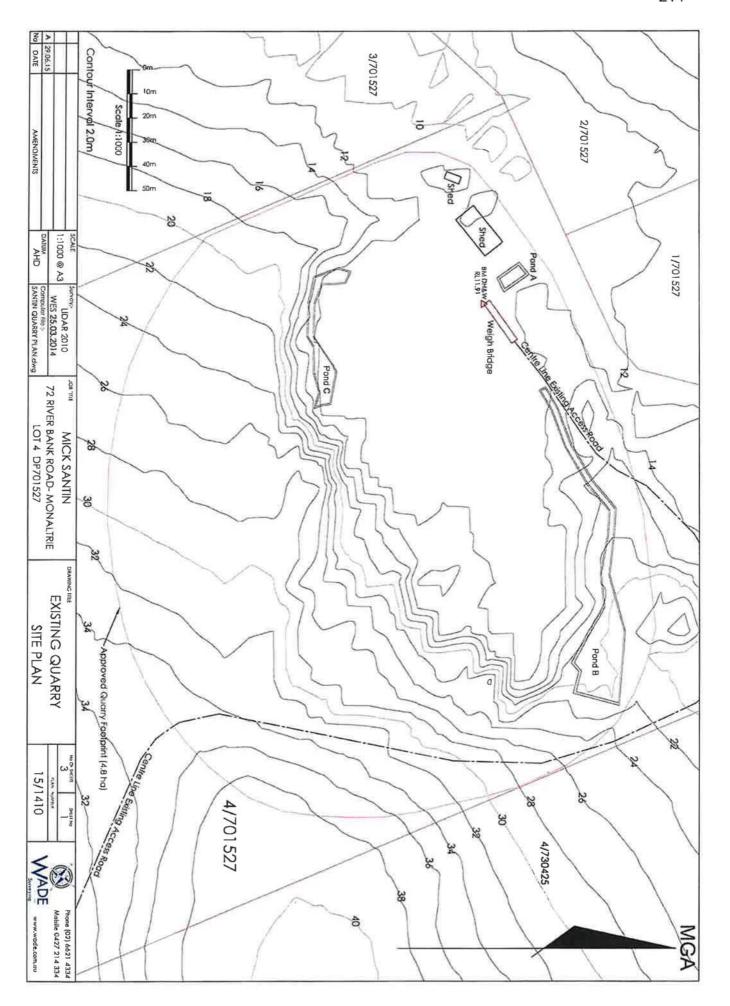
PO BOX 5711, Suite 3/14b-150 Gordon Street Port Macquarie NSW 2444 Telephone (02) 6584 7155 Facsimile (02) 6584 7160

#### Global locations

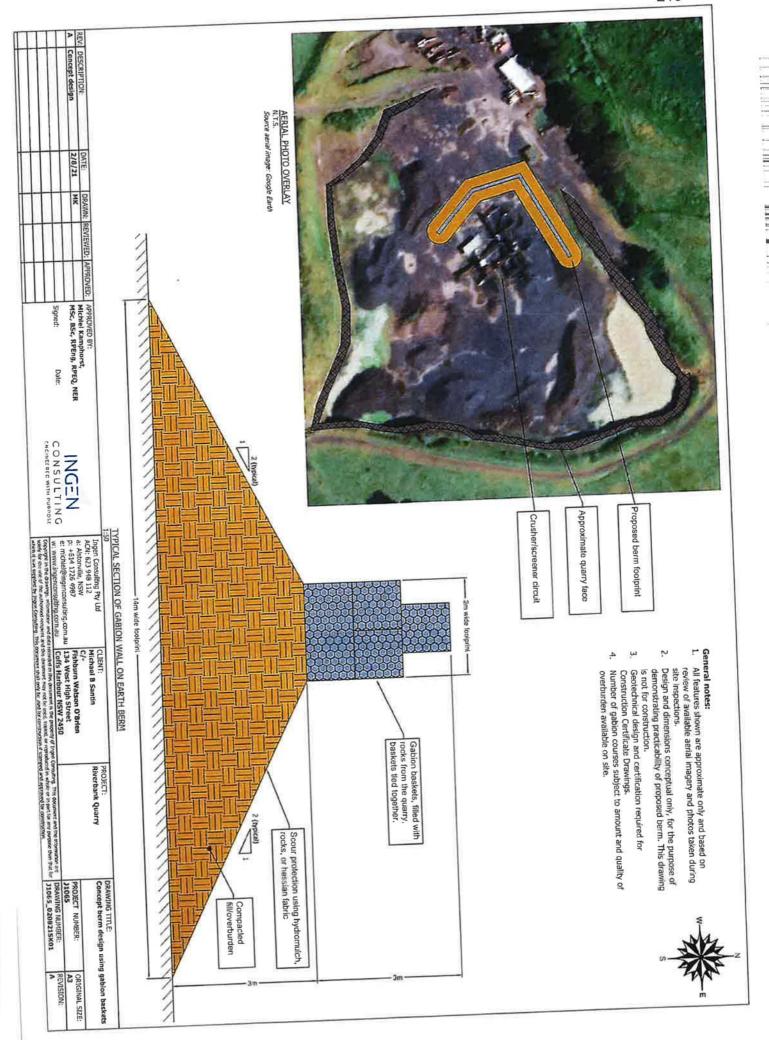
Asia Pacific Australia (Sydney Melbourne Perth Brisbane Port Macquarie Hunter Valley) China Hong Kong India Indonesia Japan Korea Malaysia Singapore Sri Lanka Taiwan Thailand Vietnam North America Mexico USA Latin America Argentina Brazil Peru Puerto R co Venezuela Europe Belgium France Germany Hungary Ireland Italy Netherlands Poland Portugal Spain Sweden UK



#### ANNEXURE F - SANTIN QUARRY SURVEY PLAN



## ANNEXURE G - NOISE BERM CONCEPT ENGINEERING DRAWING



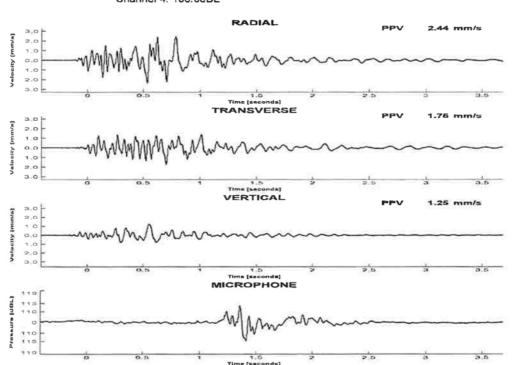
#### ANNEXURE H - 2018 AND 2019 BLAST REPORTS

## **Santins Quarry**

Location: Chicken Farm Date: 2018-12-17 Triggered by: Vector Sum Time: 12:15:53

Triggers Set

Vector Sum: 1,00mm/s Channel 4: 106.0dBL



#### **BLAST RESULTS**

Peak Vector Sum Velocity : 2.84 mm/s at 0.703 s Peak Overpressure : 114.8 dBL at 1.412 s

	Peak	Frequency (ZC at Peak)	<b>Time</b> (Rel. to Trigger)	Acceleration (Est. from PPV)	Displacement (Est. from PPV)
	[mm/s]	[Hz]	[s]	[mm/s <sup>2</sup> ]	[]
Radial	2.44	9.6	0.783	88	63.3
Transverse	1.75	10.6	0.701	57	41.5
Vertical	1.25	8.6	0.552	46	36.4

Monitoring conducted by:

(:offic)

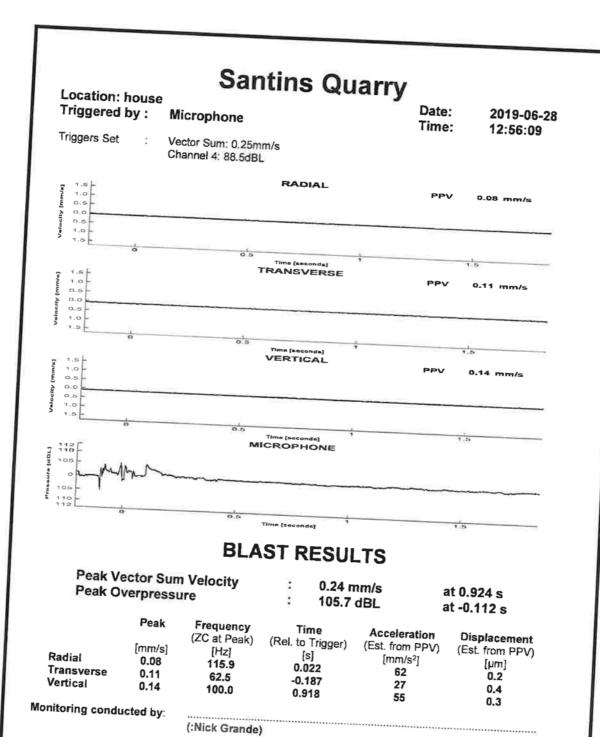
TM Serial Number :

4207

Last Calibration:

2018-08-17

Santins Quarry\M4207 Santins Quarry @ Chicken Farm @ 2018-12-17 12.15.53.twf
T-Link 1.2 - ANZEC Standard.rtt Texcel Monitors comply with Appendix J of AS 2187.2-2006



2018-07-29 Santins Quarry\M4006 Santins quarry @ chicken farm @ 2019-06-28 12.56.09.twf T-Link 1.2 - ANZEC Standard.rtt Texcel Mo Texcel Manitors comply with Appendix J of AS 2187.2-2006

Last Calibration:

TM Serial Number :

## RPQ Asphalt Pro-forma Invoice

Name

Lismore City Council

Date

18-Jul-19

**Contact Name** 

Order #

71438

Address

PO Box 23A Lismore NSW 2480

Pro Forma # LCC-180719/536

escription	Unit	QTY	Rate	Sale Amount	
. Traffic Management (includes ite specific traffic control plans) – ncluding Allowances and Travel					
ime.	per hour	4.5	\$223.080	\$1,003.86	
Controllers, Ordinary Time		0.38	\$240.850	\$91.52	
3 Controllers, Overtime	per hour	0.50	<b>4</b>		
3. Asphalt Pavement – default binder AR450	Each	0.5	\$1,237.350	\$618.68	
Cost to move labour and equipment into Lismore Council area	200				
3.1.3 Supply and Lay for AC14	Tonne	43.22	\$308.280	\$13,323.86	
40.1 - 60 tonnes	1 OITHE	40.22			
3.2 Cartage Haulage of Asphalt - one way	Tonne	43.22	\$16.720	\$722.64	
<30km	701110				
3.4 Cold Milling associated with Asphalt including removal of spoil	e Each	0.5	\$495.000	\$247.50	
Cost to move labour and equipment into Lismore Council area	m3	18.8	\$137.500	\$2,585.00	
10.1m3 up to 20m3	mo		Sale Amount	\$18,593.06	
				\$1,859.31	
			GST	\$20,452.36	
			Total Amount	φ20,432.00	

Job Date

Location

18-Jul-19

Lismore

River Bank Rd Montaltrie

18.07

RPQ HEAD OFFICE 206 – 258 Swanbank Rd Swanbank QLD 4306 P: (07) 3294 4555



### **QA Lot Submission**

Client:	Lismore City Council	Date:	18/07/2019
Location/s:	River Bank Road Monaltrie	Job Limits:	n/a

Job Number:	LCC-180719/536B
Lot Number/s:	AC-LCC-180719
Works Completed:	Heavy patch work
Products Provided:	AC14 HD-450



## QUALITY CONFORMANCE REPORT ASPHALT LAYING



	ore City Cou		JOB No.: LCC-180719	-	18/07/2019
OCATION:	Riverbank F	Road Monaltrie			
OT No.:		CHAIN	AGE START:	FINISH:	
REA: 376 r	n²	TACK COAT:	75 L	NOMINAL THICKNES	S: 50 mm
UANTITIES O	RDERED:	43.22 t	QUANTITIES	CLAIMED: 43.22 t	
		t	0	t	
		t	0.00	t_	
PPLICABLE			DOCUMENT TITLE		ATTACHED
NO	Authorisa	ation To Proceed			NO
YES	Agreed Q	uantity Record			YES
NO	Traceabili	ity Record			NO
NO	Compacti	ion Report (Correct Client De	etails/Job Site/Mix Design/Lo	t No.)	NO
NO	Compacti	ion Sample Location Map (C	orrect Site & Lot No.)		NO
NO	Asphalt S	iummary Report (Correct Clie	ent Details/Job Site/Mix Des	ign/Lot No.)	NO
NO	3m Straig	th Edge Test (Correct Client	Details/Job Site/Mix Design/	Lot No.)	NO
NO	String Lin	e Record (Correct Client Det	ails/Job Site)		NO
YES	Delivery I	Dockets (Correct Client Detail	ils/Job Site/Mix Design/Lot N	lo.)	YES
NO	Site Varia	ation Form (Correct Client De	etails/Job Site/Variation Deta	ils)	NO
NO	Texture D		NO		
NO	NO				
NO	Nonconfo	ormance Report (NCR)			NO
lon Conform Reports (NC	0.0000000000000000000000000000000000000				
Variation	5				
Comment	s				



## TRACEABILITY RECORD

+

End Ch.:

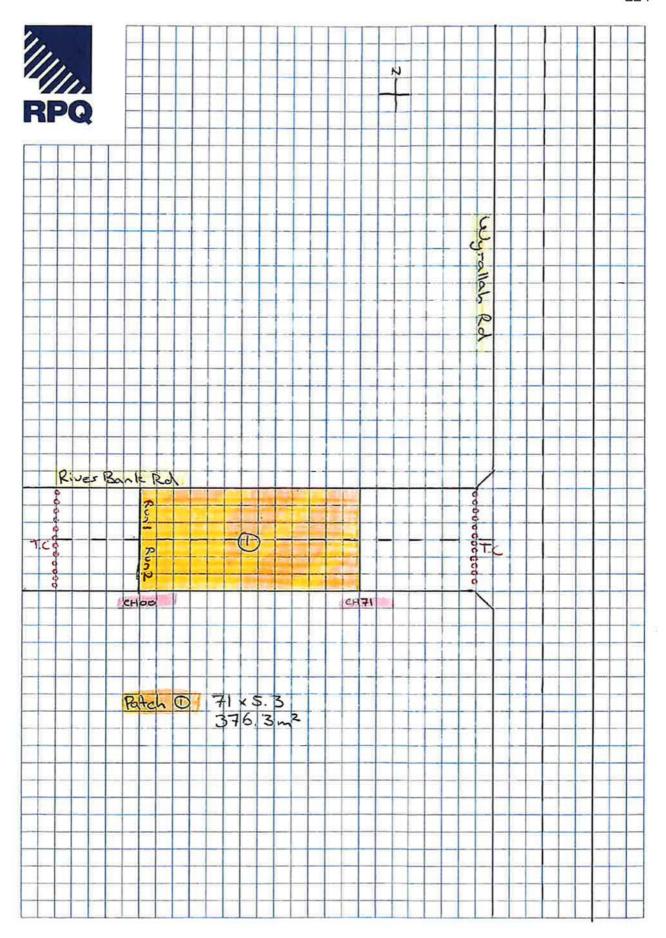
• • • • •

Litres Used: FSL Page .... Client: Lizner Gty Lovil Location: River Bank Rd, Monaltric Date: 18-7-19 Base suitable for paving? (Y/N): ......... Services protected? (Y/N): M/A. Pre-application: □ Seal □ Prime 区 Tack Area (m²): 376.3. App. Rate: ○. 2..... Completed By: Association Signature: Mix Type: ACI 45tel Asphalt Plant: Northern Rivers Start Ch.: OC .... Lot No.: 536 Job No.:

LUC 2 21.62	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	Activity Docket No. Truck ID. (6 (Rego.)		-	Mix	Start Time	Finish	Waiting	Asphalt Layer	Run No: (Mud Map)	Nett Tonnes	Progressive Tonnes	Thic	Layer Thickness (mm)	Paving Width	Start Ch.	End Ch.	Area (m²)	Temper	Temperature ('C)
2. 4.96 31.58	5 U.C. 2 9.96 31.58 2.65 00 32  5 U.C. 4 43.22 2.65 32 71  C.65 5 71  C.65 6 5 71  C.65 7 10  C.65	(0:15	7 (0:15	(0:15		ő	(O: 45	(Sump)	3	4	21.62	29.12		_			ŕ	189.3,4		Scied
2 11.64 43.22 2.65m 32 71	6. LT Asphalt Plant 10. LT Gueed by Client 12. LT We Wearing for Will 13. LT Waiting for Artist 19. LT Waiting for Artist	52:11 S1:11 / S30017 016610001	7 (40FS Y II:18	13:18		1	152		3		9.96	31.58			2.652	0	32	36.7 m		
	6. LT Asphalt Plant 1.0. LT Caused by Client 7. LT Parked Vehicles 1.1. Waiting for Mill 1.2. Survey 9. LT Waiting for Access 1.3. Clean Up	CNI6FE Y	CN16FE Y 11:30	11:30		3	So		3	2		43.22			2.6Sm		4	JOI. 3 m2		
	6. LT Asphalt Plant 10. LT Caused by Client WC 7. LT Parked Vehicles 11. Waiting for Mill 10. LT Caused by Client 10. LT Survey 9. LT Waiting for TC 12. Survey 9. LT Waiting for TC 12. Survey 9. LT Waiting for TC 13. Clean Up																			
	6. LT Asphalt Plant 10. LT Caused by Client 7. LT Parked Vehicles 11. Waiting for Mill 10. R Well 11. Waiting for Mill 12. Survey 9. LT Waiting for Access 13. Clean Up																i a			
	6. LT Asphalt Plant 10. LT Caused by Client 7. LT Parked Vehicles 11. Waiting for Mill 10. R WC 9. LT Waiting for TC 12. Survey 9. LT Waiting for Access 13. Clean Up																			
	6. LT Asphalt Plant 10. LT Caused by Client 7. LT Parked Vehicles 11. Waiting for Mill 10. R WC 7. LT Waiting for TC 12. Survey 9. LT Waiting for Access 13. Clean Up													+						
	6. LT Asphalt Plant 10. LT Caused by Client VC 7. LT Parked Vehicles 11. Waiting for Mill IC 8. LT Waiting for TC 12. Survey 9. LT Waiting for Access 13. Clean Up										ż									
	LT Asphalt Plant 10. LT Caused by Client UT Waiting for TC LT Waiting for ACCESS 13. Clean Up																			
	LT Asphalt Plant 10. LT Caused by Client UT Waiting for TC LT Waiting for ACCESS 13. Clean Up																			
	LT Asphalt Plant 10. LT Caused by Client WC LT Waiting for TC LT Waiting for TC LT Waiting for TC LT Waiting for ACCESS 13. Clean Up																			
	LT Asphalt Plant 10. LT Caused by Client WC LT Parked Vehicles 11. Waiting for Mill IC LT Waiting for TC 12. Survey LT Waiting for Access 13. Clean Up																			
	LT Asphalt Plant 10. LT Caused by Client WC LT Parked Vehicles 11. Walting for Mill IC LT Waiting for TC 12. Survey LT Waiting for Access 13. Clean Up																			
	LT Asphalt Plant 10. LT Caused by Client WC LT Parked Vehicles 11. Waiting for Mill IC LT Waiting for TC 12. Survey LT Waiting for Access 13. Clean Up																			

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F 8.1.2.1 1D - 1B



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Lucia

Payments:

Total Price:

Unit Cost; Each Items; GST : Total Amount Tendered: Change Given:

MANUAL TICKET Operator:

Rivebank Rd

Open Mon-Wed 7:00AM to 4:00PM Open Thu-Fri 7:00AM to 3:200...

Northern Rivers Quarry & Asphalt 540 Nimbin Road Blakebrook NSW 2480	Phone: 02 6629 3236	ABN: 60 080 932 837	Ticket No: 700019970-BQ	Time In: 18/07/2019 9:17:13 AM Time Out: 18/07/2019 9:17:13 AM	Vehicie Rego: Configuration: S & L Sand & Gravel	Client: Trico Asphalt Pty Ltd Order Number: LCC 12.1240 Job Number: 536	*Cartage Not Applicable	Product Trico AC14Std 450	Source: Trico Asphalt Destination: LC8	GROSS Weight: 48.02t TARE Weight: 16.44t NET Weight: 31.58t	Unit Cost:	Each Items:	Total Price:	Payments:	Total Amount Tendered: Change Given:	MANUAL TICKET Operator:	Riverbank Rd	Open Mon-Wed 7:00AM to 4:00PM

Trico Asphalt LC8

> GROSS Weight: TARE Weight: NET Weight:

Price

Product Trico AC14Std 450

Source: Destination:

"Cartage Not Applicable

CN16FE / Truck Sieve Cassel

Vehicle Rego: Configuration: Carrier: Trico Asphalt Pty Ltd LCC 12.1240 536

Client: Order Number: Job Number: Contract:

Ticket No:

ABN:

Time In: Time Out:

Northern Rivers Quarry & Asphalt 540 Nimbin Road Blakebrook NSW 2480

Delivery Docket

18/07/2019 8:44:54 AM 18/07/2019 8:44:54 AM

Delivery Docket

LCC.



Client

RPQ Asphalt Pty Ltd (RPQ200) Client Reference: RPQ Brad

River Bank Road, Monaltrie NSW

Ticket #

505992

18/07/19

Date

Submitted By

Mitchell Copland (18/07/19 5:36:16 PM GMT +10)

Vehicles 1 truck

**Authorised By** 

Job Address

Michael Clark

**Purchase Order Number** 

N/A

**Work Instructions** 

Please meet in Riverbank rd at 07:00

Name	Travel Start	Job Start	Break Start	Break Finish	Job Finish	Travel Finish	Shift Total	Travel Total
Mitchell Copland	06:15	07:00	12:00	12:30	17:15	18:00	10 hrs, 15 mins	1 hr, 30 mins
David Terry	05:30	07:00	12:00	12:30	17:15	18:45	10 hrs, 15 mins	3 hrs
Adrian Langton	06:15	07:00	12:00	12:30	17:15	18:00	10 hrs, 15	1 hr, 30 mins

Vehicle

Quantity

Flat Bed truck with VMS 1

Client Sign Off

Rpq Brad

No signature recorded

Operator Sign Off

Mitchell Copland

MAMA



Annexure I – Construction, maintenance and upgrade works associated with the section of Riverbank Road located between the quarry and Wyrallah Road for the period of 1 January 2010 and 27 April 2021

#### RPQ Asphalt Pro-forma Invoice

Name

Lismore City Council

Date

18-Jul-19

**Contact Name** 

Order #

71438

Address

PO Box 23A Lismore NSW 2480

Pro Forma # LCC-180719/536

Description	Unit	QTY	Rate	Sale Amount
Traffic Management (includes site specific traffic control plans) – Including Allowances and Travel Time.				
3 Controllers, Ordinary Time	per hour	4.5	\$223.080	\$1,003.86
3 Controllers, Overtime	per hour	0.38	\$240.850	\$91.52
3. Asphalt Pavement – default binder AR450				
Cost to move labour and equipment into Lismore Council area	Each	0.5	\$1,237.350	\$618.68
3.1.3 Supply and Lay for AC14				
40.1 - 60 tonnes	Tonne	43.22	\$308.280	\$13,323.86
3.2 Cartage Haulage of Asphalt - one way				
<30km	Tonne	43.22	\$16.720	\$722.64
3.4 Cold Milling associated with Asphalt including removal of spoil				
Cost to move labour and equipment into Lismore Council area	Each	0.5	\$495.000	\$247.50
10.1m3 up to 20m3	m3	18.8	\$137.500	\$2,585.00
		S	ale Amount	\$18,593.06
		G	ST	\$1,859.31
		T	otal Amount	\$20,452.36

Job Date Location 18-Jul-19 Lismore

River Bank Rd Montaltrie 18.07

RPQ HEAD OFFICE 206 – 258 Swanbank Rd Swanbank QLD 4306 P: (07) 3294 4555



## **QA Lot Submission**

Client:	Lismore City Council	Date:	18/07/2019
Location/s:	River Bank Road Monaltrie	Job Limits:	n/a

Job Number:	LCC-180719/536B
Lot Number/s:	AC-LCC-180719
Works Completed:	Heavy patch work
Products Provided:	AC14 HD-450



# QUALITY CONFORMANCE REPORT ASPHALT LAYING



LIENT: Lismo	ENT: Lismore City Council		lo.: LCC-180719/536B	DATE LAID: 18/07/2019					
CATION:	Riverbank R	Road Monaltrie							
T No.:	No.: CHA		NAGE START: FINISH:						
REA: 376 r	EA: 376 m <sup>2</sup> TACK COAT:		NOMIN	ALTHICKNESS: 5	60 mm				
JANTITIES ORDERED: 43.22 t		43.22 t	QUANTITIES CLAIMED:	43.22 t					
		t		t					
		t		t					
PLICABLE		DOCUMENT	TITLE		ATTACHED				
NO	Authorisa	tion To Proceed			NO				
YES	Agreed Q	uantity Record			YES				
NO	Traceabili	ty Record			NO				
NO	Compaction	on Report (Correct Client Details/Job Site	e/Mix Design/Lot No.)		NO				
NO	Compaction	Compaction Sample Location Map (Correct Site & Lot No.)							
NO	Asphalt St	Asphalt Summary Report (Correct Client Details/Job Site/Mix Design/Lot No.)							
NO	3m Straig	3m Straight Edge Test (Correct Client Details/Job Site/Mix Design/Lot No.)							
NO	String Line	String Line Record (Correct Client Details/Job Site)							
YES	Delivery D	Delivery Dockets (Correct Client Details/Job Site/Mix Design/Lot No.)							
NO	Site Varia	tion Form (Correct Client Details/Job Site	e/Variation Details)		NO				
NO	Texture D	epth Test Report (required for surfacing	layer only)		NO				
NO	Pavement	t Repairs, Trenches & Patches (Correct C	lient Details/Job Site)		NO				
NO	Nonconfo	rmance Report (NCR)			NO				
on Conform Reports (NC									
Variation	s								
Comment	s	9							



# TRACEABILITY RECORD

Litres Used: 75L ... Page .... Client: Lismort Gib Loviel Location: River Bank Rd, Monaltric Date: 18-7-19 Services protected? (V/N): W/A Pre-application: Seal Prime STack Area (m²): 376.3 App. Rate: O. Z. Base suitable for paving? (Y/N): .... .... Lot No.: 536 Job No.:

1 End Ch.: ... Mix Type: ACI 45tel Asphalt Plant: Northern Rusch Start Ch.: 00 (E.g. drains covered) Completed By: Acros Tornbull Signature: (E.g. no soft areas, profiled surface swept, markers removed, etc.)

Temperature (°C)	Screed									
Temper	Truck									
Area	(m)	189.3,4	36.7m2	Jol. 3 2						
End Ch.		Į.	32	<u>+</u>	e					
Start Ch.	STATE OF THE STATE	0	00	3.5						
Paving Width	(E)	2.65m	Z.65m	2.65m						
Layer Thickness (mm)	Left Centre Right									
Progressive	lonnes	29.12	31.58	43.22						
Nett	Tonnes	21.62 21.62	96.6	11.64 43.22			ı			
Run No:	(Mud Map)	4	2	2						
Asphalt		3	りひ	30						
Waiting	(mins.)									
Finish	Тте	54:0)	52:11	11.50						
Start	Тіте	51:01	11:18	11:30						
Correct	(N/N)	٨	٨	>						
Truck ID.	(Rego.)	CC90FS	2190FS	CNIGFE						
Docket No.		7000199日 0500FS	70001997D	FOCOLAGE CNIEFE					8.2	
Activity	(Key)	1E	1E	1E						

ASPHALT LAYER KEY:

Intermediate Course WC Wearing Course
IC Intermediate Cour
CC Corrective Course Corrective Course

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LT Waiting for TC LT Waiting for Access LT Parked Vehicles LT Asphalt Plant
 LT Parked Vehicles
 LT Waiting for TC
 LT Waiting for Acce

LT Breakdown LT Weather 2. Break
3. Lunch
4. LT Wea

1E. Patching
1F. Handwork
1G. Roundabout
1H. Intersection

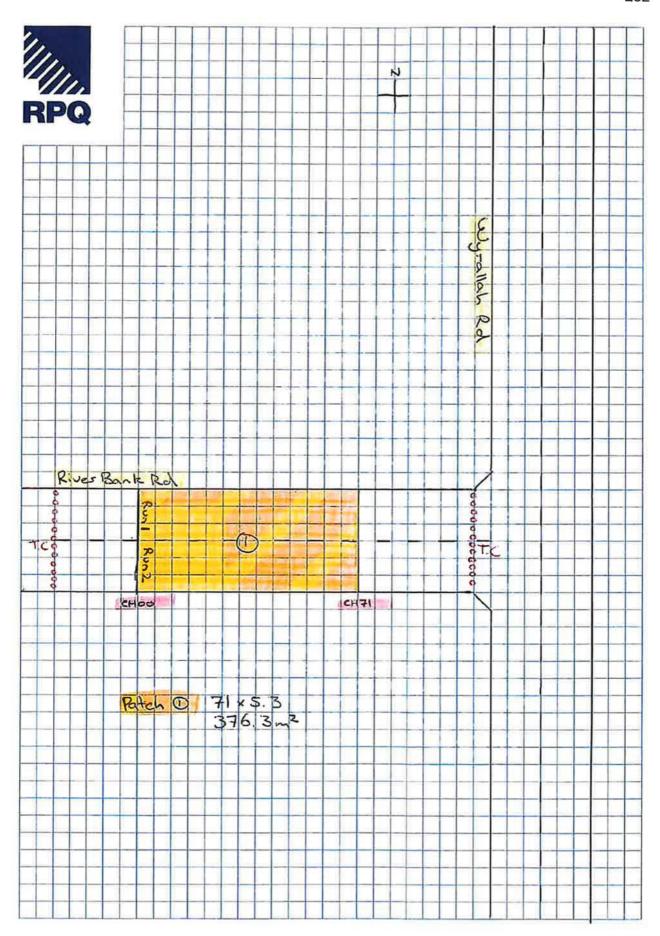
1A. Cul-de-sac1B. Straights1C. Parking Bays1D. Correction

ACTIVITY KEY:

.

LT Caused by Client
 Waiting for Mill
 Survey
 Clean Up

F8.1.2.1 1D-18



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				,		_				_							×	
Quarry & Asphalt W 2480		60 080 932 837	700019970-BQ	18/07/2019 9:17:13 AM 18/07/2019 9:17:13 AM	CC90FS Truck & Dog & L Sand & Gravel	o Asphalt Pty Ltd LCC 12.1240 536	cable	Price	Trico Asphalt LC8	48.02t 16.44t		j		:pa	Lucia		to 4:00PM to 3:30PM	
Northern Rivers Qu 540 Nimbin Road Blakebrook NSW	Phone: 02 6629 3236	ABN:	Ticket No:	Time In: 18/0 Time Out: 18/0	Vehicle Rego: Configuration: Carrier:	Client: Trico Order Number: Job Number: Contract:	*Cartage Not Applicable	Product Trico AC14Std 450	Source: Destination:	GROSS weight: TARE weight: NET weight:	Unit Cost:	Each Items: .GST : Total Price:	Payments:	Total Amount Tendered: Change Given:	MANUAL TICKET Operator:	Riverbank Rd	Open Mon-Wed 7:00AM Open Thu-Fri 7:00AM	

Trico Asphalt LC8

Price

Product Trico AC14Std 450

Source; Destination;

"Cartage Not Applicable

21.70t 10.06t 11.64t

GROSS Weight: TARE Weight: NET Weight:

Each Items: GST :

Unit Cost:

Total Price;

Payments:

Total Amount Tendered: Change Given:

MANUAL TICKET Operator:

Rivebank Rd

Lucia

Open Mon-Wed 7:00AM to 4:00PM Open Thu-Fri 7:00AM to 3:20AM

Sieve Cassel CN16FE Truck

Vehicle Rego: Configuration: Carrier:

Trico Asphalt Pty Ltd LCC 12.1240 536

Client: Order Number: Job Number:

Contract:

700019967-BQ

Northern Rivers Quarry & Asphalt 540 Nimbin Road Blakebrook NSW 2480

Delivery Docket

18/07/2019 8:44:54 AM 18/07/2019 8:44:54 AM

Time In: Time Out:

Ticket No:

ABN:

Delivery Docket



Client

RPQ Asphalt Pty Ltd (RPQ200) Client Reference: RPQ Brad

Job Address

River Bank Road, Monaltrie NSW

Authorised By

Michael Clark

**Purchase Order Number** 

N/A

**Work Instructions** 

Please meet in Riverbank rd at 07:00

Ticket #

505992

LCC.

Date

18/07/19

Submitted By

Mitchell Copland (18/07/19 5:36:16 PM GMT +10)

Vehicles

1 truck

Name	Travel Start	Job Start	Break Start	Break Finish	Job Finish	Travel Finish	Shift Total	Travel Total
Mitchell Copland	06:15	07:00	12:00	12:30	17:15	18:00	10 hrs, 15 mins	1 hr, 30 mins
David Terry	05;30	07:00	12:00	12:30	17:15	18:45	10 hrs, 15 mlns	3 hrs
Adrian Langton	06:15	07:00	12:00	12:30	17:15	18:00	10 hrs, 15 mins	1 hr, 30 mins

Vehicle

Quantity

Flat Bed Iruck with VMS 1

Client Sign Off

Rpq Brad

No signature recorded

**Operator Sign Off** 

MAMA

Mitchell Copland

Level 1 660 Lorimer St Port Melbourne Vic 3207 1300 TRAFFIC / www.altustraffic.com.au



#### MCLAREN TRAFFIC ENGINEERING

Address: Shop 7, 720 Old Princes Highway Sutherland NSW 2232 Postal: P.O Box 66 Sutherland NSW 1499

> Telephone: +61 2 8355 2440 Fax: +61 2 9521 7199 Web: www.mclarentraffic.com.au Email: admin@mclarentraffic.com.au

Division of RAMTRANS Australia ABN: 45067491678 RPEQ: 19457

Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

17th May 2021

Michael Santin C/o Fishburn Watson O'Brien

134 West High Street

COFFS HARBOUR NSW 2450

Attention: Dean Pickett

THIS AND THE FULLUWING Reference: 210244.01FA IS THE ANNEXURE MARKED WITH THE LETTER AFFIDAVIT OF DEAM REFERRED TO IN THE SWORN THE

SWORN THE ...... ., BEFORE ME:-

JUSTICE OF THE PEACE/SOLICITOR

Karen Leigh Hutchings

Justice of the Peace

NSW # 253689

#### PROPOSED MODIFICATION CONDITION 35 FOR EXISTING HARD ROCK QUARRY AT 72 RIVERBANK ROAD, MONALTRIE

Dear Dean,

Reference is made to your request to provide advice with respect to the PROPOSED MODIFICATION CONDITION 35 for the EXISTING HARD ROCK QUARRY at 72 Riverbank Road,

#### Existing Condition / Background

#### **Existing Condition 35**

The existing Condition 35 is as follows:

"That loaded truck movements generated as a consequence of the operation of the quarry not exceed an average of 15/day and be subject to a maximum of 20 loaded truck movements per

#### 1.2 Background

The undersigned has been engaged to undertake a review of the following documents related to the subject modification application with respect to Condition 35:

- (a) Statement of Facts and Contentions filed on 15 March 2021.
- (b) Riverbank Quarry Traffic Impact Assessment dated 29 June 2020 prepared by INGEN
- (c) Fourth Amendment dated 28 July 2006 (MC06/18) Conditions of Consent of original DA No. 92/523 for extension to existing hard rock quarry, Lot 4 DP 701527, 72 Riverbank Road,
- (d) Transport for NSW (TfNSW) letter dated 1 September 2020.
- (e) Riverbank Road Quarry, Monaltrie Plan of Management dated May 2021.



Following a review of the above listed documents, conducted site inspection on 22 April 2021 and consultation with the applicant and other experts, the undersigned states as follows:

- 1) That the assessment theoretical peak daily loaded truck traffic generation of 46 loaded truck movements per day for a maximum of 29 days per annum referenced in the INGEN Report is not a realistic calculation of likely loaded truck movements for the existing or proposed modification to the existing hard rock quarry.
- 2) The likely peak loaded truck movements per day are limited by the operational efficiency of plant and equipment that exists, or as contemplated under the modification application, on the site.
- 3) The proposed modification to Condition 35, as set out below, aligns with the rationale of a limited number of higher capacity loaded truck movements.

### **Proposed Modification Condition 35**

The Modification Condition 35 is as follows, with recommended changes shown underlined:

"That loaded truck movements generated as a consequence of the operation of the quarry not exceed an average of 15/day and be subject to a maximum of 20 loaded truck movements (greater than 4.5 tonne) per day."

Please contact the undersigned should you require further information or assistance.

Yours faithfully,

McLaren Traffic Engineering

Craig M<sup>c</sup>Laren

Director

BE Civil, Grad Dip (Transport Engineering), MAITPM, MITE

RMS Accredited Level 3 Road Safety Auditor [1998]
SafeWork NSW Traffic Control Work Training card, [Authorisation number TCT0015914 : Prepare Work Zone (PWZ)] Expert Traffic Engineering & Road Safety Witness at NSW Land & Environment & NSW Supreme Court

JUSTICE OF THE PEACE/SOLICITOR

Justice of the Peace

# River Bank Road Quarry, Monaltrie Plan of Management

Michael Santin
4 August 2021

→ The Power of Commitment



230 Harbour Drive, Coffs Harbour, New South Wales 2450, Australia

T 61-2-6650 5600 | F 61-2-9475 0725 | E cfsmail@ghd.com | ghd.com

Printed date	4/08/2021 8:43:00 AM
Last saved date	04 August 2021
File name	C:\Users\jlmackintosh\Documents\12550951-REP_Quarry Plan of Management Plan.docx
Author	Ben Luffman
Project manager	Ben Luffman
Client name	Michael Santin
Project name	Santin Quarry Plan of Management
Document title	River Bank Road Quarry, Monaltrie   Plan of Management
Revision version	Rev 1
Project number	12550951

	- Commence	Author	Reviewer		Approved f	Date to	
Status Code	Revision	Autioi	Name	Signature	Name	Signature	Date
		B Luffman	S Lawer		S Lawer		17/05/2021
S04	0	B Luiman	O Zumon	-	S Lawer	0	04/08/2021
S04	1	B Luffman	S Lawer	(a)	S Lawer	da	

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	2.7	Rate of extraction	4						
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#### 1. Introduction

Santin Quarry Products (SQP) operate the hard rock quarry known as River Bank Quarry at Lot 4 DP 701527, 72 River Bank Road, Monaltrie (the site). The quarry provides a range of materials to local Councils and contractors.

This Plan of Management (PoM) has been prepared in response to Condition 4 of the Notice to Applicant of Determination of a Development Application for Development Consent No. 92/523 (Amended):

A detailed Plan of Management shall be submitted to Council within one year from the date of commencement, and then upgraded every two (2) years or shorter period as may be determined by Council. Should a shorter period be required Council shall provide six months notice. Such plan shall report on all operational parameters of the quarry including but not limited to; quarry development, drilling and blasting activities and monitoring, progressive rehabilitation, control of pollutants, quantity of material won, ground water seepage into the pit and surface water effects. Such plan shall be of a standard acceptable to Council's Planning Department and the Regional Inspector of Mines, Department of Mineral Resources, Lismore.

The PoM provides the framework for environmental management for site operations. The PoM identifies and documents the key environmental risks and mitigation measures implemented to ensure that the environmental objectives and legal obligations are met.

This PoM has been prepared with reference to the following documentation:

- Environmental Impact Statement Proposed Extension of Existing Quarry Riverbank Road, Wyrallah (Brian J Mackney and Associates 1992)
- ISO14001:2015 Environmental Management Systems
- Department of Infrastructure, Planning and Natural Resources (DIPNR) (2004) Guidelines for the preparation of Environmental Management Plans
- Notice of Determination of Development Application (No. 92/523 (Amended)) and dated 28/07/2006
- Relevant legislation

#### 1.1 PoM objectives

The key objectives for this PoM are:

- Compliance with relevant environmental legislation and regulations
- Compliance with the Conditions of Development Consent No. 92/523 (Amended)
- Minimising pollution, waste generation and environmental impacts

#### 1.2 Scope and limitations

This report has been prepared by GHD for Michael Santin and may only be used and relied on by Michael Santin for the purpose agreed between GHD and Michael Santin as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Michael Santin arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set cut in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Michael Santin and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

#### 2. Overview of operations

The extent and layout of the quarry is shown in Figure 2.1. The approved quarry footprint including the floor and faces, maintenance areas and open storage areas has an area of approximately 3.5 hectares. The quarry floor and faces have an area of approx. 2.6 hectares.

Quarry products include; crusher dust, crushed road base, gravels and aggregate.

A description of how the quarry is operated is provided below.

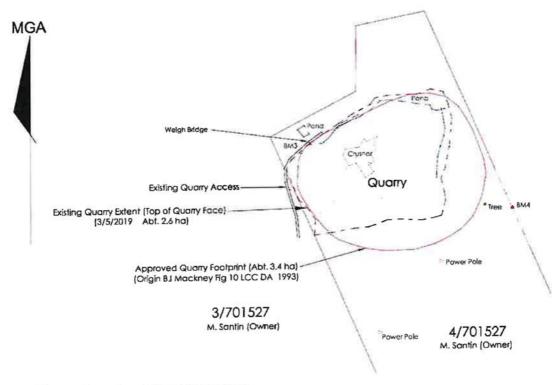


Figure 2.1 Quarry layout (Source: WADE 2019)

#### 2.1 Staging

It was originally proposed to develop the quarry in four stages, with the intent to re-orientate the working face of the quarry more northward. The quarry has progressed since this time and is now considered to be within the originally described Stage 4, whereby the face of the quarry will generally be extended to the south towards the southern extent of the approved extraction area.

#### 2.2 Land stripping

Pasture grass, topsoil and subsoil overburden above the quarry face to be worked is removed with a 25 tonne excavator to create a working bench for blast preparation above the quarry face.

The grass, topsoil and subsoil are either stockpiled immediately adjoining the blast area or used to form and build or augment bunds to the west and northeast of the quarry.

#### 2.3 Blasting

Blasting involves drilling core holes in which to place explosives to be detonated to loosen and shatter the basalt to enable crushing. Subject to demand, drilling and blasting generally occurs on 2 - 3 occasions per year, and is undertaken by a suitably licenced subcontractor.

Subject to weather conditions drilling generally takes 2 - 3 days.

#### 2.4 Extraction/raw feed winning

Following blasting the following occurs:

- The blown rock is screened using a 25 tonne excavator to separate larger rock from rock suitable for crushing.
- The 25 tonne excavator will pile suitably sized rock ready for loading by a 4 m<sup>3</sup> rubber tyred front end loader or excavator into the crusher.

#### 2.5 Crushing and screening

Crushing and screening is undertaken at the site using essentially the same fixed jaw crusher and screener that existed in the quarry in 1993.

Rock with a maximum size of 0.5 m diameter is loaded and crushed. Crushed rock is then sorted and screened from where conveyors drop the processed material into temporary stockpiles near the plant.

Processed material at the crusher is either direct loaded for haulage or relocated to product stockpiles on the quarry floor.

#### 2.6 Loading

Loading of trucks is undertaken using a 4 m³ rubber tyred front end loader. The loaded truck then drives onto the weighbridge to weigh the load prior to the truck leaving the quarry.

To satisfy Transport for NSW weight of loads requirements, no loads are greater than the registered payload size of the truck. The loader operator is to record in a docket book:

- Date
- Time
- Registration
- Type of product
- Weight

#### 2.7 Rate of extraction

The approved rate of extraction in DA No. 1992/523 is  $15,000 \text{ m}^3$  (40,500 tonnes) per annum, however the operation has purposefully capped extraction at  $11,100 \text{ m}^3$  (29,970 tonnes) per annum to remain below the Environment Protection Licence (EPL) threshold of  $11,111 \text{ m}^3$  (30,000 tonnes).

The estimate of the resource remaining in-situ and not yet extracted within the approved extraction area is approximately  $180,000 \text{ m}^3$  (486,000 tonnes). At an annual rate of extraction of  $11,100 \text{ m}^3$  (29,970 tonnes) the life of the quarry is estimated to be approximately 16 years.

#### 3. Environmental risk assessment

The environmental risks have been assessed by examining all site activities associated with quarry operations to determine their potential impacts on the environment. The risk rating is determined by considering the likelihood and consequence of an activity using the matrix shown in Table 3.1 and applying that rating to select environmental aspects, as shown in Table 3.2.

Table 3.1 Risk matrix

Likelihood	Consequence		
	Low	Medium	High
Will occur	M	H H	Н
Likely to occur	L/M	M	#
Unlikely to occur	L	L/M	M
Will not occur	L	L	L/M

The results of this broad risk assessment are shown in Table 3.2.

Table 3.2 Risk assessment

Aspect	Clearing & Grubbing	Blasting / Extraction	Screening / Crushing	Material Transport	Rehabilitation
Air	L/M	M	H	L/M	L
Surface Water	14	M	L/M	L/M	L/M
Groundwater	L	M	L	L	L
Noise & Vibration	L/M	H	(H)	M	L
Waste	L	M	M	L	L
Ecology	L/M	L/M	L/M	L	L
Transport	L	L	L	M	L

As indicated by Table 3.2, all aspects, except ecology, have at least one medium rated risk. Noise and vibration has two high risk ratings, while surface water and air also have a high risk rating. Ecology risks are rated L/M or below because of the limited ecology value at the site.

Appropriate control measures to mitigate or minimise the risks are provided in Section 4 below.

#### 4. Environmental management

#### 4.1 Roles and responsibilities

Key site personnel and environmental management responsibilities are outlined in Table 4.1.

Table 4.1 Roles & responsibilities

Role	Responsibilities
Quarry Manager	The Quarry Manager (QM) is responsible for the overall implementation of the PoM and environmental management on site. Key responsibilities include:  Reviewing and endorsing the PoM as required  Maintaining compliance with relevant legislation, conditions of approval and any licences  Communicating environmental objectives, targets and commitments to site staff  Delivering environmental training  Leading environmental incident investigations and reporting to regulatory authorities where appropriate  Responding to community complaints and enquiries  Liaison with stakeholder agencies and community groups where required  Approving any environmental reports required to be submitted to relevant authorities
Quarry Operator	The Quarry Operator (QO) is responsible for managing the daily quarry activities and implementing environmental controls. Key responsibilities include:  — Providing input to PoM reviews  — Communicating environmental management requirements during toolbox talk or other regular meetings  — Undertaking environmental monitoring and inspections  — Monitoring the work of subcontractors working on site  — Stop work in the event of a pollution incident and implementing the emergency response procedure
Operators	Site workers and operators are responsible for implementing environmental control measures associated with their daily work. This includes:  - Minimising their impact on the environment while undertaking works  - Implementing and maintaining environmental controls  - Reporting to the QM when an incident occurs and taking measures to respond to the incident  - Completing any reporting and monitoring requirements for their specific role

#### 4.1.1 Subcontractors

As a minimum, subcontractors and their employees will comply in full with the requirements of this PoM as it applies to site environmental management and controls. Subcontractor personnel are considered equivalent to site personnel in all aspects of environmental management and control and their responsibilities in this respect are the same as site personnel.

#### 4.2 Environmental training and awareness

Site environmental management requirements are communicated in the site induction to all staff, subcontractors and visitors. The induction includes the following information:

- Environmental legal context including due diligence and duty of care
- Site environmental objectives and targets
- Site environmental setting and sensitive environmental aspects
- Environmental incident response and management procedure
- Overview of environmental control measures

There are no specific environmental training requirements beyond the environmental site induction for site operations. Subcontractors engaged to undertake specialist tasks (e.g. water quality monitoring), will be appropriately qualified to conduct the works.

Other environmental issues are communicated to site staff through toolbox talks and other meetings.

#### 4.2.1 Training records

Training records are maintained in a site training register which includes:

- Details of the person being trained (name, role, company)
- Training date
- Type of training

#### 4.3 Soil and water management controls

Objective  - Maintain receiving surface water and groundwater quality and quantity of the quarry.  Targets  - Manage erosion associated with operational activities, in accordance w Urban Stormwater Soil and Construction – Volume 2e Mines and Quantity			tity during operation
		e with <i>Managing</i> uarries (DECC,2008)	
No.	Control		Responsibility
S1	Train all staff on eros through inductions, to	sion and sediment control practices and the requirements of the PoM colboxes and targeted training.	Quarry Manager
S2	All topsoil and overly and stockpiled separ	ing material will be progressively stripped from areas to be excavated ately for future rehabilitation of the quarry, refer to Appendix E.	Quarry Operator
S3	All permanent stockp	iles will be stabilized and revegetated with a suitable cover crop e.g.	Quarry Operator
S4	Implement and maint Management Plan (E	tain erosion and sediment controls in accordance with Soil and Water ENV 2019) in Appendix C and Figure 4.1.	Quarry Operator
S5	<ul> <li>50 mg/L for Total</li> <li>6.5 – 8.5 for pH</li> <li>Visible oil and green these concentration from rainfall measures</li> </ul>	limits do not apply to discharge from the sediment basin solely arising at the premises exceeding 95.3 mm in total falling over any period or when the water is used on site e.g. dust control, adding	Quarry Operator
S6	Each sedimentation the upper level of the C).	basin must have a marker (the "sediment basin marker") that identifies e sediment storage zone and design storage capacity (refer to Appendix	Quarry Operator
S7	The design storage of within 5 days of the osite.	capacity of the sediment basins (refer to Appendix C) must be restored cassation of a rainfall event that causes runoff to occur on or from the	Quarry Operator
S8	If required to achieve prior to discharging of	the discharge criteria, treat the basin in accordance with Appendix D, off site.	Quarry Operator
S9	Sediment must be re exceed the sediment for future rehabilitation	emoved regularly from the basins, so the sediment volume does not a basin marker level. Sediment removed from the basin is to be stockpiled on of the quarry.	Quarry Operator
S10	Machinery is to be re to be stored on site.	fuelled by mobile vehicles with appropriate storage containers. No fuel is	Quarry Operator
S11	Bund(s) are to be de	and oils must be stored in tanks or containers inside suitable bund(s). signed, constructed and maintained in accordance with AS1940-2004 g of Flammable and Combustible Liquids.	Quarry Operator

Moni	toring	1 1 1 1
<b>S12</b>	Rainfall at the premises must be measured and recorded in millimetres per 24 hour period, at the same time each day.	Quarry Operator
S13	Erosion and sediment controls are to be monitored weekly and following rain, with any issues addressed, as required.	Quarry Operator
S14	Basins A and B are to be monitored for TSS, pH and oil and grease prior to discharge. The following concentration limits must be achieved prior to discharging:  Oil and grease – visual  pH – 6.5-8.5  TSS – 50 mg/L  Note: Monitoring and the above concentration limits do not apply, if rainfall exceeding 95.3 mm falls over any consecutive five day period.	Quarry Operator
S15	The volume of water in the sediment basins is to be monitored following rain. If, within 5 days of rainfall, the design capacity is not available (as shown by the sediment basin marker), the basin must be discharged to restore the design capacity.	Quarry Operator
S16	The volume of sediment in the basins is to be monitored following rain and removed to maintain the design capacity, as shown by the sediment basin marker.	Quarry Operator
S17	The spill kit is to be checked monthly and any missing materials to be replaced.	Quarry Operator

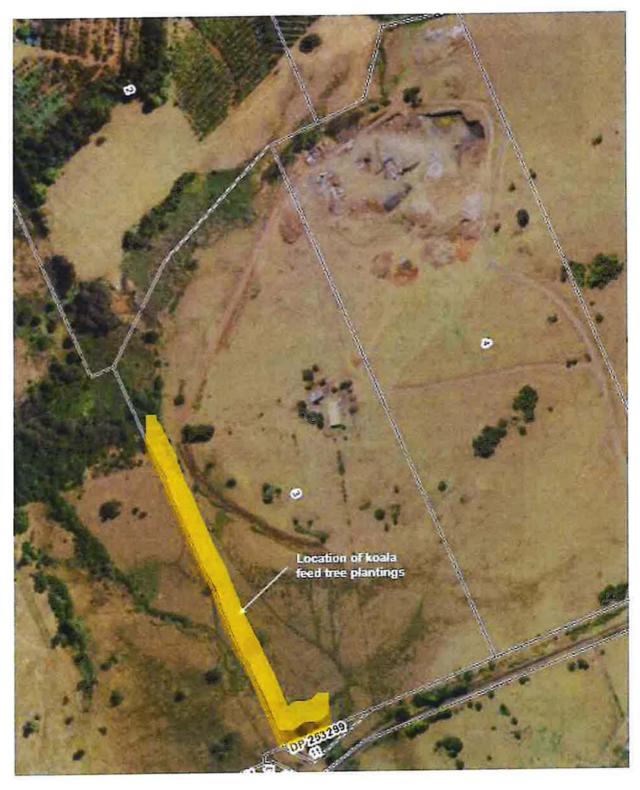


Erosion and sediment controls (ENV 2020) Figure 4.1

- Access Road Workshop

# 4.4 Flora and fauna management controls

Objective Targets		<ul> <li>Maintain significant habitat and minimise vegetation disturbance</li> <li>Minimise the spread of weeds</li> </ul>	
		<ul> <li>No fauna fatalities</li> <li>No unapproved disturbance of vegetation</li> <li>No new occurrences of weeds on site</li> </ul>	
No.	Control		Responsibility
F1	Train all induction	staff on flora and fauna control practices and the requirements of the PoM through ns, toolboxes and targeted training.	Quarry Manager
F2	The bou	ndaries of the approved quarry footprint, as identified in the approved quarry plan clearly marked on site.	Quarry Manager
F3	Quarry o	operations will not extend outside the approved quarry footprint.	Quarry Operator
F4	Native v	egetation will not be cleared as a result of quarry operations.	Quarry Operator
F5	Subject to be provided Lot 2 DP	to concurrence of the owner of Lot 1 DP701257 and Council, screen tree planting will ded along the southern east/west common boundary, or equivalent location within 9701527.	Quarry Manager
F6	planting	ed trees will be planted along the western boundary of Lot 3 DP 701527, refer to .2. Refer to the Rehabilitation Plan (Appendix E) for details regarding species, and maintenance. The dominant species are to be Flooded gum (Eucalyptus Forest Red Gum (Eucalyptus tereticornis) and Tallowood (Eucalyptus microcorys).	Quarry Manager
F7	All weeds	s will be controlled according to the requirements of the Biosecurity Act 2015.	Quarry Operator
F8	All native	animals, including snakes, will not be harmed or handled.	Quarry Operator
F9	A stock p	proof fence and appropriate warning signage will be erected around the quarry r, incorporating lockable gates.	Quarry Manager
F10	If injured the anima	native wildlife is found on the site, W.I.R.E.S will be contacted to collect and care for al.	Quarry Operator
F11	The site	will be rehabilitated in accordance with the Rehabilitation Plan in Appendix E.	Quarry Manager
Moni	toring		Falle ( N
-12	The site	will be inspected monthly for weeds.	Quarry Operator
F13	The bour	ndary markers will be inspected monthly to ensure they can still clearly be seen and have extended outside the quarry limits.	Quarry Operator
14	and even	ation of koala trees and bunds will be monitored every month for the first six months y six months thereafter. Any required replacement trees, guards or watering will be d within 1 week of the inspection.	Quarry Operator



Koala feed tree plantings Figure 4.2

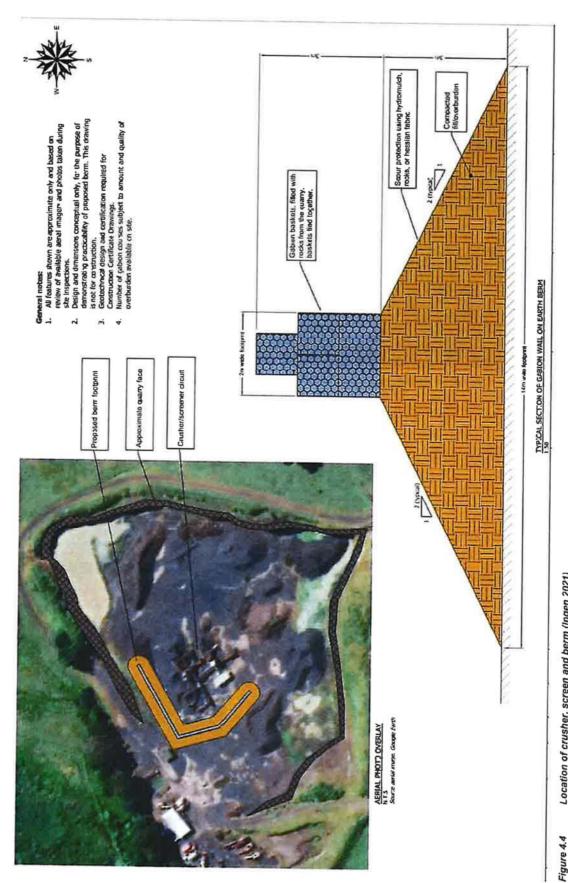
# 4.5 Noise management controls

Objec	distance to local residents from operational hoise			
Targe	day/evening/night	day/evening/night  No justified complaints from adjacent residents in relation to noise generation		
No.	Control	Responsibility		
N1	Train all staff on noise control practices and the requirements of the PoM through inductions, toolboxes and targeted training.	Quarry Manager		
N2	LA10 noise levels from the quarry will not exceed the background noise levels at any affected residence by more than 5dB(A) i.e., 40 dB(A). If noise monitoring indicates this criteria is exceeded, a qualified acoustic consultant will be consulted and any recommendations implemented.	Quarry Manager Consultant		
N3	Working hours are limited to:  - Quarrying – 7:30 am – 4:30 pm Monday to Saturday  - Blasting – 8:00 am – 4:30 pm Monday to Friday  - Drilling and crushing – 8:00 am – 4:30 pm Monday to Saturday	Quarry Operator		
N4	No crushing is to be done on weekends or public holidays until an Acoustic Report is submitted from a qualified Acoustic Engineer indicating noise levels at adjoining properties are satisfactory to Council.	Quarry Manageri Consultant		
N5	One week prior to drilling and blasting, the 11 adjoining landowners within the buffer zones will be notified in writing or email by the Quarry Manager, unless the landowner advises in writing they do not need to be notified. A list of the properties to be notified is provided in Appendix F.	Quarry Manager		
N6	The crushing and screening operations will be screened by a 6 metre high berm constructed directly west and north of the current crushing and screening operations, as shown by Figure 4.4.	Quarry Manager		
N7	Acoustic certification of future changes to the pit layout and equipment is required by an acoustic consultant, prior to them occurring, to verify the noise impacts are consistent with the approval.	Quarry Operator		
N8	Equipment will be maintained and operated in accordance with manufacturer's recommendations. Equipment identified as being excessively noisy will be serviced. If problems still remain after servicing, equipment will be fitted with noise attenuation devices or removed from site. Any replacement equipment will require an acoustic consultant to certify it will maintain or reduce the noise levels from the operation.	Quarry Operator		
N9	When not in use, vehicles and machinery will be turned off.	Quarry Operator		
N10	Cover noisy parts of the crusher and screen with insulation material, see Figure 4.3.	Quarry Operator		
N11	Rocks to be carefully placed in the hopper and trucks, rather than being dropped in from a height.	Quarry Operator		
N12	Crushing and screening operations to be similar to what was done during the attended testing day of the 12th of March 2020;  Insulation covers over loud machine components of the crushers and screens, see Figure 4.3.  Gentle placement of rocks in the hopper.	Quarry Operator		
Monito				
N13	Routine weekly inspections will occur throughout the operational lifetime of the quarry to identify any ad-hoc noise issues such as faulty equipment, noisy works.	Quarry Operator		
N14	Berms are to be inspected monthly to ensure they remain in good condition and meet the requirements outlined in N6.	Quarry Operator		
N15	A noise compliance assessment will be undertaken in accordance with Section 4.10 of the Noise Impact Assessment (Ingen 2020), Appendix G.	Quarry Manager/ Consultant		



Figure 4.3 Example of insulating noisy parts of the crusher and screen (Ingen 2020)

4



Location of crusher, screen and berm (Ingen 2021)

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GHD | Michael Santin | 12550951 | River Bank Road Quarry, Monaltrie

# 4.6 Blasting management controls

Objective   To minimise the impacts of quarry operations on the local community environment from blasting and vibrations  Targets   No exceedance of the blasting criteria  No justified complaints from adjacent residents in relation to blasting a		ity and the built
		ng and vibrations
No.	Control	Responsibility
B1	Train all staff on blasting control practices and the requirements of the PoM through inductions, toolboxes and targeted training.	Quarry Manager
B2	One week prior to blasting the 11 adjoining landowners within the buffer zones will be notified in writing or email by the Quarry Manger, unless the landowner advises in writing they do not need to be notified. A list of the properties to be notified is provided in Appendix F.	Quarry Manager
В3	Blasting will be restricted to between 8:00 am - 4:30 pm Monday to Friday.	Quarry Operator
B4	Blasting is to achieve the following limits:  - Overpressure 115 dB(L)  - Peak particle velocity 5 mm/s  If blast monitoring indicates this criteria is exceeded, a qualified consultant will be consulted.	Quarry Manager/ Consultant
B5	and any recommendations implemented.  Blasting is to be done by a qualified and experience subcontractor.	Quarry Manager/
В6	No explosives are to be stored on site.	Quarry Manager
Monit	toring	
B7	Blast monitoring will occur for every blast and will be undertaken by a suitably trained professional. Blast monitoring will be undertaken:  - Every blast at receiver R1 - 55 Chilcott Street, Monaltrie  - At other locations following receipt of a justifiable blasting related complaint	Quarry Manager/ Consultant

# 4.7 Air quality management measures

Obje	ctive	Minimise air quality impacts from site activities	
Targets  - No visible offsite air quality impacts as a result of site operations  - No justifiable complaints related to air quality attributable to site oper		erations	
No.	Control		Responsibility
A1	All personnel working dust.	ng at the site will be made aware of their responsibilities in minimising	Quarry Manager
A2	Unsealed haul truck	k routes will be watered as required, particularly during peak periods of and extended dry spells or windy conditions.	Quarry Operator
<b>A</b> 3	Stockpiles and distr periods or when du	urbed areas of the quarry will be watered during extended dry or windy st is observed to be leaving site.	Quarry Operator
<b>A</b> 4	Water sprays are re visible.	equired to be operating on crushing and screening plant, when dust is	Quarry Operator
<b>A5</b>	Loaded trucks leave	ing the construction site will be covered to minimise the transport of dust	Quarry Operator/ Truck Drivers
A6	Equipment, machin	ery and vehicles will be maintained to manufacturer's specifications to emissions.	Quarry Operator
A7		hinery will not be left running or idling when not in use.	Quarry Operator

Monitoring		
<b>8</b> A	Routine weekly inspections will occur throughout the operational lifetime of the quarry to identify any air quality issues such as dust emissions.	Quarry Operator
A9	Dust monitoring will occur following continued (>1 per week), justified complaints. The dust monitoring will involve installing temporary dust deposition gauges, by a qualified consultant, for a period of 1 month at the nearest complainant. If dust deposition exceeds 4 g/m² per month, any additional controls recommended by the consultant will be implemented.	Quarry Manager/Consultant

# 4.8 Waste management measures

Object	ctive – Minimise the volume of waste generated from site operations		
Target	S	The volume of waste disposed at landfill is less than 1% of the volume. No recyclable products disposed to landfill No contamination of the quarry	volume extracted
No.	Control		Responsibility
W1	All personnel wo waste.	rking at the site will be made aware of their responsibilities in minimising	Quarry Manager
W2	The volume of wa	aste generated will be minimised.	Quarry Operator
W3	Excess quarry m	aterial will be used on site as fill and/or in rehabilitation works.	Quarry Operator
W4	All recyclables (in organics) to be co	ncluding aluminium, paper and cardboard, steel, glass, rigid plastic, ollected and recycled accordingly.	Quarry Operator
W5	All waste will be disposed at an ap	classified in accordance with the Waste Classification Guidelines and oppopriately licensed facility.	Quarry Operator
W6	An onsite wastew 68 of the Local G	vater system will be installed and maintained, in accordance with Section overnment Act.	Quarry Operator
W7	Any waste general storage, treatment	ated outside the premises must not be received at the premises for at, processing, reprocessing or disposal, without the approval of Council.	Quarry Manager
Monito			
W8	Routine weekly in identify any waste	spections will occur throughout the operational lifetime of the quarry to a issues.	Quarry Operator
W9	Waste classificati	on and disposal will be recorded.	Quarry Operator

#### Heritage management measures 4.9

Objective Targets		Avoid damage or disturbance of heritage items		
		<ul> <li>No damage to heritage items</li> <li>All site staff and contractors trained on unexpected finds protocol</li> </ul>		
No.	Control		Responsibility	
Н1	All personnel wor	king at the site will be made aware of their responsibilities if a heritage item te.	Quarry Manager	
H2	If it is suspected that Aboriginal material has been uncovered as a result of earthworks/ activities:  Work in the surrounding area is to stop immediately.  A temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site.  An appropriately qualified archaeological consultant is to be engaged to identify the material.  If the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010).		Quarry Manager	
Monit	oring			
НЗ	Routine weekly in identify if any Ab	nspections will occur throughout the operational lifetime of the quarry to original material is uncovered.	Quarry Operator	

#### 4.10 Traffic management measures

Object	tive – Minimise	<ul> <li>Minimise impacts to the local residents and public infrastructure from site traπic</li> </ul>			
Target		N. and description with violation movements			
No.	Control		Responsibility		
T1	All truck drivers entering the quarry will operating at the site.	Quarry Manager			
Т2	Loaded truck movements generated a to exceed an average of 15/day or a m 4.5 tonne) per day.	Quarry Operator			
Т3	Install traffic advisory signs on Riverba	Quarry Manager			
T4	The intersection of the access road and Riverbank Road will be upgraded within 2 years, in accordance DA No. 5.1992.523.4.		Quarry Manager		
T5	The internal access road will be 3 m wide bitumen sealed to where the road divides. The pavement will be suitable to cater for gravel haulage vehicles.		Quarry Manager		
Т6	All vehicles must enter and leave in a forward direction.		Quarry Manager Truck Drivers		
Monito	oring				
T7	The following details are to be recorded	Quarry Operator			
	- Date				
	<ul><li>Time</li><li>Registration</li></ul>				
	Type of product				
	- Weight				

#### Incidents and complaints

#### 5.1 Emergency response

Incidents and near misses may occur with potential or actual environmental harm. Incidents resulting from normal operations are likely to include:

- Spills or leaks of hazardous substances (oils, fuels, chemicals)
- Release of contaminated stormwater from the site
- Excessive noise or dust levels at sensitive receivers

Environmental control measures are established to minimise the risk of environmental harm occurring.

#### 5.1.1 Emergency contacts

Details for organisations that may be contacted to respond to an environmental emergency are provided below in Table 5.1. These details are to be made available to all site personnel on site signage and induction material.

Table 5.1 Emergency contact details

Agency	Contact	
Police / Fire / Ambulance	000	
Hospital	Uralba Street, LISMORE 02 6621 8000	
SafeWork NSW	131 050	
EPA	131 555	
Lismore City Council	02 6625 0500	
WIRES Wildlife Rescue	02 6628 1898	

#### 5.1.2 Incident investigation

All incidents are documented, investigations conducted and action plans established in order that the incident does not occur again. Where lessons are learnt from the investigation or current procedures are identified as being ineffective, the PoM will be revised to include the improved procedures or requirement.

An incident investigation includes the following basic elements:

- The cause, time and duration of the event
- Contact details for all personnel involved in the incident and subsequent response
- Action taken in relation to the event with respect to containment, notification, and residual effects
- Details of any measure taken or proposed to be taken to prevent a recurrence of such an event

All personnel are required to report all incidents, as it is regarded as a valuable method of addressing shortcomings in procedures, training or equipment, and is an opportunity for improvement.

#### 5.1.3 Notification

The Quarry Manager will immediately notify the EPA of pollution incidents on or around the site which have occurred in the course of activities in the following circumstances:

- If the actual or potential harm to the health or safety of human beings or ecosystems is not trivial
- If actual or potential loss or property damage (including clean-up costs) associated with a pollution incident exceeds \$10,000

Written details of the notification are to be submitted to the EPA within 7 days of the date on which the incident occurred.

#### 5.2 Complaints

A telephone complaint line will be established to receive complaints from members of the public in relation to activities conducted at the quarry. The complaints line is publicly available and advertised on signage at the site entry.

A legible record (see Appendix B) of all complaints in relation to pollution arising from any activity must include:

- The date and time of the complaint
- The method by which the complaint was made
- Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect
- The nature of the complaint
- The action taken in relation to the complaint, including any follow-up contact with the complainant
- If no action was taken, the reason why no action was taken

#### Reporting and review

#### 6.1 Reporting and records

#### 6.1.1 Environmental inspection checklist

The effectiveness of environmental protection measures is assessed weekly. To achieve this, an environmental inspection checklist will be used to address the key mitigation actions as well as any specific approval requirements. A copy of the checklist is in Appendix A.

The purpose of the checklist is to:

- Provide a surveillance tool to ensure that safeguards are being implemented
- Identify where problems might be occurring
- Identify where sound environmental practices are not being implemented
- Facilitate the identification and early resolution of problems

Any non-conformances identified through the checklist process would be highlighted and an environmental action report or a non-compliance/environmental incident notification report completed. The checklist would remain "open" until:

- The issue has been resolved
- A new or revised procedure has been established and implemented
- Training has been provided to relevant personnel/sub-contractors

#### 6.1.2 Compliance reporting

Every three years from the date of the consent, the Quarry Manager will prepare a compliance report with the following details:

- A description of the quarrying that was carried out since the previous report, and the quarrying that is
  proposed to be carried out over the next reporting period including quarry production and transport data,
  details of proposed working stages, stages to be opened and/or closed and rehabilitation works.
- A summary of the monitoring results and complaints records since the last report.
- A statement of compliance with each of the relevant conditions of the consent including identification of any non-compliance since the previous report, and a description of what actions were taken and will continue to be taken to ensure compliance. Identified actions shall be included in an amending PoM.

A copy of the report is to be provided to Council.

#### 6.1.3 Records

Environmental reporting and records are maintained to demonstrate compliance with the PoM. Records to maintain include:

- The Notice to Application of Determination
- Induction and training register
- Environmental inspection and monitoring reports/results (refer to Section 6.1.1 and Appendix A)
- Compliance reports (refer Section 6.1.2)
- Incident reports and register (refer to Appendix B)
- Complaints register (refer to Appendix B)
- Truck movements (refer to Appendix B)
- Extraction volumes (refer to Appendix B)
- All regulatory correspondence

#### All records are to be:

- Maintained in a legible form
- Kept for at least four years
- Produced to any authorised officer of the EPA or Council upon request

#### Review and improvement 6.2

The Quarry Manager will review the PoM and its operation and implementation every three years. The purpose of the review is to ensure that the PoM is meeting the requirements of the standards, policies and objectives. Between the scheduled reviews, a register of issues will be maintained to ensure that any issue raised by internal and external personnel associated with the quarry operations is recorded.

The review will consider (where available or applicable):

- Site personnel comments
- Agency comments
- Audit findings
- Environmental monitoring records
- Complaints
- Details of corrective and preventative actions taken
- Environmental non-conformances, environmental inspection notices, inspection reports, and nonconformance reports
- Incident reports
- Changes in organisation structures and responsibilities
- The extent of compliance with objectives and targets
- The effect of changes in standards and legislation
- Co-ordination of environmental management of sub-contractors

Details of any significant changes made to the PoM will be summarised in a table and forwarded in a memo to all site staff, contractors and Council.

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# Appendices

# Appendix A

**Environmental Checklist** 

### **Environmental Inspection Checklist**

Inspection Date :			Inspecti	on Conduc	cted By:	
Weather Conditions:	Dry 🗌	Slight Wind [	Calm	Rain	Strong Wind	
Rainfall – Past 24 hrs:				ast 5 Days		

ltem	Observation	Action required & location	Responsibility	Closed
Soil an	d Water			
	Erosion and Sediment controls installed & in good working order?			
	Do erosion and sediment controls require maintenance or replacement?.			
	Are stockpiles located and maintained in accordance with the PoM?			
	Are basins full and requiring treatment and discharge? If yes, check water quality			
	Are monitoring points discharging? If yes, check water quality			
	Do sediment basins require maintenance?			
	Are clean and dirty water separated?			
	Are site access locations free from mud or excessive dirt on the local roads?			
Air Qual				150 80
	Is dust from quarry operations visible during inspection?			
	Are dust suppression measures in place? And effective?			
	Is any machinery emitting smoky exhaust?			
	Are truck loads leaving site covered?			
Flora an	d Fauna			
	Is the extent of the quarry clearly marked/fenced? Is fencing in good repair?			
	Are hygiene measures being implemented?			
	Are there any weeds?			
	Have any unexpected species of fauna been identified / relocated / injured in the past week?			

Item	Observation	Action required & location	Responsibility	Closed
Heritag	e manufacture de la companya de la c		HUSBAN ACTOR	
	Have any unexpected finds of heritage items or human remains occurred in the past week?	S		
Noise &	& Vibration		4506/50075	
	Are noise controls installed and effective?			
	Have all activities occurred withi permitted hours in the last week			
	Do plant/equipment have appropriate mitigation measures installed?			
Hazard	ous Substances & Dangerous Goo	ds		
	Are spill kits available in all work areas and in stock?			
	Is there evidence of hydraulic/vehicle oil spills on site	97		
	Are stored chemicals in bunded areas with at least 110% storage capacity of the largest container is the bunded area free from accumulated storm water or spilled chemicals?	ge ?		
Waste	Management			
	Is the site free from litter and waste bins available?			
	Are appropriate and segregated waste bins available?			
Comple	aints			
	Have any complaints relating to environmental issues been received in the past week? If so please detail.			
Opport	nal Items/ tunities for rement/ tions			
Inspec	tion By			
Signat	ure			

# Appendix B

Records

Basin monitoring records

							_	_	 	_	_	_	_	_	_	_	 _	_	_	_	_	_	_	_	_
7	TSS	mg/L	90																						
Basin B	Oil & Grease	mg/L	Visible																						
	Hd	됩	6.5 to 8.5																						
	TSS	mg/L	50																						
Basin A	Oil & Grease	mg/L	Visible																						
	Hd	됩	6.5 to 8.5																						
	5 days	mm																							
Rainfall	24hrs	mm																							
Comments																									
Test Type			Field/Lab																						
Discharge			Yes/No																						
Sampled by																									
Time																									
Date		Unit	Discharge																						

#### Blasting records

Blast No	Date	Time	Overpressure (dB)	Ground Vibration (mm/s)
	Limits		Never greater than 120dB  Not greater than 115dB for 5 % of blast	Never greater than 10mm/sec  Not greater than 5mm/sec for 5 % of blast

# **Complaint record**

į.	Method of	Pollution Complaint Category	これのはいる
Complainant#	complaint		Response
1			
_			
_			
Н			
		0 0 0 0 0	

# If the complaintant will not provide any personal details, provide a note to that effect

Date	Jan	Feb	Mar	Apr	May	Jun Jun	Jul	Aug	Sen	÷	Nov	2
-				No. of the last of				And	dan	30	AOM	Dec
2												
<sub>6</sub>												
4												
2												
9												
7												
<b>&amp;</b>												
6												
10												
11												
12												
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18												
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22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
MonthlyTotal												
	-											

#### Truck records

		Registration	Product	Weight
Date	Time	Registration	Troudet	,, origina
			,	

# Appendix C

Soil and Water Management Plan





Riverbank Road Quarry, Monaltrie

Soil and Water Management Plan

Riverbank Road Quarry, 72 Riverbank Road, Monaltrie, NSW 26 August 2019 Revision: B Reference: 190215

#### **Document Control Record**

Tony Coyle

Scientist

Senior Environmental

Document prepared by:

Env Solutions Pty Ltd ABN 58 600 788 814 45-65 Smith Drive West Ballina, NSW 2478 Australia

Name

Title

E admin@envsolutions.com.auW www.envsolutions.com.au

Docu	ment control					222222
Repo	rt title	Soil and Water Management	Plan			
Docui	ment ID	19215 SWMP	Project nu	mber	190215	
Client		Riverbank Road Quarry, 72 Riverbank Road, Monaltrie, NSW	Client con	tact	Mick Santi	in
Rev	Date	Revision details/status	Prepared by	Author	Verifier	Approver
A	5 August 2019	Issued for client review	тс	тс	JF	JF
В	26 August 2019	Final	TC	TC	JF	JF
Currer	nt revision	В				
Appro	oval					
Author	signature	1011	Approver si	gnature	Mu	a fact

James Foster

Principal

## Riverbank Road Quarry, Monaltrie

Date 26 August 2019 Reference 190215 Revision B

Env Solutions Pty Ltd ABN 58 600 788 814 45-65 Smith Drive West Ballina, NSW 2478 PO Box 248 Ballina, NSW 2478 Australia

E admin@envsolutions.com.au

www.envsolutions.com.au

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## 1 Purpose

#### 1.1 Introduction and Purpose

Env Solutions (ENV) has prepared a Soil and Water Management Plan (SWMP) on behalf of Riverbank Road Quarry in relation to the operational basalt extraction quarry and associated works on Lot 4 of DP 701527 Riverbank Road, Monaltrie. This SWMP has been developed primarily to inform the s.4.55(2) application to Lismore City Council (LCC) for the continuation of the quarry. It is understood that the SWMP will also be submitted as part of an application to the NSW Environmental Protection Authority (EPA) for an Environmental Protection Licence (EPL).

An existing sediment pond has been redesigned by ENV with consideration of the catchment area as well as localised soil and rainfall data.

This report contains details on:

- The newly designed sediment pond;
- A site description and physical characteristics of the site;
- Associated stormwater, erosion and sediment controls;
- Water management;
- Air emissions;
- Management of potential environmental impacts; and
- Administration of the SWMP.

The SWMP is to be implemented by adoption of the strategies referred to in various sections of this report, with monitoring, reporting and corrective actions recorded in an Environmental Management Log (EML). The EML is to be updated continuously in response to inspections on the site and any breaches of the SWMP that may occur.

The purpose of the management measures outlined in this SWMP is to minimise the impacts on the environment that will likely arise from site-based works, and to achieve the following outcomes:

- Prevent nuisance dust:
- Prevent the displacement of sediment and soil across and off the site;
- Preserve water quality in receiving environments;
- Control and treat surface runoff from the quarry during operation;
- Maintain existing surface water conditions outside the disturbance area;

- Divert 'clean' runoff around disturbed areas; and
- Achieve compliance with statutory requirements.

This SWMP has been undertaken in accordance with the following guidelines:

Managing Urban Stormwater: Soils and Construction, "The Blue Book" (Landcom, 2004)

Due to the nature of the proposal being an extractive industry, this report addresses the impacts during the design of the sediment basin and stormwater treatment system in accordance with:

Managing Urban Stormwater: Soils and Construction: Volume 2E Mines and Quarries (DECC 2008)

#### 1.2 Quarry Site and Operator Details

Details relating to the quarry site and the operator are presented in Table 1.

Table 1. Quarry Site and Operator Details

Riverbank Road Quarry	
Mick Santin	
72 Riverbank Road, Monaltrie, NSW	
Lot 4 DP 701527	
Total site – approximately 16.31ha (LCC 2019)	
Lismore City Council	
Zone RU1 – Primary Production	
	Mick Santin  72 Riverbank Road, Monaltrie, NSW  Lot 4 DP 701527  Total site – approximately 16.31ha (LCC 2019)  Lismore City Council

# 2 Site Description

#### 2.1 Site Location

The site occurs approximately 6 km south of Lismore Central Business District (CBD) and is accessed from the south of the Site via Riverbank Road. The northern boundary borders an ephemeral watercourse and the eastern and western lot boundaries adjoin open grassland. The locality predominantly supports rural landuse, dominated by open grassland used for beef grazing. The site in relation to the broader locality is depicted in Figure 1.

The land is described as Lot 4 DP 701527 72 Riverbank Road, Monaltrie, NSW. Refence to the Site Plan is provided in Figure 2, Figure 3 and Figure 4.



Figure 1. Site Locality Plan



Figure 2. Site Plan – Lot 4 DP 701527

#### 2.2 Site Topography

The quarry occurs on the northern slope of a crest that has a maximum elevation of approximately 40m AHD, and grades down to a perennial drainage line that occurs at approximately 12m AHD (refer Figure 3).

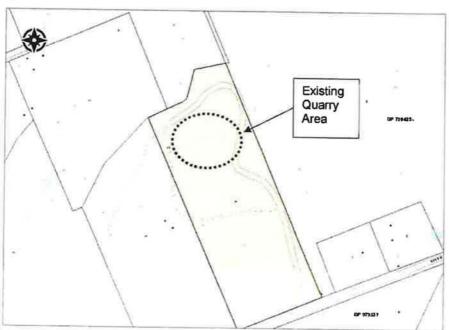


Figure 3. Site topography showing the 10m contours

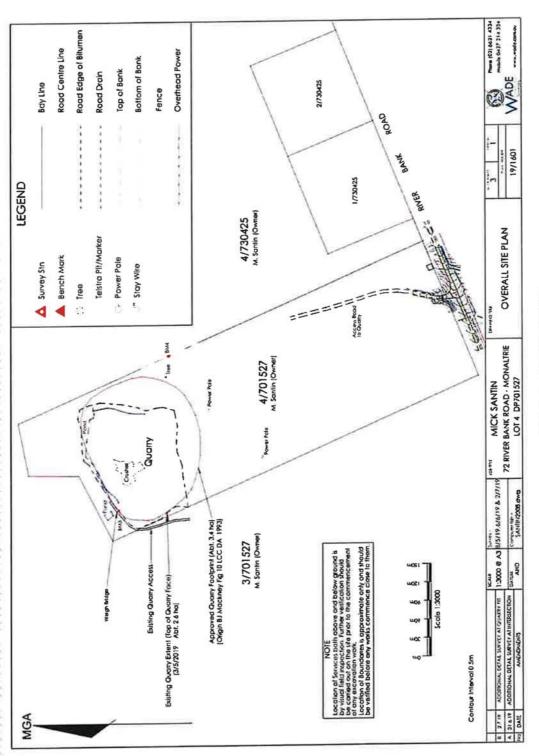


Figure 4. Overall Site Plan

#### 2.3 Geology and Soils

#### 2.3.1 Geological Setting

The regional geological mapping for the site and surrounding area are presented in Figure 5.

The site occurs on the western edge of the 'Lismore Basalts' (Tlb) geological unit. This geological unit extends some distance to the east, south and north of the site and generally occurs as the 'Alstonville Plateau'. The geological unit (Qa) further to the west of the site comprises river gravels, alluviums, sand and clay (Department of Mines 1972).

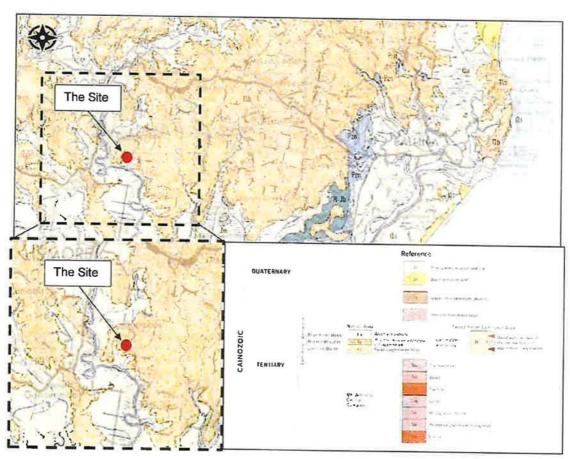


Figure 5. The site located on the Regional Geology Map (Tweed Heads 1:250 000)

#### 2.3.2 Soil Setting

The soil landscapes for the subject site are presented in Figure 6. Soil at the site are mapped as the Georgica (Ge variant c) soil unit (Morand 1994). This soil unit is typified by high rolling and steep waning hills on Lismore Basalts. This profile consists of moderately well-drained shallow to deep Chocolate soils and Prairie Soils on crests and upper slopes. Deep poorly to moderately well-drained Black Earths occur on the lower slopes and footslopes.

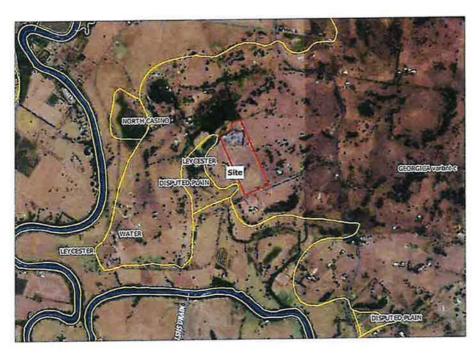


Figure 6. The site relative to the mapped soil units in the locality

#### 2.3.3 Surface Water

Site drainage in the locality of the quarry is shown in Figure 7. Site drainage at the site is in a northerly direction towards a 2<sup>nd</sup> order unnamed perennial drainage line (LCC 2019). The catchment in which the quarry occurs is described as the Wyrallah Area sub-catchment (LCC 2019). The drainage line along the northern site boundary becomes a 3<sup>rd</sup> order stream directly downstream of the quarry, and eventually a 4<sup>th</sup> order stream after which it flows into the Wilsons River, approximately 2km south of the quarry.



Figure 7. The site relative to surface water drainage lines

#### 2.3.4 Groundwater

The nearest licensed groundwater bore (GW072554) is located on the property directly north of the quarry (i.e. Lot 1 DP 701527) (Water NSW 2019), approximately 40m north of the site boundary. Data from the drillers log indicates the bore is drilled to a final depth of 12m and has a standing water level of 3m. The log indicates a 3m clay layer, followed by a 7m layer of gravel and broken rock, followed by 2m of basalt (which supports the groundwater).

A search of the Water NSW (2019) Groundwater Database has identified four licensed groundwater bores within 1 km of the quarry site. The locations of these facilities are shown in Figure 8.

Table 2 lists details of groundwater facilities identified from a search of the Water NSW Groundwater database (Water NSW 2019).

Table 2. Licensed groundwater bores within 1km of the site

GW Number Easting		Northing	Туре	Use	Aquifer	Yield (L/s)	Depth (m)	SWL (mbgl)
GW072554	527577	68073278	Bore	Stock, Domestic	Gravel, basait	1.23	10	3.00
GW062043	526925	6807454	Excavation	Irrigation	Soil	NR	7.5	NR
GW302703	526868	6807253	Bore	Stock, Domestic	NR	NR	3	NR
GW301825	528673	6807925	Bore	Stock, Domestic	Basalt	0.27	66.7	NR

Three of the four bores are for domestic and stock purposes. Groundwater well GW072554 occurs on the property directly north of the quarry. Functional bores are drawing from a basalt aquifer.

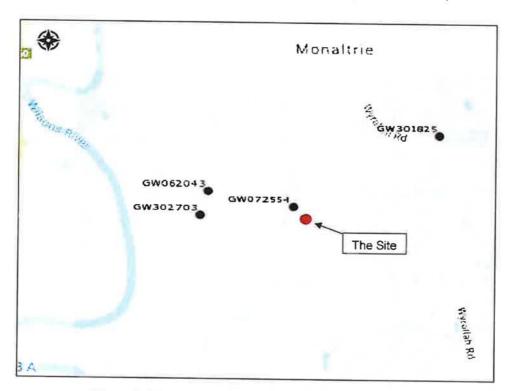


Figure 8. Licenced groundwater works within 1km of the site

#### 2.3.5 Soil Erodibility and Soil Erosion Hazard

Soil erosion is affected by the erodibility of the *in situ* soil and is based on the soils' properties. Erosion hazard is a measure of the susceptibility of an area to erode given the prevailing agents of erosion and a specific land use (Morand, 1994). Erodibility and erosion hazard for the topsoil – A horizon (ge1) is provided in Table 3.

Table 3. Erodibility and erosion hazard for the site

	K-factor:	0.024
	Non Concentrated Flows:	moderate
Erodibility	Concentrated Flows:	mod-high
	Wind:	low
	Non Concentrated Flows:	moderate
Erosion Hazard (grazing)	Concentrated Flows:	mod-high
	Wind:	slight

Table 3 shows that the natural topsoil at the site (i.e. A horizon ge1) has moderate to moderate-high erodibility and moderate to moderate-high erosion hazard for water borne concentrated and non-concentrated flows.

The wind hazard rating for soils of this type is slight.

#### 2.4 Climate

The site is located 4.2 km south-east of the Lismore Airport Weather Station (Lismore AWS) Australian Bureau of Meteorology (BOM) automatic weather station. According to the BOM (2019a), the Lismore region has a subtropical climate, moderate humidity and moderate temperatures are experienced all year round and rainfall is highest during the summer months. The hottest temperatures typically occur in January and range from 18.7°C to 30.3°C, and the coldest temperatures typically occur in June and July and range from 6.1°C to 20.8°C.

Average annual rainfall is approximately 1226.4 mm, ~53% of which occurs in the months November to April (inclusive). Total annual evaporation is approximately 1533 mm. Evaporation exceeds rainfall only during the months of August to December (inclusive) (evaporation data from Lismore AWS and Lismore CBD not available, hence data from Alstonville Tropical Fruits Research Station was used — BOM 2019b). Table 4 indicates monthly climate statistics for the region of Lismore (Lismore AWS).

Table 4. Long-Term Average Monthly Climate Statistics - Lismore AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall (mm)	143.3	127.7	179.4	106.6	66.3	111.3	33.2	62.1	38.3	92.1	103.9	117.5
Mean Maximum Daily Temp (°C)	30.3	29.6	28.3	25.9	23.5	20.8	20.9	22.7	25.7	27.2	28.6	29.5
Mean Minimum Daily Temp (°C)	18.7	18.6	17.3	14.1	9.9	8.1	6.1	6.5	9.7	12.9	15.4	17.4

#### 2.4.1 Wind

Wind data for Lismore (Centre Street) was used for this analysis (BOM 2019c), as windspeed for Lismore AWS is not available (BOM 2019a).

The mean morning (9am) wind speed is relatively consistent throughout the year and ranges from 5.4 km/hr in May to 7.6 km/hr on October. The afternoon windspeed is more variable and ranges from 9.7 km/hr in May to 15.8 km/hr in October.

Mean monthly windspeed for the period 1957 to 2003 is shown in Figure 9.

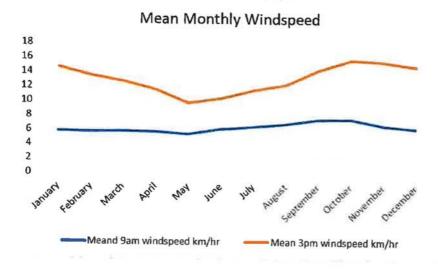


Figure 9. Mean monthly windspeed at BOM Lismore (Centre Street)

# 3 Erosion and Sediment Control

#### 3.1 Introduction

This SWMP specifies the management measures necessary to mitigate any impacts associated with possible soil erosion and sedimentation on the site.

The proposed erosion and sediment controls have been prepared in consultation with managing urban stormwater - soils and construction (Landcom, 2004) along with its supplement: managing urban stormwater soils and construction volume 2E mines and Quarries (DECC, 2008).

#### 3.2 Objectives

The principle objectives of the Soil and Water Management Plan are to:

- minimise erosion and sedimentation from all disturbed areas
- ensure the separation of "dirty" water and "clean" water
- minimise pollution of receiving waters and groundwater
- maximise existing ponded water and stormwater re-use

The proposed erosion and sediment controls include:

- minimising the areas of disturbance
- diverting clean water away from disturbed areas
- installing erosion and sediment control devices
- constructing a sediment basin
- testing of all discharges prior to release
- dust mitigation measures such as watering

#### 3.3 Relevant Soil Parameters

#### 3.3.1 Soil Dispersion Rates

Soil dispersion rates are important characteristics to consider when addressing sediment control measures with sediment ponds. Understanding dispersion characteristics of soils likely to be localised in each sediment pond via introduction through surface water runoff will indicate the likelihood of fine soil particles settling in each pond and subsequently causing inability for sediment reduction — without the application of flocculant treatment(s).

The Emerson Aggregate Test (EAT) determines the cohesiveness of soils as identified through a class categorising system, in which Class 1 indicates complete dispersion while Class 8 indicates no

dispersion and material will not swell once introduced in distilled water. Slaking identification of material within the process is also identified for each soil type.

Soils at the site are described by Morand (1994) as the Georgica (Ge variant c) soil unit (Morand 1994). This soil unit is typified by high rolling and steep waning hills on Lismore Basalts. This profile consists of moderately well-drained shallow to deep Chocolate soils and Prairie Soils on crests and upper slopes. Deep poorly to moderately well-drained Black Earths occur on the lower slopes and footslopes.

The EAT results for the A Horizon soils within the Georgica soil unit can be referenced in **Table 5**as shown below. This data indicates that soils relevant to the site (ge1) have a low likelihood for soil dispersion build-up in the sediment ponds.

The implementation of an aluminium flocking agent to waters within the sediment ponds may be required on occasion.

Although it is the Georgica soil unit that is known to occur at the site, the soils within the actual catchment of the 'operational quarry area' are generally limited to the coarse material that has resulted from the processing of the basalt rock within the quarry. This material, being basically rock, is not considered dispersive.

#### 3.3.2 Soil Erodibility Rates

Soil erodibility for material on site should be considered in order to reduce the probability of surface soils loss, erosion and to establish dust pollutions probability on site.

The erodibility factor as stated in the Unified Soil Loss Equation is identified as K. The K factor is determined by soils susceptibility of soil to sheet and rill through erosion and ranks erodibility on a scale of very low – very high.

The erodibility results for the A Horizon soils within the Georgica soil unit can be referenced in Table 5. The data indicates that soils relevant to the site (ge1) have a moderate likelihood for soil erodibility.

The soils within the actual catchment of the 'operational quarry area' are generally limited to the coarse material that has resulted from the processing of the basalt rock within the quarry. This material, being basically rock, is less erodible than the natural topsoil material (ge1) described above and in Table 5.

#### 3.3.3 Wind Erodibility Rates

Wind erodibility assesses the susceptibility of dry soil to be detached and transported by wind. Typically, soil with a high wind erodibility will have a low percentage of retained aggregates. The erodibility is assessed by measuring the percentage of air-dry soil aggregates retained by a 0.85 mm hand sieve.

The wind erodibility factor considers concentrated and non-concentrated flow as well as wind strengths.

The wind erodibility results for the A Horizon soils within the Georgica soil unit can be referenced in Table 5. The data indicates that soils relevant to the site (ge1) have a low likelihood for wind erodibility.

Table 5. Soil Dispersion, Soil Erodibility and Wind Erodibility Data

	Soil Dispersion (EAT) Rates						
Soil Material -	Class		Slake Probability		Results		
ge1	8		No slaking		Does not swell		
	Soil Erodibility (K Factor) Rates						
	USCS KFact		USCS CFact		Ranking		
ge1	CL		0.024		Mod		
	Wind Erodibility (K Factor) Rates						
	K Factor	Non- Concentrated Flows		Concentrated Flows		Wind	
ge1	0.024		Moderate	Moder	ate-High	Low	

#### 3.4 Management of Surface Hydrology

#### 3.4.1 Surface Water Management Overview

An overview of the surface water management system is described below in 10.

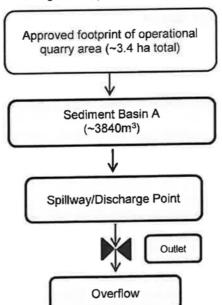


Figure 10. Surface Water Treatment System

#### 3.4.2 Surface Hydrology within the Operational Quarry Area

All the Approved Quarry Footprint occurs in a single catchment area, that being the northern slope of a hill, the top of which corresponds with the southern edge of the limit of the existing approved footprint.

Surface water management controls are shown in Appendix C.

Surface water that falls within the 'operational quarry area' is to be captured via the following means:

- the floor of the quarry within the operational quarry area is to be profiled to divert surface water
  to a dedicated diversion channel that is maintained along the quarry face. This channel is to
  flow in a north-easterly direction into Sedimentation Pond A which is located in the north-east
  corner of the quarry;
- small earth bunds and swales are to be installed in various locations to ensure surface water does not flow outside of the dedicated 'operational quarry area'.

#### 3.4.3 Surface Hydrology outside the Operational Quarry Area

Surface water that falls outside the 'operational quarry area' is to be diverted by the following means:

- run-off upslope of the existing quarry is diverted via large earth berms that occur directly upslope
  of the quarry walls. These berms are to be progressively moved back as the quarry expands
  laterally.
- surface water run-off adjacent to the lower portions of the 'operational quarry area' is prevented
  from flowing into the quarry area via maintenance of the ground profile, which is sloped away
  from the 'operational quarry area';
- surface water run-off adjacent to the lower portions of the 'operational quarry area' that
  comprises associated facilities such as sheds, workshops and carparks is diverted to
  Sedimentation Pond B, which occurs adjacent to the perennial drainage line.

#### 3.5 Sedimentation Basin

#### 3.5.1 Basin Sizing

The sedimentation basin has been sized using the guidance of Landcom's manual 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004). Data used for the design is as follows:

- "Type F" sediment basin consistent with both Table 6.1 and Section 6.3.3(c) of Managing Urban Stormwater: Soils and Construction (Landcom 2004);
- Sediment basin spillway capacity of 10-year ARI peak discharge;
- Total sediment basin volume (V) = settling zone volume (V1) + sediment storage volume (V2).
   The sediment storage volume is the portion of the basin storage volume that progressively fills with sediment until the basin is de-silted. The settling zone volume is the minimum required free storage capacity that must be restored within 5 days after a runoff event;
- Sediment storage volume = 50% of settling zone;
- Sediment basin settling zone volume based on 95th percentile (wet conditions) 5-day duration (95.3 mm – Lismore);

- Adopted volumetric event runoff coefficient (Cv) of 0.79 based on the minimal surface penetration of runoffwater due to the hardrock base and the 'design rainfall depth' of 95.3 mm (refer Table F2 Lancom 2004);
- 6-hour, 10 year ARI has been calculated utilising the Australian Government Bureau of Meteorology (www.bom.gov.au/water/designrainfalls accessed July, 2019) Intensity-Frequency-Duration (IFD) Design Rainfall Depth for Latitude/ Longitude (-28.8625, 153.2875). Here, and Annual Exceedance Probability (AEP) of 50% (10-year ARI equivalent) has been determined where rainfall intensity duration of 6 hours (I) = 67.5 mm;
- Time of concentration (Tc) = 0.76 x (A/100)°-38 hrs (Volume 1, Book IV of Pilgrim from );
- Total catchment area (m³) design based on the current approved footprint as provided by Wade 2019 (refer Figure 4) (i.e. at any one time 'total disturbed area' should never exceed 'total catchment area').

A workings summary is provided in Table 6, and detailed workings are provided in Appendix A.

Table 6. Sediment Basin Sizing Summary

Pond Location	Cv	R x-day y-%ile	Total catchment area (ha)	Settling zone volume (m³)	Sediment storage volume (m³)	Total basin volume (m³)
Basin A	0.79	95.3	3.4	2560	1280	3840
Basin B	0.79	95.3	0.2	150	75	225

#### 3.5.2 Basin Design

As per section 6.3.3(i) of *Managing Urban Stormwater: Soils and Construction*' (Landcom 2004), 'sediment retention basins that might discharge sediment-laden stormwater more than once per year should have a minimum length to width ratio of 3 to 1 to reduce short-circuiting'. Given spatial limitations, basin design recommendations are presented in Table 7.

Table 7. Basin Design Recommendation (I x w x d)

Basin Location	Total Basin Volume (m³)	Approx. Allocated Area (m²)	Depth (m)	Length (m)	Width (m)	L:W Ratio
Basin A	3840	3300	2	85	25	3.4:1
Basin B	225	100	1.5	10	10	1.1

Sediment Basin A is likely to be >1500mm in depth, constructed from rock and be unprotected, hence in accordance with s.6.3.3(j) of Landcom (2004) the internal batter gradients will comprise the following:

• 0.5(H):1(V)

Sedimentation B is existing and there is limited room for expansion. Disturbance in this catchment area is minimal relative to the 'operational quarry area', hence the existing sedimentation basin is likely to be adequate for this non-operational zone.

#### 3.5.3 Basin Infrastructure

#### Basin A

The following infrastructure will be included in the basin construction to allow monitoring and discharge of water:

- An outlet designed in accordance with s.6.3.3(j) that includes the following:
  - A primary outlet designed to have a capacity to pass the peak flow from the design storm event and an invert level at least 300 mm below any emergency outlet;
  - The primary outlet will be a 200mm dia. pipe fitted with a valve;
  - The emergency spillway will comprise the use of the existing basin (Basin B) that has the capacity to accept the peak flow from the design storm event. An overland flow path to Basin B will be maintained from Basin A to allow flood event water to be directed into that basin.
- A stake shall mark the lower level of the sediment accumulation zone.

#### Basin B

An existing rock overflow is present. Water seeps through the overflow rocks progressively until a stable water level occurs in the basin. Formal monitoring of discharge from this basin is not considered necessary, although it will be inspected during the day to day monitoring of other erosion and sediment infrastructure.

#### 3.5.4 Basin Management

Based on current design guidelines, Sediment Basin A will be dewatered within 5 days after a runoff event to provide free storage capacity of at least the Settling Zone Volume. Options for dewatering are as follows:

Option 1: pumped out and used on site for dust suppression

Option 2: discharged to the perennial watercourse to the north of the quarry if the discharge criteria are met (refer s. 4). If the discharge criteria are not met the following will occur:

- flocculation of the basin water can occur using adjustment chemicals such as gypsum, lime or alum;
- prior to discharge the water must be tested by a suitably accredited laboratory (i.e. NATA accreditation).

# 4 Water Management

#### 4.1 General Quality Management

Water quality management measures will include the following general monitoring:

- Ongoing monitoring of quarry floor levels to ensure all surface water within the 'operational quarry area' is captured by Sediment Basin A;
- Monitoring of sediment levels in Sediment Basin A to ensure sediment is not above the allocated marked level on the monitoring stake;
- Monitoring of the function of the outlet system on Sediment Basin A to ensure functionality at all times.

#### 4.2 Water Quality Monitoring

One round of baseline monitoring was undertaken in the existing sedimentation pond (Pond B), and at a location upstream and downstream of the Pond B spillway. Sampling was undertaken for pH, Total Suspended Solids and Turbidity. All reported values from all three sites were within the prescribed ranges presented in Table 8. The results of the sampling are provided in Appendix B.

All surface water shall be directed toward Sediment Basin A, treated and validated prior to discharge. The adopted trigger values for discharge are based on those presented in Table 3.3.2 – 3.3.3 South - East Australia ANZECC/ARCANC (2000) 95<sup>th</sup> Level of Protection (% species) 'Trigger values for fresh water (ugl-1)' for slightly disturbed ecosystems – Lowland Rivers. These are presented in Table 8.

Table 8. Monitoring/Discharge Requirements

Parameter	Unit of Measure	Compliance Criteria
Turbidity	NTU	6 - 50
Total Suspended Solids	mg/L	<50
Hq	pH Units	6.5 - 8.0
Oil & Grease	Visual	None

Location: Sediment Basin A discharge point (refer Appendix C).

Parameters: Discharge criteria specified in Table 8.

Frequency: Prior to discharge.

As outlined in s. 3.5.4, based on current design guidelines, Sediment Basin A will need to be dewatered within 5 days after a runoff event to provide free storage capacity of at least the Settling Zone Volume.

# 5 Air Quality Management

#### 5.1 Fugitive Dust Management

Dust from the site shall be managed to prevent excessive degradation in air quality or nuisance to adjacent sites. This will be measured by limiting complaints from neighbours to less than one per year. Refer to Section 2.3.5 for Wind Erodibility Rates at site.

During operational works, dust will be controlled on-site using a site-based water truck with dribblers or sprays, as well as the following (when necessary):

- Use of misters on the rock crusher
- Temporary road construction with gravel or road base;
- · Limiting traffic on disturbed areas;
- Providing wind breaks and vegetation adjacent to stockpile areas;
- Dust covers provided on trucks and dumpers; and,
- Regular watering with the water truck.

Where wind speed exceeds about 10m/s (20 knots or 36 km/hr), or a watering spray/truck is not available, activities generating dust shall cease unless the Site Manager certifies that dust controls are operating effectively, and air quality does not cause a nuisance.

In the event that dust control is unsatisfactory, some of the following measures may be utilised:

- Inspection of existing controls and clean, upgrade or improve as required;
- Open weave barrier fencing provided on the windward side;
- Disturbed areas covered with geotextile or dust reducing polymer;
- Temporary access roads and parking areas sealed with a gravel layer; and/or,
- Construction activities to stop, disturbed areas stabilised and the dust control measures reviewed.

#### 5.2 Air monitoring

In the event of continuing complaints from neighbours, dust monitoring shall be conducted in accordance with AS3580.10.1 (2003). The Site Manager is responsible for visually monitoring air quality and the adequacies of dust control measures at least daily, and as required to ensure that the above requirements are satisfied, and performance is satisfactory. In the event of unsatisfactory dust control, as indicated by excessive complaints, the Site Manager is responsible for initiating a review of the dust controls and dust monitoring as required.

# 6 Management of Potential Environmental Impacts

This section of the SWMP acknowledges the potential environmental impacts associated with the development and presents strategies to mitigate them.

Each potential impact has a mitigation measure which is designed to provide a safeguard to protect the environment. Each safeguard requires a commitment of the operator to ensure compliance with the requirements and reporting obligations.

#### 6.1 Sediment and Erosion Controls

Person responsible	Site Operations Manager, Consulting Engineer					
Issue	Sediment and erosion controls.					
Operational policy	To prevent the displacement of sediment off-site during storm events.					
Performance criteria	Off-site discharges to comply with requirements and no visual sediment leaving the site.					
Implementation strategy	Erosion and sediment control devices shall be installed. These are to include:					
	<ol> <li>Install temporary erosion and sediment controls</li> <li>Construct Sediment Basin A</li> <li>Construct earth bunds around the upslope portion of the site to divert clean water away</li> <li>Maintain ground profile within the quarry floor to ensure surface water is directed to surface water channel and onwards to Sediment Basin A</li> <li>Maintain the integrity of the surface water swale to ensure flow occurs to the Sediment Basin A</li> </ol>					
Monitoring	Visual inspections to be carried out weekly and after rainfall events to ensure that erosion measures are in place, operational and suitable for the activities taking place.					
	Surface water quality to be monitored during storm events.					
Auditing	Management shall undertake visual inspections monthly and after storm events that control measures are in place and properly maintained.					

### Reporting

Monitoring of sediment basin as per parameters in Table 8 to be recorded.

Reporting required as part of annual returns (if required).

### Identification of incident or failure

- 1. Signs of erosion on site
- 2. Damaged or failed erosion control devices
- 3. Falling water quality
- 4. Build-up of sediment

### Corrective action

Apply remedial measures to improve sediment and erosion control measures, for example hay bales, silt fences and flocculation of sediment basins or use of water for dust suppression.

### 6.2 Surface Water Quality

Person responsible

Issue

Operational policy

Performance criteria

Site Operations Manager, Consulting Engineer

Surface water quality

To establish background water quality conditions and maintain these conditions wherever practicably possible during operation of the quarry.

All water discharged from the site will comply with the following criteria:

Parameter	Unit of Measure	Compliance Criteria
Turbidity	NTU	6 - 50
Total Suspended Solids	mg/L	<50
pН	pH Units	6.5 - 8.0
Oil & Grease	Visual	None

### Implementation strategy

- Earth bunding to be installed on the upslope sides of the 'operational quarry area' to direct all surface water run-off away from the quarry area
- Sediment Basin A to be fitted with a valve or other means to facilitate the recycling and/or discharge of water. Recycle and discharges are only to occur once discharge criteria is tested and met.
- Where pH or TSS does not meet discharge criteria, sediment basin to be limed and/or flocculated until both criteria are met.
- Basins to be emptied within 5 days of cessation of rainfall.

Monitoring Auditing Turbidity, Total Suspended Solids, pH, Oils & Grease.

Management to audit water quality results to ensure all discharges comply with the performance criteria.

### Reporting

Results of all field and laboratory sampling associated with a controlled discharge event from Sediment Basin A are to be kept on site for inspection by local and State government representatives.

Annual returns to be compiled and submitted to EPA and LCC (if required).

### Identification of incident or failure Corrective action

Degradation of surface water quality at the sediment basin outside of the ranges of the discharge criteria prescribed in Table 8.

If pH is detected outside the criteria range, then such waters will be contained, and the pH adjusted to within the range 6.5-8.5 prior to release.

If total suspended solids exceed the water quality criteria, then water will be contained on-site for sufficient time to allow suspended solids to settle out prior to release or treated with a flocculent.

Water will not be released in greases or oils are observed.

#### 6.3 **Dust Management**

### Person responsible Site Operations Manager, Consulting Engineer

Issue

Minimisation of dust movement off-site.

Operational policy

To achieve acceptable air quality standards through the control of the movement of dust off-site from site operations.

Performance criteria

Complaints relating to dust to be less than 1 per year.

If dust monitoring is implemented, then:

Ambient air quality should not deteriorate by more than 30% over a period of 7 consecutive days. Dust deposition at nearby receptors should not exceed 4 g/m² month (2g/m² month above ambient).

### Implementation strategy

The minimisation of the movement of dust off-site will be achieved through the following on-site practices:

- Stockpiling will only be undertaken in designated areas.
- 2. An on-site water cart will be available at all times.
- 3. Crushing will only be undertaken with equipment fitted with dust suppression system(s).
- 4. Water cart will apply water to all roads, stockpiles and identified dust generating areas as required to minimise the generation of dust.
- 5. Work on-site will cease if wind speed exceeds 10 m/s unless all dust mitigation (such as a water cart) measures are in place and functioning adequately.

### Monitoring

Daily inspections will be carried out to verify that dust mitigation measures are being implemented. Dust monitoring will be conducted upon receipt of continued (>1 per week) complaints by sensitive receivers. If dust monitoring is to take place, the following will occur:

# Auditing Reporting Identification of incident or failure Corrective action

- Temporary dust deposition gauges will monitor the movement of dust off-site at the neared residences adjacent to the proposed workings, given the predominant wind direction.
- Monitoring will be undertaken in accordance with AS3580.10.1 (2003)
   Management to examine the complaints register weekly and review corrective actions taken.
  - The operator is to notify the NSW EPA of a possible environmental nuisance on receipt of 3 or more dust complaints in 24 hours.
  - Reports are to be made available to either the EPA or Council upon request.
  - Complaints by residents are to be recorded in complaints register and details included in any annual reporting.

Any dust related complaints by residents will indicate a failure of the dust control measures.

Locate the source of the dust and implement the following measures:

- Apply water sprays using water cart
- Cover or water exposed areas
- If dust persists, cease the dust generating activities.

All dust complaints to be addressed in consultation with Lismore City Council officers.

### 7 References

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# Appendix A Basin Size Volume Calculations Site Plans

### **SWMP Commentary, Standard Calculation**

Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

### 1. Site Data Sheet

Site name: River Bank Road Quarry

Site location: River Bank Road, Monaltrie, NSW

**Precinct: Existing Quarry** 

Description of site: Existing Hard Rock Quarry

Site area			Site		
	Α	В			Remarks
Total catchment area (ha)	3.4	0.2			
Disturbed catchment area (ha)	3.4	0.2			

Soil analysis

Soil landscape	Ge (	Georgia	1)	DIPNR mapping (if releva	nt\
Soil Texture Group	F	F		Sections 6.3.3(c), (d) and	

Rainfall data

Design rainfall depth (days)	5	5	See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	95	95	See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	95.3	95.3	See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	67.5	67.5	See IFD chart for the site
Rainfall erosivity (R-factor)	5E+06	5E+06	Automatic calculation from above data

### Comments:

### **SWMP** Commentary, Standard Calculation

### 2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y, tc} \times A$$

where:

Q<sub>v</sub> is peak flow rate (m<sup>3</sup>/sec) of average recurrence interval (ARI) of "Y" years

is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F

Fy is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)

A is the catchment area in hectares (ha)

I<sub>y, tc</sub> is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration ( $t_c$ ) = 0.76 x (A/100)<sup>0.38</sup> hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

#### Peak flow calculations, 1

Site A (ha)	tc	Rainfall intensity, I, mm/hr							
	(ha)	(mins)	1 yr,tc	5 yr,tc	10 yr,te	20 yr,tc	50 yr,tc	100 <sub>yr,tc</sub>	Cta
A	3.4	13	69.5	108	119	134	153	168	0.8
В	0.2	4	69.5	108	119	134	153	168	8.0
									_
									_

### Peak flow calculations, 2

Freque	Frequency							
ARI yrs	factor	Α	В					Comment
yrs (F <sub>y</sub> )	(m³/s) (m³/s	(m <sup>3</sup> /s)	(m³/s)	(m <sup>3</sup> /s)	(m³/s)	(m3/s)		
1 yr, lc	0.8	0.420	0.025					
5 yr. ts	0.95	0.776	0.046					
10 yr. tc	1	0.900	0.053					
20 yr, tc	1.05	1.064	0.063					
50 yr, to	1.15	1.330	0.078					
100 yr. tc	1.2	1.524	0.090					

### 4. Volume of Sediment Basins, Type D and Type F Soils

Basin volume = settling zone volume + sediment storage zone volume

### **Settling Zone Volume**

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y-\text{\%ile, x-day}} (m^3)$$

where:

10 = a unit conversion factor

C<sub>v</sub> = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

### Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

### **Total Basin Volume**

Site	C,	R x-day y-%ile	Total catchment area (ha)	Settling zone volume (m³)	Sediment storage volume (m³)	Total basin volume (m³)
Α	0.79	95.3	3.4	2559.758	1280	3839.637
В	0.79	95.3	0.2	150.574	75	225.861

## Appendix B Results of Baseline Surface Water Monitoring

Graham Lancaster Laboratory Manager

# **RESULTS OF WATER ANALYSIS**

3 samples supplied by Env Solutions Pty Ltd on 4th June, 2019. Lab Job No.12419 Samples submitted by Tony Coyle. Your Job: River Bank Quarry PO Box 248 BALLINA NSW 2478

Parameter	Methods reference	Sample 1	Sample 2	Sample 3
		Sed. Pond	SW 1	SW 2
	Job No.	12419/1	12419/2	12419/3
Н	APHA 4500-H*-B	96.9	7.19	7.32
Total Suspended Solids (mg/L) Turbidity (NTU)	GFC equiv. filter - APHA 2540-D	41	17	12
		7	7	-

### Notes:

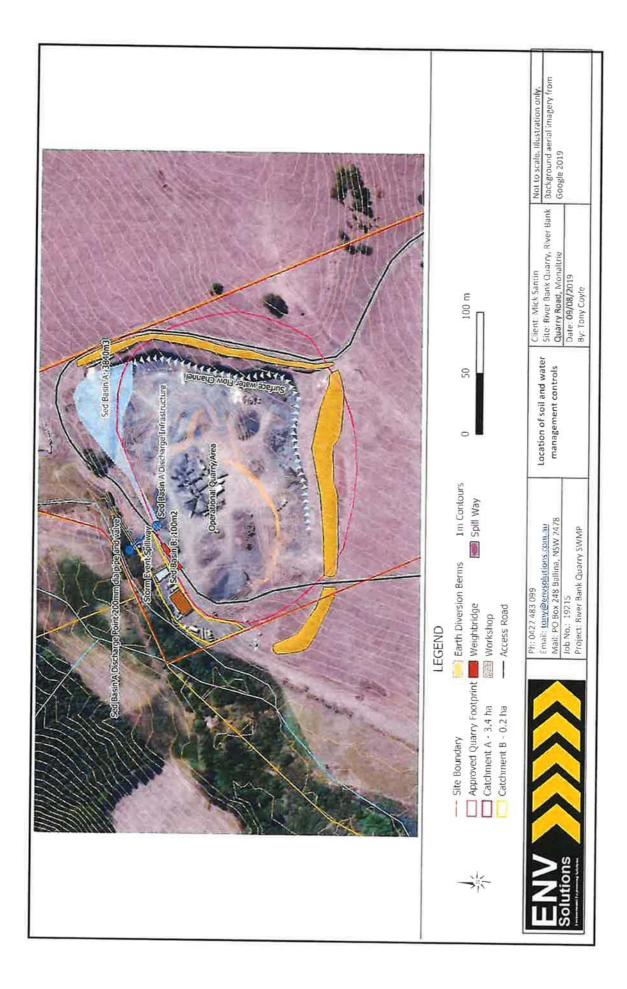
- 1. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre) = 1000 ppb (part per billion).
- 2. Analysis performed according to APHA (2017) 'Standard Methods for the Examination of Water & Wastewater', 23rd Edition, except where stated otherwise.
  - 3. Analysis conducted between sample arrival date and reporting date.
    - 4. \*\* NATA accreditation does not cover the performance of this service.
      - Denotes not requested.
- 6. This report is not to be reproduced except in full.
- 7. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
  - 8. This report was issued on 06/06/2019.





Environmental Analysis Laboratory, Southern Cross University, Tel. 02 6620 3678, website: scu.edu.au/eal

### Appendix C Surface Water Management Controls





Env Solutions Pty Ltd ABN 58 600 788 814

PO Box 248 Ballina, NSW 2478 Australia T +61 7 3173 8000

F +61 7 3173 8001 E admin@envsolutions.com.au W www.envsolutions.com.au

# Appendix D

**Basin treatment** 

### pH Treatment

- Treat for pH prior to T.S.S.
- Hydrochloric acid (32% Muriatic) or sulfuric acid will be used to lower pH when the pH exceeds 8.5.
- Agricultural Lime (Aglime) or Hydrated lime will be used to treat water with a pH less than 6.5.
- Determine the volume of water in basin.
- Determine percentage of lime or acid required by taking a 10 litre sample of basin water and adding a known amount of lime or acid (initially 0.004%). If the pH is still not acceptable, vary the amount of lime or acid until within the limits.
- Repeat the above procedure to confirm the amount of acid or lime required.
- Once the required percentage has been determined, calculate the actual amount of lime or acid to be added by multiplying the volume of water in the basin by the determined percentage.
- Add the required amount of lime or acid to the basin.
- Mix the water in the sediment basin well.
- → Test water to confirm it is within pH of 6.5 to 8.5.

### **TSS Treatment**

- If the basin requires treatment/flocculation (e.g. T.S.S. >50 mg/l), gypsum is to be immediately applied evenly
  across the top of the water at the manufacturer's recommended dosage initially, then at an acceptable rate
  should more flocculants be required.
- The basin should be monitored daily after flocculation until desired TSS is achieved and to assist in determination of optimal dosage levels.
- Method of application involves mixing in a drum with water and spraying across the whole surface of the basin.
- When spraying flocculants, the mixture must hit the water at between 10 to 20 degrees to increase surface areas exposure to the water column.
- When using liquid gypsum such as "Hydra-Gyp" the solution must be mixed before use to ensure gypsum is
  evenly suspended throughout mixture. This is best achieved using an aeration device at 3 bars of pressure for
  approximately 15 minutes.
- Flocculation of sediment basins must occur within 24 hours of the conclusion of each rain event. Ongoing visual monitoring of the basins should occur during this time.
- Test water to confirm it is less than 50 mg/L.
- Alternative flocculation agents may be investigated if gypsum is found to be unsuitable. Use of alternative flocculating agent will only occur after approval from the Council.

# Appendix E

Rehabilitation Plan

### Aim

To provide a plan to restore the site to as near as possible to the original rural landscape after quarrying activities have ceased.

### **Objectives**

The objectives of the rehabilitation plan are to:

- Describe topsoil stripping and stockpiling methods
- Describe the site preparation, revegetation and weed control methods required
- Describe the maintenance activities
- Provide a schedule for the proposed works

### Topsoil stripping and stockpiling

The following measures should be adopted for soil stripping and stockpiling:

- Soils should be stripped in a slightly moist condition (neither too dry nor wet) thus reducing dust generation and deterioration in topsoil quality.
- Topsoil should be stockpiled only when disturbed areas are not available for immediate rehabilitation.
- Soil stockpiles should be constructed to minimise the stockpile area in a discrete two metre high (maximum) pile, with a working face battered down at 30 degrees.
- Stockpiles should be trimmed, deep ripped to 500 mm, immediately sown with permanent pasture species, and fertilised.

### Site preparation

- All machinery and infrastructure will be removed from the quarry area.
- The perimeter of the quarry will be fenced for safety and to exclude stock and fauna.
- No machines will be allowed inside the restoration area other than for works associated with planting and weeding.
- The face of the quarry would be backfilled with suitable material to form a 2 in 1 batter, as shown by Figure E1.
- The floor of the quarry and access roads are to be ripped/roughed to a depth of 250 mm to key in topsoil.
- Topsoil stripped from the site prior to the quarry operations commencing will be respread across the floor and batters to form a minimum of 100 mm deep layer.
- Sediment and erosion controls should be maintained until the site is stable.

### Revegetation

The area to be revegetated has been divided into two zones, as shown on Figure E1:

- Zone A is the batters to be planted with native trees and shrubs
- Zone B is the quarry floor and access roads to be revegetated with pasture grasses suitable for grazing

At this stage, it is not known the final landform of the quarry pit prior to rehabilitation, so the extent of the two zones are to be confirmed onsite, in consultation with Council, based on site conditions, prior to commencing revegetation works. Revegetation of Zone A will be via a mix of planting tube stock or hiko cells and seeding. Revegetation of Zone B will be via seeding.

Seeding and planting details are provided below. The desired density of each stratum is provided in the species table. This may be altered in consultation with Council.

### Seeding

Seed is to be purchased from local suppliers or collected locally. All seed collection, management, cleaning and storage will be in accordance with *Guideline 5: Seed Collection from Woody Plants for Local Revegetation (FloraBank, 1999)*.

Seeding will be done prior to planting. Seed broadcasting is to be done by hand or mechanical means at the sowing rates indicated below. The seed will be raked following sowing to cover the seed and improve success rates. The seed will be watered weekly until established.

### **Planting**

Ideally, planting will be done at the start of autumn but due to the mild climate of the area, planting at any time during the year should not cause a significant problem. The tube stock, where possible, should be sourced from nurseries that use local seed stock, ideally from within the Lismore area.

The planting method includes:

- Soak all plants before planting.
- Make a hole large enough for the tube stock.
- Add water crystals and a slow release fertiliser suitable for native species.
- Remove the plant from the container being careful not to damage the roots.
- Insert the plant into the hole so that the base of the stem is a little below the surrounding ground.
- Firm the soil around the root ball to remove air gaps.
- Water the plant with at least 2 L of water.
- Mulch the plant using native tree mulch, weed mats or saw dust. Make sure the mulch is not against the stem
  of the plant.
- Install a protective guard using wooden/bamboo stakes or milk carton.
- Water weekly for the first month. Further watering may be required if there is no rain.

### Species list

Recommended species and planting densities for Zone A are provided below. The recommended species are based on those recommended in the EIS. If the recommended species are unavailable consult Council for suitable replacement species.

In Zone B, it is recommended to sow a mixture of ryegrass, legumes and tropical grasses. Sowing rates are as recommended by supplier but it is intended to achieve 90% cover.

Table E.1 Recommended species for Zone A

Species List	Seed Rate <sup>1</sup>	Plant Number <sup>1, 2</sup>	Required Density <sup>1</sup>
Upper storey/canopy	2 kg/ha	500	1/15 m <sup>2</sup>
Brush box (Lophostemon suaveolens)			
Flooded gum (Eucalyptus grandis)			
Forest Red Gum (Eucalyptus tereticornis)			
Tallowood (Eucalyptus microcorys)			
Teak (Flindersia australis)			
Green Kamala (Mallotus claoxyloides)			
Red Kamala (Mallotus philippensis)			
Silty Oak ( <i>Grevillia robusta</i> )			
Crows Ash (Pentaceras australe)			

Species List	Seed Rate <sup>1</sup>	Plant Number <sup>1, 2</sup>	Required Density <sup>1</sup>
Brush Ironbark ( <i>Bridelia exaltata</i> )			
Foambark Tree (Jagera pseudorhus)			
Small-leaved tuckeroo (Cupaniopsis parvifolium)			
Red-fruited kurrajong (Sterculia quadrifida)			
Mid storey	2 kg/ha	500	1/10m <sup>2</sup>
Native Holly (Alchomea ilicifolia)			
Brush Muttonwood (Rapanea howittiana)			
Banana Bush (Ervatamia angustisepala)			
Sweet Pittosporum (Pittosporum undulatum)			
Sandpaper Fig (Ficus fraseri)			
Native cascarilla (Croton verreauxii)			
White bolly gum (Neolitsea dealbata)			
Scaly myrtle (Austromyrtus hillii)			
Sterile Cover Crop	10 kg/ha	NA	NA
Rye (Lolium rigidum)		i i	
Japanese Millet (Echinochloa esculenta)			

<sup>&</sup>lt;sup>1</sup> This relates to the storey not the individual species.

### Maintenance and monitoring

Regular maintenance activities will include:

- Follow-up watering
- Repairing damaged tree guards
- Monitoring survival rates and installing replacement plants where required to achieve the densities above
- Weed control and continued follow-up spot spraying, hand removal, etc as required

### Weed control

Weed control is vital to the success of the revegetation. The noxious and environmental weed species likely to be at the site and their recommended control method are provided below.

Table E.2 Weed control

Scientific Name	Common	Noxious	S Control Methods					
Name		Cut and paint <sup>1</sup>	Scape and Paint <sup>1</sup>	Direct Inject <sup>1</sup>	Spot Spraying <sup>1</sup>	Manual Removal		
Ageratina adenophora	Crofton Weed	Class 4				√2, (4+7)	1	
Ageratum houstonianum	Blue Billy Goat Weed					1	1	
Baccharis halimifolia	Grounsel Bush	Class 3	1/4			√7	√3	
Bidens pilosa	Farmers Friends					1	1	

<sup>&</sup>lt;sup>2</sup> This assumes half the desired density will be achieved by seeding.

### Reporting

Reporting will be required at the following stages:

- Completion of initial planting
- After each maintenance and monitoring period
- At completion of maintenance and monitoring period

### Rehabilitation schedule

The following table provides an indicative schedule for the revegetation works. Maintenance and monitoring may continue for longer than five years depending on the success of the revegetation. Revegetation will be considered complete once the densities in the species table have been achieved. Completion of the revegetation works is the responsibility of the Quarry Manager but it is recommended that a qualified bush regenerator contractor be engaged to do the works.

Table E.3 Rehabilitation schedule

Task*	Year 1	Year 2	Year 3	Year 4	Year 5
Site Preparation					
Seeding/Planting					
Maintenance/Monitoring					

See details for requirements of each task

<sup>&</sup>lt;sup>1</sup> Glyphosphate unless specified; <sup>2</sup> Seedlings; <sup>3</sup> Saplings; <sup>4</sup> Mature plants; <sup>5</sup> Large infestations; <sup>6</sup> Small infestations; <sup>7</sup> Grazon; <sup>8</sup> Metsulfuronmethyl; <sup>9</sup> Glyphosate & Metasulfuron-methyl mix; <sup>10</sup> Penetrant; <sup>11</sup> Bromoxynil

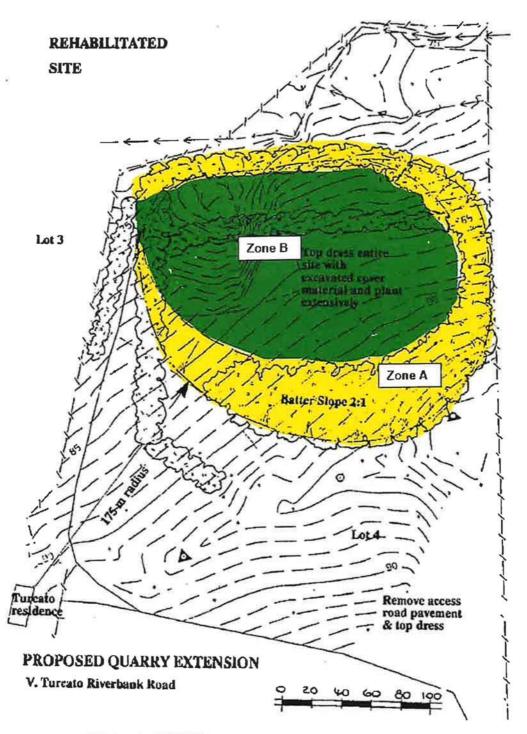


Figure E.1 Rehabilitation plan (BJM 1992)

# Appendix F

**Notification list** 

Table F.1 Drilling, blasting and crushing notification list

Property	Lot/DP	Address	Confirmed notification not required	Notified
1	Lot 3 DP 701523	96 Riverbank Road, Monaltrie		
2	Lot 2 DP 701527	55 Chillcott Street, Monaltrie		
3	Lot 1 DP 7015237	55 Chillcott Street, Monaltrie		
4	Lot 1 DP 1249996	56 Chillcott Street, Monaltrie		
5	Lot 1 DP 730425	50 Riverbank Road, Monaltrie		
6	Lot A DP 979537	39 Riverbank Road, Monaltrie		
7	Lot 4 DP 730425	589 Wyrallah Road, Monaltrie		
8	Lot 1 DP 530135	495 Wyrallah Road, Monaltrie		
9	Lot 1 DP 1249996	124 Riverbank Road, Monaltrie		
10	Lot 2 DP 730425	34 Riverbank Road, Monaltrie		
11	Lot 3 DP 730425	2 Riverbank Road, Monaltrie		

# Appendix G

Noise Impact Assessment

NGEN

CONSULTING

Ingen Consulting Pty Ltd | ABN 18 623 948 112 Alstonville NSW 2477 | 0417 264 987 michiel@ingenconsulting.com.au www.ingenconsulting.com.au



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Michiel Kamphorst, MSc BSc RPEng RPEQ NER

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Santin Quarry Products

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Malcolm Scott

Approved for use by:

Name: Michiel Kamphorst

Signature:

Date: 30/6/19

### Ingen Consulting information

Ingen Consulting Pty Ltd, ABN 18 623 948 112
Alstonville NSW 2477
+61 4 1726 4987
michiel@ingenconsulting.com.au
www.ingenconsulting.com.au

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### Riverbank Quarry Noise Impact Assessment

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### 1. INTRODUCTION

Ingen Consulting P/L has been engaged by Santin Quarry Products to prepare a Noise Impact Assessment (NIA) for Riverbank Quarry at Lot 4 DP 701527, No. 72 Riverbank Road, Monaltrie, NSW. This NIA builds on previous documentation prepared for the quarry.

#### 1.1. Scope

This NIA is prepared for Rosehill Quarry at Lot 4 DP 701527, No. 72 Riverbank Road, Monaltrie, NSW. The NIA is to assess the proposed development for compliance with the 2017 NSW Government's Noise Policy for Industry (NPfI).

This NIA has been prepared in accordance with the following standards, guidelines and policies:

- NSW Environment Protection Authority Noise Policy for Industry, October 2017
- Australian Standard 1055 series (Acoustics Description and measurement of environmental noise)
- Australian Standard 2659 series (Guide to the use of sound measuring equipment)

### 1.2. Site description

The subject site is located along Riverbank Road, in Monaltrie, NSW. The subject site is shown in Figure 1 and comprises Lot 4 DP 701527 (continuous red line in Figure 1). The adjoining Lot 4 DP730425 and Lot 3 DP 701527 (dashed red line in Figure 1) is also owned by the quarry. The aerial photo in Figure 2 shows the quarry pit, with the crusher and screeners in the centre of the pit, and an excavator working in the southwestern corner.

The quarry floor has an elevation between approximately 11.5 and 12m AHD, with the top of the rock face to the southeast at approximately 32 to 33m AHD. The quarry pit is located on the side of a hill slope, with surrounding hilltop elevations ranging from approximately 50 to 60m AHD. The surrounding land uses are rural in nature, with grass pastures and a chicken farm. All lots appear to contain occupied residential dwellings. Lot 2 DP1249996 does not have a dwelling entitlement.

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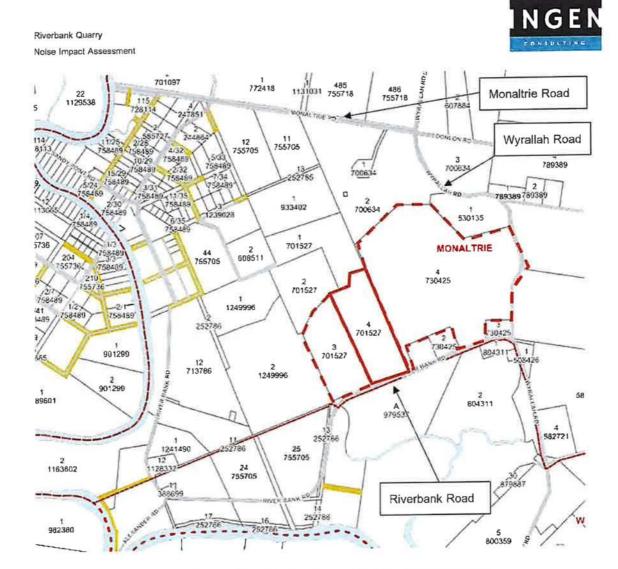


Figure 1 | Site location, Source of map: Lismore IntraMaps 2019





Figure 2 | Aerial photo of quarry (undated), Source: Lismore IntraMaps 2019

### 1.3. Proposed development

The existing quarry on the subject allotment was granted consent in May 1993 for an annual production rate not exceeding  $15,000\,\mathrm{m}^3$ , equivalent to 40,500 tonnes crushed annually, with an approved quarry duration of 25 years. Subsequently, 5 modifications to the consent have been approved. The current approval limits the noise emissions as follows: " $L_{A10}$  noise levels emitted from the quarry and all plant and equipment shall not exceed the background noise levels by more than 5 dB(A) when measured at any affected residence." This NIA has been prepared in conjunction an application for a modification (Section 4.55 application) to seek approval to extend the life of the quarry until 12 May 2036.

Quarry works include blasting, ripping, crushing, stockpiling, loading and haulage of material.

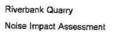
### 1.4. Abbreviations and definitions

Commonly used terms and abbreviations throughout this report are:



### Table 1 | Abbreviations and definitions

Term/abbreviation	Definition
A-weighting	Adjustment made to sound level measurements to approximate the response of the
	human ear.
Ambient noise	The all-encompassing noise associated with a given environment. It is the composite
	of sounds from many sources, both far and near.
Amenity noise level	A noise level intended to limit continuing and cumulative increases in noise level due
	to consecutive developments.
Annoyance	An emotional state connected to feelings of discomfort, anger, depression and
Manager (1996) * (2 and Caralysis)	helplessness. It is generally measured by means of the ISO15666 defined
	questionnaire (EEA, 2010).
Assessment period	The period in a day over which assessments are made: day, evening, or night.
Assessment background	The single-figure background level representing each assessment period.
level	1 A D D D D D D D D D D D D D D D D D D
Background noise	The underlying level of noise present in ambient noise, generally excluding the noise
And reference to the state of	source under investigation, when extraneous noise is removed. This is described
	using the L <sub>AF90</sub> descriptor.
Best available technology	Equipment, plant and machinery incorporating the most advanced and affordable
achievable (BATEA)	technology available to minimise noise output.
Best management practice Adoption of particular operational procedures that minimise noise whi	
(BMP)	productive efficiency.
C-weighting	Adjustment made to sound level measurements that takes into account the low-
	frequency components of noise within the audibility range of humans.
Compliance	The process of checking that source noise levels meet with the noise limits in a
	statutory context.
Construction activities	Activities that are related to the establishment phase of a development and that wil
	occur on a site for only a limited period of time.
Day	The period from 7am to 6pm (Monday to Saturday) and 8am to 6pm (Sundays and
	public holidays)
Decibel (dB)	A measure of sound level. The decibel is a logarithmic way of describing a ration
	The ratio may be power, sound pressure, voltage, intensity or other. In the case of
	sound pressure, it is equivalent to ten times the logarithm (to base ten) of the ration
	of a given sound pressure squared to a reference sound pressure squared.
EP&A Act	Environmental Planning and Assessment Act 1979.





Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may		
	include construction and traffic generated by holiday periods and by special events		
	such as concerts or sporting events. Normal day traffic is not considered to be		
	extraneous.		
Feasible and reasonable	Noise mitigation that can be engineered and is practical and the benefits of which		
mitigation	outweigh adverse social, economic and environmental effects, including cost.		
Greenfield site	Undeveloped land.		
Impulsive noise	Noise with a high peak of short duration or a sequence of such peaks		
Industrial noise source	Typically includes manufacturing, extractive industry, commercial use, warehouse,		
	maintenance and repair, intensive agricultural and livestock, utility and reticulation		
	services.		
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 decibels.		
L <sub>AF90, 15min</sub>	The A-weighted sound pressure level measured using fast time weighting that is		
	exceeded for 90% of the time over a 15-minute assessment period. This is a measure		
	of background noise.		
L <sub>Aeq, T</sub>	The time-averaged sound pressure level. The value of the A-weighted sound pressure		
	level of a continuous steady sound, that with a measurement time interval T, has the		
	same mean square sound pressure level as a sound under consideration with a level		
	that varies with time.		
Low frequency	Noise containing major components in the low-frequency range (10Hz to 160 Hz).		
Median	The middle value in a number of values sorted in ascending or descending order. For		
	an odd number of values this is the middle value. For an even number of values this		
	is the arithmetic average of the two middle values.		
Noise limits	Enforceable noise levels that appear in conditions on consents and licences.		
Night			
	The period from 10pm to 7am (Monday to Saturday) and 10pm to 8am (Sundays and public holidays).		
Noise-sensitive land uses			
TOTAL TO TAIN USOS	Land uses that are sensitive to noise, such as residential areas, churches, schools and recreation areas.		
Operator			
Project noise trigger levels	Noise-source manager.		
(PNTL)	Target noise levels for a particular noise-generating facility. They are based on the		
Proponent	most stringent of the project intrusiveness level and the project amenity noise level.		
TAN SHI HASH SONOL	The developer of the industrial noise source.		
Rating background level	The overall, single-figure background level representing each assessment period over		
(RBL)	the whole monitoring period. This is the level used for assessment purposes.		
Receiver	The noise-sensitive land use at which noise from a development can be heard.		
Tonality	Noise containing a prominent frequency and characterised by a definite pitch.		



### 2. BACKGROUND NOISE

### 2.1. Measurement procedure

An unattended noise survey has been carried out at the three worst affected receivers, which are the dwellings located at 55 Chilcott Street (R1), 41 Chilcott Street (R2) and 50 Riverbank Road (R5) in Monaltrie, NSW (refer to Figure 3). These locations have been selected as the testing and modelling carried out by Vipac in 2015 show these as worst affected. Although the background levels at residences along Wyrallah Road are likely higher due to traffic noise, background testing at these locations was not deemed warranted as they are located further away from the quarry and have a lesser noise impact than the residences located closer.

Table 2 | Instrumentation

Receiver	Instrument	Serial #	Calibration Date
R1: 55 Chilcott Street	Bruel & Kjaer 2250 Sound Level Meter	2449940	Oct 2018
R2: 41 Chilcott Street	Bruel & Kjaer 2250 G4 Sound Level Meter	3008548	Sept 2017
R5: 50 Riverbank	Bruel & Kjaer 2250L Sound Level Meter	2602785	Oct 2018
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Bruel & Kjaer 4231 Calibrator	2292735	Oct 2018





Figure 3 | Unattended test locations

Measurements were made in general accordance with procedures described in:

- Australian Standard AS 1055.1-1997: 'Acoustics Description and measurement of environmental noise - General procedures'
- The NSW Government Noise Policy for Industry (Oct 2017) (NPI).

The noise loggers used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters" (1990) as Type 1 precision sound level meters and have an accuracy suitable for both field and laboratory use.

The loggers' calibrations were checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4231. No significant system drift occurred over the measurement period.

The noise loggers and calibrator have been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates by a NATA certified facility. The internal test equipment used is traceable to the National Measurement Laboratory at CSIRO, Lindfield, NSW.



The noise loggers were located within 30m of each of the residential dwellings in the direction of the quarry in a secure location as far as practical from trees.

Bruel & Kjaer outdoor microphone kits were fitted to the noise loggers and the microphones located at a height of 1.2 - 1.5m. The clocks on the noise loggers were synchronized and set to record 15 minute sampling periods with an 'A' frequency weighting and fast response over a period of 10 days from the  $7^{th} - 17^{th}$  of June 2019.

The quarry has not been able to shut down to enable background noise monitoring due to demand for products from the quarry. The monitoring was conducted over a 10-day period with a weekend and a long weekend (5 days non-quarry) to compare noise levels between quarry operating days and non-operating days. Attended observations were conducted during quarry operations and on a non-quarry day.

At the end of the monitoring period, data was downloaded into Bruel & Kjaer 7815 Noise Explorer environmental noise software and Microsoft Excel for analysis.

#### 2.2. Weather conditions

Rain and wind data were obtained from the Bureau of Meteorology Lismore Airport weather station approximately 4 kilometres to the north-west. Weather conditions were generally good for noise monitoring with some isolated showers (mainly at night) and a storm on the night of the 16<sup>th</sup>. There were a few periods where wind was above 5m/s. Data that was affected by rain and wind has been deleted from background noise level calculations.

#### 2.3. Measurement results

Summaries of background noise levels at receiver locations are presented in Table 3, Table 4 and Table 5 as well as Figure 4 below. All levels are in dB(A). Details of numerical data are provided in Appendix A.

Table 3 | Summary of day-time background noise levels

			Day Pe	riod Rec	eiver Back	ground N	oise Wonit	oring Sum	шагу -	Idile 201		
Receiver	7 <sup>th</sup>	gth	9 <sup>th</sup>	10 <sup>th</sup>	11 <sup>th</sup>	12 <sup>th</sup>	13 <sup>th</sup>	14 <sup>th</sup>	15 <sup>th</sup>	16 <sup>th</sup>	Non-Quarry RBL	All days RBI
	Fri	Sat	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Sun		
	Quarry	Non	Non	Non	Quarry	Quarry	Quarry	Quarry	Non	Non		
R1	IVD	31.0	32.0	32.9	35.1	35.1	34.3	31.5	IVD	32.5	32.0/35	32.7/35
R2	IVD	31.7	32.0	32.7	36.3	37.2	37.5	37.1	IVD	31.6	31.9/35	34.5/ <b>35</b>
R5	IVD	30.5	31.1	30.1	29.8	32.2	33.4	32.4	IVD	29.3	30.6/35	30.8/35

The day RBL has been adjusted to the NPfl day period minimum of 35 dB(A).

IVD - Insufficient Valid Data



Table 4 | Summary of evening time background noise levels

127 E					.Broania iti	STATE INIONITE	oring Summ	ary - June	2019		
Receiver	7 <sup>th</sup>	8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>	11 <sup>th</sup>	12 <sup>th</sup>	13 <sup>th</sup>	14 <sup>th</sup>	15 <sup>th</sup>	16 <sup>th</sup>	RBL
	Fri	Sat	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
R1	25.1	23.8	25.8	26.5	28.0	26.5	29.6	27.2	27.4	IVD	26.5/3
R2	24.9	24.4	27.1	26.7	29.2	29.3	31.1	27.9	25.3	IVD	27.1/3
R5	25.0	24.4	23.6	26.9	23.0	24.1	27.4	25.2	25.8	IVD	25.0/3

The evening RBL has been adjusted to the NPfl evening period minimum of 30 dB(A).

IVD - Insufficient Valid Data

Table 5 | Summary of night-time background noise levels

Receiver	7 <sup>th</sup>	8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>	11 <sup>th</sup>	12 <sup>th</sup>	13 <sup>th</sup>	14 <sup>th</sup>	15 <sup>th</sup>	16 <sup>th</sup>	RBL
	Fri	Sat	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	NDL
R1	IVD	21.7	22.0	23.6	22.2	25.1	27.3	IVD	IVD	IVD	22.9/30
R2	IVD	21.3	22.9	24.4	23.1	25.9	25.7	IVD	IVD	IVD	23.7/30
R5	IVD	22.4	19.2	20.0	17.9	21.6	22.3	IVD	IVD	IVD	20.8/30

The night RBL has been adjusted to the NPfI night period minimum of 30 dB(A).

IVD - Insufficient Valid Data



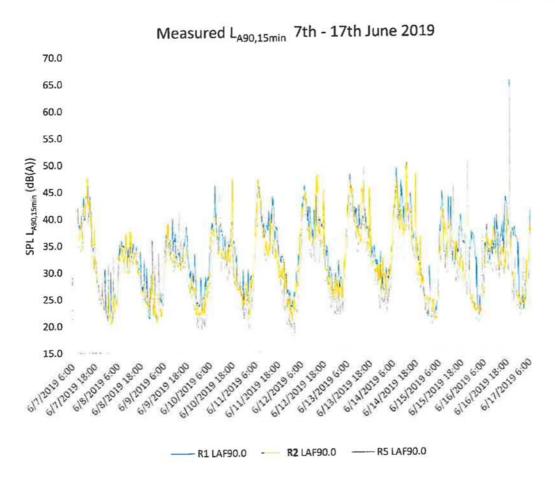


Figure 4 | Measured  $L_{AF60,15\,min}$   $7^{th}-17^{th}$  June 2019



# 3. PROJECT NOISE TRIGGER LEVEL

The project trigger noise level (PTNL) provides a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures.

The PTNL, feasible and reasonable mitigation, and consideration of residual noise impacts are used together to assess noise impacts and manage the noise from a proposal or site. It is the combination of these elements that is designed to ensure that acceptable noise outcomes are determined by decision makers.

The PTNL is defined as the lower value of the intrusiveness noise level and the amenity noise level. The intrusiveness noise level is calculated by adding 5 dB to the RBL, and is defined as a  $L_{Aeq,15min}$ . As described in section 2.3, the RBL's for the nearest sensitive receivers are 35/30/30 dB(A) (day/evening/night), which results in intrusiveness noise levels of 40/35/35 dB(A)

Table 2.2 of the NPfl provides amenity noise levels for various land uses. The rural residential recommended amenity noise levels are 50/45/40 dB(A).

Adopting the lesser of the intrusiveness noise level and the amenity noise level (as per section 2.1 of the NPfI), the project trigger noise levels for this development are determined to be **40/35/35** dB(A) (day/evening/night).



# 4. OPERATIONAL NOISE EMISSIONS

Noise emission modelling is carried out to estimate the likely project noise levels at the nearest sensitive receivers. This modelling will be used to assess the noise impact against the project trigger noise levels. The assessment of the significance of residual noise levels and terminology used is as per section 4 of the NPfl.

#### 4.1. At-source mitigation

Following previous equipment noise emission testing at the quarry, the quarry operator has carried out at-source mitigation works and management measures, between January 2020 and March 2020.

These mitigation works and management measures included the following:

- Insulation covers over loud machine components of the crushers and screens (examples in Figure 7 and Figure 8)
- Gentle placement of rocks in the hopper (Figure 6)
- Presence of large stockpiles roughly in line between the crushing and screening setup and R2 (Figure 9)

Further parameters to which these tests were subject are:

- 300-minus basalt rock was being crushed and screened
- There was no loader working near the quarry face
- No haulage or quarry trucks were operating
- Noise tests were carried out in between rain events
- Estimated Pasquill Stability Class B
- Wind direction was south-westerly
- Wind speeds were between 0 and 3 m/s, depending on the measurement location.

Any conclusions drawn based on these tests are subject to the quarry being operated in this manner.

#### 4.2. Attended testing

Calibration testing was intended both in the paddock to the East of the quarry and at R2 (41 Chilcott Street). The quarry operations were not audible east of the quarry, whereas during the July 2019 calibration monitoring the  $L_{Aeq}$  levels measured ranged from 48 to 52 dB(A).

At location R2 (41 Chilcott Street) the measured sound levels at the site (after removal of the background noise) varied between 38 dB(A) and 42 dB(A). It was not possible to measure background noise at that time as the quarry was operational, but from the estimated level of the environmental and traffic noise



observed at the site during testing, an  $L_{Aeq}$  of 40 dB(A) is deemed representative of the quarry emissions. This is below the PTNL for this development, and some 8 dB(A) less than measured during the July 2019 calibration monitoring.

This test was carried out from 9:44am to 9:59am on Thursday the 12<sup>th</sup> of March 2020. The wind direction at R2 was southwest, with a wind speed between 0 and 0.5 m/s. The weather station on top of the quarry face measured a wind speed in the order of 2 to 3 m/s at that time. The temperature was 22°C and relative humidity 85%. The sky was mostly cloudy with short periods of sun and also short periods of rain. Test data during rain events has been excluded from all reported results.

Test results are provided in Table 6.

Table 6 | Measurement results

Test location	L <sub>Aeq</sub> , dB(A)	Distance to equipment, m	Photo of setup
ML1	85.5	8	
ML2	82.4	11	





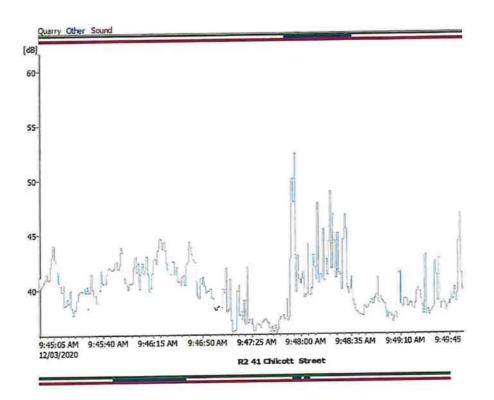
ML3	80.8	16	
ML4	78	9	
ML5	77.3	17	
ML6	76	23	

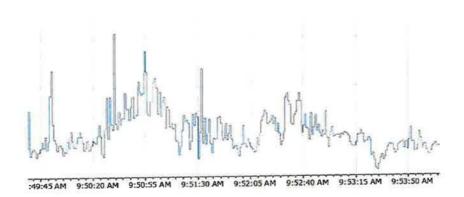
342



ML7	78.2	21	
ML8	90.7	4.5	
Top of East quarry wall	64	114-130	
Top of West quarry wall	66	105-137	
41 Chilcott Test #1	38	560	
41 Chilcott Test #2	42	560	









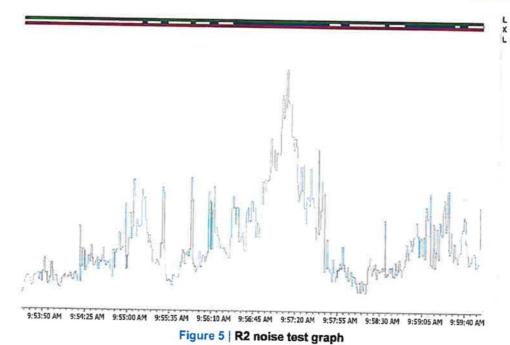




Figure 6 | The hopper being loaded gently





Figure 7 | Insulation placed over plant (1)



Figure 8 | Insulation placed over plant (2)



Figure 9 | Quarry floor layout with respect to R2

# 4.3. Modelling parameters

Noise emission modelling is carried out using SoundPLAN 8.0. Industry noise is assessed using Concawe, as this method provides flexibility to change meteorological conditions to those observed in the field during calibration testing or specified in the 2017 Noise Policy for Industry for modelling purposes.

The Digital Ground Model for the site is constructed using LiDAR information for the surrounding area combined with aerial imagery, and quarry pit survey data for the quarry pit itself.

The internal haulage route noise emissions are modelled by placing 20 single point truck sources, evenly spread along the internal haulage route. Each point is given a time histogram representing the duration that truck emissions would be in the vicinity of that point.

## 4.4. Calibration of equipment sound power levels

During the attended noise testing, both in the quarry pit and at the receiver locations referred to above, it was apparent how much quieter the quarry was operating compared to site visits carried out in the



past. It was clear that with the at-source mitigation measures taken, the equipment sound power levels were significantly reduced. The test results and conditions from this inspection are used in a SoundPLAN model to quantify these equipment sound power levels.

It is noted that the wind was stronger on top of the quarry face than at receiver R2. Wind data on the website of the Bureau of Meteorology for the monitoring period shows wind speeds between 3m/s and 3.6m/s during the monitoring period, which is more in line with the weather station results on top of the quarry face. Therefore, the adopted wind speed for the calibration model is 2.5 m/s. Concawe is used to carry out the attenuation calculations in SoundPLAN version 8.0.

The SoundPLAN model layout is provided in Figure 10. It is important to note that the image file used is dated 15<sup>th</sup> of April 2018 on the Lismore Intramaps website. The stockpile locations shown are accurate, but as shown in Figure 9, the current stockpiles are larger than shown on the aerial image. The larger stockpile dimensions have been approximated with the stockpile geometries shown in Figure 10.

The calibration process adopted for this report warrants further detail. The testing was carried out in the quarry pit close to machinery with the intent of converting measured sound pressure levels to equipment sound power levels. However, during the testing, all machinery was operating and measured sound pressure levels were likely affected by reflections between hard machine surfaces, off the quarry floor, stockpiles and quarry walls and directionality of each machine. As a result, the confidence that sound pressure levels measured represent the true emissions by each machine is low, as each sound pressure level would include the cumulative effects of all machines and all reflections. Therefore, true machine sound power levels could not be calculated.

Instead, machine sound power levels have been calibrated by using the sound pressure levels measured at receiver R2. The environmental model in SoundPLAN is set up and run and machine sound power levels are adjusted to a point where the model predictions are in line with what was measured on site. Therefore, the equipment sound power levels in the model are not the true sound power levels but include calibration and correction factors that correct for the measurement uncertainties in the quarry pit and discrepancies in the geometric and environmental attenuation between reality and the model.

Based on the above, we will refer to 'adjusted equipment sound power levels' instead of 'equipment sound power levels', so that the adopted terminology reflects this methodology.



The resulting adjusted equipment sound power levels are as follows:

Excavator loading crusher: 98 dB(A)

Primary crusher: 112 dB(A)

Secondary crusher: 108 dB(A)

Screens: 106 dB(A)Generator: 100 dB(A)

These adjusted sound power levels are less than typical for a basalt quarry and can only be sustained if the machines are operating in a similar way in the future. The sound power level of the loader working near the rock face (114 dB(A)) and the sound power level of the haulage trucks (100 dB(A)) will be the same as adopted in the previous Noise Impact Assessment prepared for this site, and issued by our office on the 29<sup>th</sup> of August 2019.



Figure 10 | SounPLAN quarry pit layout, Source of aerial image: Intramaps 2018

## 4.5. Equipment noise characteristics



Equipment noise test results have been analysed for characteristics such as tonality and low-frequency. Intermittency does not require to be assessed as it applies to night-time only, which is when the quarry is not operating.

The spectral data in Appendix B shows that within the quarry pit or in close proximity to it, there are tonal and low-frequency characteristics, with the 80Hz level exceeding its adjacent bands by 15dB or more in some instances, and a difference of 15dB or more between some of the C- and A-weighted L<sub>eq</sub> levels. However, at the receiver (R2), where the need for modifying factor corrections is assessed in accordance with section C1 of the 2017 NPfl, these issues have dissipated.

Therefore, modifying factor corrections do not apply.

#### 4.6. Meteorological conditions

Fact Sheet D of the 2017 Noise Policy for Industry addresses how to account for noise-enhancing weather conditions. Two types of meteorological conditions have been defined. For day-time these are:

- Standard meteorological conditions: stability categories A-D with wind speeds up to 0.5 m/s at
   10m AGL
- Noise-enhancing meteorological conditions: stability categories A-D with light winds (up to 3 m/s at 10m AGL)

If the noise enhancing meteorological conditions occur for less than 30% of the time, then the standard meteorological conditions may be adopted for the assessment.

In Lismore, the noise enhancing conditions occur for up to 20% of the time. Therefore the standard meteorological conditions can be adopted for further modelling. The 'worst-case' omnidirectional wind source is used for modelling with the standard meteorological conditions, in order to account for all possible wind directions.

#### 4.7. Scenarios using current quarry layout

The recalibrated equipment levels depicted in the previous chapter are used to estimate the noise impact at the various receivers for a number of scenario's under standard meteorological conditions, using the current quarry layout. The scenarios are defined in Table 7 and single point modelling results in Table 8. In this table, results without residual noise impact are shown in green, results with a residual noise impact of up to 2dB in orange, and results with a residual noise impact exceeding 2dB in red.

Table 7 | Scenario definition



Scenario ID	Excavator loading crusher	Primary crusher	Secondary crusher	Screens	Loader working rock face	Haul trucks
SA01	Y	Y	Y	Y	N	N
SA02	Y	Υ	Y	Υ	Y	N
SA03	Y	Υ	Υ	Υ	N	Y
SA04	Y	Y	Υ	Υ	Υ	Y
SA05	N	N	N	N	Y	N
SA06	N	N	N	N	Y	v

Table 8 | Single point modelling results, existing quarry layout

ID	PTNL	PTNL + 2dB (negligible residual noise impact)	SA01	SA02	SA03	SA04	SA05	SA06
R1	40	42	38	40	38	40	36	37
R2	40	42	44	45	44	45	40	21
R3	40	42	27	27	28	28	16	21
R5	40	42	32	33	37	37	25	36
R6	40	42	23	24	27	28	18	26
R7	40	42	23	24	25	25	16	21
R9	n/a	n/a	36	36	36	36	16	21
R10	40	42	37	44	39	42	40	40

The results in Table 8 demonstrate that additional barrier attenuation is required to ensure crushing and screening activities do not exceed the PTNL + 2dB value of 42 dB(A).

# 4.8. Scenarios with additional barrier attenuation

Additional barrier attenuation for R2 and R10 can be achieved by building a 6m high berm directly to the West (top of berm at 10m from nearest plant) and North (top of berm at 20m from nearest plant) of the existing crushing and screening operations as shown in Figure 11. The scenarios relevant to this arrangement are defined in Table 9 with the modelling results in Table 10.

The modelling results demonstrate that all relevant scenarios have a satisfactory noise impact. SA11 and SA13 have no residual noise impact and SA12 and SA14 have a negligible residual noise impact.

A grid noise map for the worst case scenario SA14 is provided in Appendix C of this addendum.





Figure 11 | Proposed noise berm in quarry pit

Table 9 | Scenario definition, with additional barrier attenuation

Scenario ID	Excavator loading crusher	Primary crusher	Secondary crusher	Screens	Loader working rock face	Haul trucks
SA11	Υ	Υ	Υ	Y	N	N
SA12	Y	Y	Y	Υ	Y	N
SA13	Y	Υ	Y	Y	N	Y
SA14	Υ	Υ	Y	Υ	Y	Y

Table 10 | Single point modelling results, with additional barrier attenuation

ID	PTNL	PTNL + 2dB (negligible residual noise impact)	SA11	SA12	SA13	SA14
R1	40	42	38	40	38	40
R2	40	42	36	42	37	42
R3	40	42	25	26	26	27
R5	40	42	32	33	37	37



R6	40	42	23	24	27	28
R7	40	42	23	24	25	25
R9	n/a	n/a	36	36	36	36
R10	40	42	38	42	38	42

#### 4.9. Discussion

From these analysis works we conclude that satisfactory noise emissions can be achieved, in the sense that modelled noise impact will not exceed the Project Target Noise Levels plus negligible residual noise impacts if the operations comply with the following:

- Continue to cover noise plant with insulation material.
- Construct a 6-metre high berm directly to the West and North of the current crushing and screening operations.
- Rocks to be carefully placed in the hopper, rather than being dropped in from a height.
- Crushing and screening operations to be similar to what was done during the attended testing day of the 12<sup>th</sup> of March 2020.

Ensure adequate maintenance and repair of plant and equipment

## 4.10. Noise complaints and compliance monitoring

The predicted noise levels at receivers are based on the equipment, locations and operating procedures conducted during the calibration survey conducted on the 12<sup>th</sup> of March 2020, and the included noise mitigation measures outlined in Section 4.9. The noise modelling in this report and measurements conducted on the 12<sup>th</sup> of March, demonstrates quarry operations can comply with the New South Wales Noise Policy for Industry criteria.

If, during the extended life of the quarry, different equipment is brought onto the site, then the sound power levels of this equipment should be checked to ensure that it is not greater than the equipment it is replacing, its location is similar to the equipment being replaced, and its operation is similar to the replaced equipment. Compliance noise monitoring should be conducted if there is additional equipment brought on to the site, an increase in sound power levels, or the location or type of operations that differ from the operations conducted during the calibration survey and the recommended noise mitigation measures.

The quarry is to have a contact number, email and responsible person details available to nearby receiver locations. If a noise complaint is received by the quarry, the complaint should be investigated, noting the type and location of equipment, the noise mitigation measures in use at the time, and the



weather conditions. The circumstances and conditions when the complaint was made are to be evaluated. The assessment is to be conveyed back to the complainant in a prompt manner.

All complaints are to be kept in a legible register that includes, but not limited to: time and date of the complaint reported, time and date of the noise issue, the name and contact details of the person making the complaint, receiver location, nature of the complaint (e.g. specific types of noise or time of day), noise mitigation measures (including size and location of stockpiles) in use at the time, type and location of equipment in use, weather conditions, the name and signature of the person who assessed the complaint, and the time and date the complainant was notified of the assessment.

Compliance noise monitoring to be conducted if there are consistent legitimate noise complaints.

In addition to compliance monitoring following noise complaints or replacement of quarrying equipment, it is recommended that regular compliance monitoring is carried out for the first 12 months following approval of the application. This regular compliance monitoring regime is recommended to include the following:

- Issue of a compliance report to Lismore City Council on a quarterly basis
- The compliance report to include an update complaint register
- Per quarter at least 6-hours' worth of attended testing at sensitive receivers during days of typical quarry operations.
- Attended test results to be included in quarterly report and describe operations, weather conditions and emitted quarry noise levels at the receivers.

The noise complaints assessment, register and compliance noise monitoring, will assist in identification of any unforeseen circumstances and provide data for feasible and reasonable additional noise mitigation measures if required.



# 5. ROAD NOISE EMISSIONS

Road noise generation is assessed under the 2011 Road Noise Policy and applies to the haulage road outside the subject site, being Riverbank Road and Wyrallah Road.

#### 5.1. Assessment criteria

The 'principal haulage route' is defined as Riverbank Road and Wyrallah Road. The applicable noise criteria match those for arterial and sub-arterial roads, resulting from existing residences affected by additional traffic on existing arterial / sub-arterial roads generated by land use developments. The applicable assessment criteria are:

- Day (7am 10pm): L<sub>Aeq,15hr</sub> = 60 dB(A), external
- Night (10pm 7am): L<sub>Aeq,9hr</sub> = 55 dB(A), external

The relative increase criteria are also applicable, due to the principal haulage route being classified as an arterial / sub-arterial road. The total traffic noise level increase shall not exceed:

- Day (7am 10pm): L<sub>Aeq,15hr</sub> + 12 dB(A), external
- Night (10pm 7am): L<sub>Aeq,9hr</sub> + 12 dB(A), external

Trucking operations to the west along Riverbank Road and East Gundurimba Road are limited to 8:30am to 3:30pm Monday to Friday.

There will be no trucking operations during night-time, therefore, the night-time criterion does not apply.

## 5.2. Assessment scenarios

Table 11 provides an overview of the assessment scenarios that will be applied:



Table 11 | Road noise scenarios

ID	Background traffic year	Quarry traffic	Applied road sections
RN1	2019	Existing approved average	Riverbank Road and Wyrallah Road
RN2	2019	Existing approved peak	Riverbank Road East and Wyrallah Road
RN3	2029	Existing approved average	Riverbank Road and Wyrallah Road
RN4	2029	Existing approved peak	Riverbank Road East and Wyrallah Road
RN5	2029	Proposed increased peak	Riverbank Road East and Wyrallah Road
RN6	2019	Nil	All
RN7	2029	Nil	All

Traffic flows are modelled as the hourly volumes taken as an average over the 15-hour day period. The resulting traffic volumes are depicted in Table 12 and Table 13. These volumes are based on the traffic data supplied in the Traffic Impact Assessment, prepared for this application by Ingen Consulting.

Table 12 | Riverbank Road traffic scenarios

	Backgr	ound traffic	Quar	ry traffic	Tota	l traffic
ID	cars	trucks	cars	trucks	cars	trucks
RN1	2.9	0.4	0.67	2	3.61	2.40
RN2	2.9	0.4	0.67	2.7	3.61	3.07
RN3	2.9	0.4	0.67	2	3.61	2.40
RN4	2.9	0.4	0.67	2.7	3.61	3.07
RN5	2.9	0.4	0.67	6.1	3.61	6.53



Table 13 | Wyrallah Road traffic scenarios

	Backgro	und traffic	Quar	rry traffic	Tota	l traffic
ID	cars	trucks	cars	trucks	cars	trucks
RN1	202.6	18.1	0.67	2	203	20
RN2	202.6	18.1	0.67	2.7	203	21
RN3	247.1	22.5	0.67	2	248	25
RN4	247.1	22.5	0.67	2.7	248	25
RN5	247.1	22.5	0.67	6.1	248	29

#### 5.3. Receiver identification

Identified receivers are those located within 50 metres from the road and up to approximately 1.5km from the quarry site. Receiver ID's and addresses are provided in Table 14 and locations shown in Figure 12. Due to the scale of the model, receivers will be modelled as a free field receiver point at the façade nearest the road, and a 2.5 dB façade correction will be added for assessment against the criteria.

Table 14 | Road noise receiver identification

ID	Address
RR01	495 Wyrallah Road
RR02	589 Wyrallah Road
RR03	578 Wyrallah Road
RR04	631 Wyrallah Road
RR05	641 Wyrallah Road
RR06	695 Wyrallah Road
RR07	698 Wyrallah Road
RR08	2 Riverbank Road
RR09	1 Riverbank Road
RR10	34 Riverbank Road
RR11	50 Riverbank Road
RR12	279 Riverbank Road
RR13	290 Riverbank Road
RR14	312 Riverbank Road
RR15	330 Riverbank Road





Figure 12 | Receiver locations, Source of aerial image: Lismore Intramaps 2019

#### 5.4. Modelling results

Noise emission modelling was carried out using the RLS90 calculation method in SoundPLAN version 8.0. Vehicle speed of both cars and trucks was set to 80 km/h and road gradients were determined based on 2m LiDAR data received for the area and available via Lismore Intramaps. No road surface correction was applied.

The modelling results are depicted in Table 15 (free field) and Table 16 (façade corrected). The results show that all increases (refer to table Table 11 for an overview of road noise scenarios) due to the quarry with respect to background traffic are below 2 dB and are therefore not further addressed (RNP clause 3.4).



# Table 15 | Free field results (no façade correction)

ID	RN1	RN2	RN3	RN4	RN5	RN6	RN7
RR01	58.7	58.9	59.7	59.7	60.1	58.5	59.4
RR02	57.8	58.0	58.8	58.8	59.2	57.6	58.5
RR03	64.4	64.5	65.3	65.3	65.8	64.1	65.0
RR04	59.9	60.1	60.9	60.9	61.3	59.7	60.6
RR05	58.3	58.4	59.2	59.2	59.6	58.0	58.9
RR06	58.2	58.3	59.1	59.1	59.5	57.9	58.8
RR07	54.4	54.5	55.3	55.3	55.7	54.1	55.0
RR08	54.7	55.1	55.5	55.7	56.9	53.6	54.5
RR09	53.4	53.7	54.1	54.3	55.5	52.3	53.1
RR10	44.4	44.9	450	45.4	47.1	42.4	43.2
RR11	45.1	45.7	45.4	46.0	48.2	42.1	42.8
RR12	49.2		49.2			42.7	42.7
RR13	41.9		41.9			35.5	35.6
RR14	42.4		42.4			36.0	36.0
RR15	41.0		41.0			34.6	34.6



Table 16 | Façade corrected results

ID	RN1	RN2	RN3	RN4	RN5	RN6	RN7
RR01	61.2	61.4	62.2	62.2	62.6	61	61.9
RR02	60.3	60.5	61.3	61.3	61.7	60.1	61
RR03	66.9	67	67.8	67.8	68.3	66.6	67.5
RR04	62.4	62.6	63.4	63.4	63.8	62.2	63.1
RR05	60.8	60.9	61.7	61.7	62.1	60.5	61.4
RR06	60.7	60.8	61.6	61.6	62	60.4	61.3
RR07	56.9	57	57.8	57.8	58.2	56.6	57.5
RR08	57.2	57.6	58	58.2	59.4	56.1	57
RR09	55.9	56.2	56.6	56.8	58	54.8	55.6
RR10	46.9	47.4	452.5	47.9	49.6	44.9	45.7
RR11	47.6	48.2	47.9	48.5	50.7	44.6	45.3
RR12	51.7		51.7			45.2	45.2
RR13	44.4		44.4			38	38.1
RR14	44.9		44.9			38.5	38.5
RR15	43.5		43.5			37.1	37.1



#### 6. VIBRATION

The current NSW blasting criteria are the *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*, issued by the Australian and New Zealand Environment Council in 1990. For 95% of the blasts during day-time, this document provides the following guidelines:

- Maximum overpressure of 115 dB(L)
- Maximum peak particle velocity of 5 mm/s

An overview of blasting records provided to our office for this quarry is provided in Table 17 below. These results show that after initial compliance issues in 1993, blasting has been compliant with ANZEC recommendations. Provided future blasting is carried out with the same management techniques as has been done the past years, no further blasting and vibration assessment is warranted.

Table 17 | Blasting test results records

Location	Date	Overpressure,	Peak Particle	Reference/Source
		dB(L)	Velocity, mm/s	
R1	9/6/1992	121.7	2.4	ABC 1992
R1	7/4/2014	100	1.02	Vipac 2015
R1	20/6/2014	112.3	0.762	Vipac 2015
R1	21/8/2014	105.5	0.889	Vipac 2015
R1	17/12/2018	114.8	2.84	Blasting contractor
R1	28/6/2019	105.7	0.24	Blasting contractor



# 7. THE USE OF BEST MANAGEMENT AND BEST TECHNOLOGY

Notwithstanding the analysis and information provided above, we recommend that Best Management Practices (BMP) are implemented and Best available technology economically achievable (BATEA) used as much as possible. An overview of these methodologies is provided below.

Typical examples of BMP relevant to this project that could be implemented where possible are:

- Use the quietest plant that can do the job.
- Restrict truck movements on ridgelines and exposed haul routes. Aim to have internal truck routes as far from adjacent residences as possible and use the available shielding on the site to minimise the noise impact.
- Site noise equipment behind structures, mounds and stockpiles that could act as noise barriers.
- Where there are several noise pieces of equipment, schedule operations such that they are used separately rather than concurrently. The noise modelling results in this report illustrate the noise impact differences between individual plant and combined plant.
- Keep equipment well-maintained and operating in a proper and efficient manner.
- Run regular toolbox talks on the effects of noise and the use of quiet work practices.

Typical examples of BATEA relevant to this project that could be implemented if needed:

- Use broad-band 'squawkers' rather than tonal reverse beepers
- Use equipment with efficient muffler design
- Rubber-line truck trays to minimise the noise impact of trucks when loaded.



# 8. CONCLUSIONS AND RECOMMENDATIONS

#### 8.1. Operational noise emissions

Consideration is given to the history of this quarry and associated legislative requirements. The quarry appears to have been operating within the noise limits of the 1993 DA documentation and approval. It has been identified however, that the background noise levels provided as part of the 1993 DA submission appear unrealistically high, when compared to current background testing methods and the acoustic environment of the receivers. Our 10-day background testing at the 3 nearest receivers to the quarry have provided Rating Background Levels all below the minimum of 35 dB(A). Given a minimum RBL of 35 dB(A), a Project Trigger Noise Level of 40 dB(A) has been adopted for this site, which is significantly less than the noise impacts measured and predicted as part of the 1993 DA.

Given operations for the coming 25 years would need to comply with the 2017 Noise Policy for Industry, mitigation and management techniques need to be employed in order to reduce the noise impact on the nearest receivers, particularly those to the north and northwest of the site. From the analyses carried out in this report we conclude that satisfactory noise emissions can be achieved, in the sense that modelled noise impact will not exceed the Project Target Noise Levels plus negligible residual noise impacts if the operations comply with the following:

- Continue to cover noise plant with insulation material.
- Construct a 6-metre high berm directly to the West and North of the current crushing and screening operations.
- Rocks to be carefully placed in the hopper, rather than being dropped in from a height.
- Crushing and screening operations to be similar to what was done during the attended testing day of the 12<sup>th</sup> of March 2020.
- Ensure adequate maintenance and repair of plant and equipment/

This addendum report demonstrates that compliance with the 2017 Noise Policy for Industry can be achieved in these circumstances. On this basis, the S4.55 modification application is recommended for approval from an environmental noise perspective.

If during the extended life of the quarry, noise compliance is not achieved due to unforeseen circumstances, then further at-source mitigation can be carried out using methods such as the following:

- Spray reverberating surfaces with bitumen paint.
- Weld angle brackets to reverberating surfaces to increase the natural frequency of these.
- Install additional acoustic blankets.



 Limit use of loader near quarry face during periods that the crushers and screens are not operating.

#### 8.2. Road noise emissions

The road noise impact of the development has also been considered. The noise increase due to quarry traffic when compared to background traffic is less than 2 dB and it is concluded that the road noise impact of the quarry complies with the requirements of the NSW Road Noise Policy.

#### 8.3. Vibration

Blasting records provided demonstrate that blasting impacts have been compliant in recent years. Therefore no further analysis work is warranted, provided best-practise blasting methods continue to be applied and monitored.



#### REFERENCES

Riverbank Quarry, Addendum to the Noise Impact Assessment, Ingen Consulting Pty Ltd, Alstonville, Revision 0, 12 March 2020

Riverbank Quarry, Noise Impact Assessment, Ingen Consulting Pty Ltd, Alstonville, Revision 0, 12 August 2019

Noise Policy for Industry, NSW Environment Protection Authority, Sydney, October 2017

NSW Road Noise Policy, NSW Environment, Climate Change & Water, Sydney, March 2011

Notice to applicant of determination of a development application, Lismore City Council, 12 May 1993

Lismore City Council minutes of pre-lodgement meeting held on Tuesday, 2 June 2020 82.2020.7.1, Lismore City Council

Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration, Australian and New Zealand Environment Council, September 1990

Noise Impact Assessment, Vipac Engineers & Scientists Ltd, Toronto NSW Australia, 22<sup>nd</sup> September 2015

Environmental Impact Study for proposed quarry extensions Riverbank Road, Wyrallah, Australian Blasting Consultants Pty Ltd, 1992



## APPENDIX A - BACKGROUND NOISE SURVEY RESULTS

					Frida	ay 7th June	2019						
							Start	R1	R1	R2	R2	R5	R5 Large
	200					1	12:00	51.0	43.9	47.2	40.2	48.9	40.1
Rain Affected						-						TOTAL T	
Rain & Wind A Data	Апестеа						12:15	46.9	39.7	46.6	43.2	50.2	41.1
Wind Affected 5m/s	Data >						12:30	47.4	40.7	46.4	41.9	52.2	41.7
Jilys							12:45	50.5	39.8	47.2	40.1	51.2	41.8
							13:00	49.8	41.7	50.2	44.3	49.9	41.4
							13:15	50.9	42.9	48.9	44.2	50.3	41.9
							13:30	50.4	44.1	48.5	43.3	51.7	43.9
							13:45	53.6	43.0	50.4	43.8	50.2	43.5
							14:00	53.9	45.2	52.1	47.5	51.0	41.5
							14:15	51.9	46.0	49.1	41.8	50.3	38.8
									42.7	46.6	41.3	53.1	42.4
							14:30	50.5				48.2	41.8
							14:45	48.2	40.3	49.8	41.5		41.7
							15:00	50.9	42.7	50.4	43.7	51.8	
							15:15	51.2	44.2	48.2	41.3	49.7	38.4
							15:30	48.7	41.5	47.1	40.7	44.6	37.0
							15:45	48.2	41.4	50.2	38.7	44.4	37.0
							16:00	49.7	40.6	49.5	37.9	44.3	34.3
							16:15	46.4	36.6	42.1	33.0	43.6	33.0
							16:30	45,8	34,3	38,2	32.8	57.8	33.
				-			16:45	45.9	34.0	45.8	33.3	43.4	32
						À	17:00	42.9	34.7	42.1	32.4	44.5	32.
						4	17:15	41.5	33.6	33.5	30.1	36.3	32.
						*	17:30	33.9	31.1	36.0	33.1	39,6	33.
							17:45	34.0	32.1	41.4	38,9	39.9	34.5
							18:00	36.4	33.4	38.6	33,0	40.5	34.
							18:15	34.3	32,2	34.6	32.7	36.4	30.
							WATER TO		32.1	33.7	30.0	35.3	30.
							18:30	35.4			29.4	37.4	30.
						8	18:45	31.9	29,2	32.2		34.0	30.
							19:00	30.6	28.1	31.8	28,7		
							19:15	31.5	28,8	31.1	28.1	39.7	31.
							19:30	33.3	26,9	31,9	27.2	32,2	28.
							19:45	38.2	27.8	45.9	27.2	43.2	26.
							20:00	34.0	26.7	30.9	25.6	31.9	26,
							20:15	31.0	25.1	28.1	25.4	28.8	25,
Start Time	R1 LAcq	R1 Larenn	R2 Lana	R2 Largo d	R5 Larg	R5 Lunco	20:30	28.7	24.9	32.2	25.1	29,5	25.
8:45	51.3	42.2	49.7	41.1	49.5	40.1	20:45	29,0	24.9	29.0	25,8	29.9	26.
9:00	49.1	40,5	49.0	37.7	43,2	36,9	21:00	28,1	25,1	28,5	25.9	29.5	25.
9:15	51.4	39.4	44.8	35,4	44.1	35.5	21:15	28,9	24.1	28.3	25.2	35,1	24.
9:30	51.1	38.8	48.5	36,2	44.6	34.8	21:30	41.0	26.6	31.7	27.1	37.0 27.9	28.
9:45	51.4	38.0	44.1	36,3	43,9	33.9	21:45	35.9	27,1	28,2	25.0	27.3	24.
10:00	49,4	38.9	45.7	37.1	39.2	33.9	22:00	28,2	25.3	28.2	25.5	27.8	24.
10:15	52.0	38.8	48.0	38,8	41.9	34.4	22:15	29.5	24.9	27.8	23.7	28,5	23.
10:30	49.5	38.4 40.7	46.4	39.3	42.1	34.8	22:45	28.4	23.1	26.8	23.8	29.7	25.
10:45	53.2	38.7	45,3	37.7	44.3	35.5	23:00	33.3	29,9	28.5	23.8	31.5	27.
11:00	45.4	36.9	42.4	34.2	49.8	36.3	23:15	38.2	30.6	26.8	23.6	28.0	24.



	11:30	48.5	36.2	45.2	37.4	45.1	34.9	23:30	29.0	26.4	26.7	22.9	32.6	22.9	I
l	11:45	56.3	43.1	48.0	40.4	50.1	39.6	23:45	26,3	23.0	26.8	21.5	25.9	21.4	1

			_			Canada	1h 1 704						
Start	R1	R1	R2	R2	R5	R5	Start Start	9 R1	I 01	T 02	T 22	1	
Time	Larg	Larroge	Lang	Lasson	Lara	Lason	Time	LACO	R1 Largon	R2 Lara	R2 Largo	R5	R5 L <sub>AF90.0</sub>
0:00	25.1	21,5	26.1	22.2	25.4	21.6	12:00	46.7	33,0	40.6	30.9	46.8	29.9
0:15	25.8	21.5	24.9	21.8	26.8	22.1	12:15	47.8	32.4	43.7	37.7	40.1	30.7
0:30	24.2	21.1	25,2	21,3	29.1	20.9	12:30	49.7	35.2	49.0	34.8	39.2	32.8
0:45	26.8	20.9	28.8	23.6	39.1	32.2	12:45	54.7	33.7	62.7	37.5	39.3	31.9
1:00	36.5	28.8	29.8	26.1	37.7	30.7	13:00	60.0	32.7	41.9	34.7	39.7	32.4
1:15	34.6	28.8	25.5	22.7	29.2	26,3	13:15	52.1	32.9	42.8	33.6	44.1	32.4
1:30	28.0	24.7	25.3	22.4	28.5	25.7	13:30	43.7	34.3	41.3	33.0	39.8	32.5
1:45	28.1	23.8	26,2	21.7	26.1	23.5	13:45	44.5	33.4	36,5	31.6	38.6	31.2
2:00	28.2	22.7	27.5	21.5	27.3	23.6	14:00	45.2	35.5	38.2	32.6	41.2	32.6
2:15	32.4	30.0	28.7	23.3	27.2	23.6	14:15	48.3	35.1	38.9	32.8	37.0	34.1
2:30	29.6	25.7	23.7	20.4	25.6	21.1	14:30	52,0	32.6	44.8	32.3	48.6	33.2
2:45	25.0	21.5	25.1	20.9	24.4	21.6	14:45	42.7	33.3	43.5	33.6	46.6	33.2
3:00	25.3	21.3	31.7	21.3	25.7	22.7	15:00	46.7	33,8	38.5	32.7		
3:15	28.2	22.0	25.2	20.8	23.3	21.3	15:15	50.4	32.6	37.4		38.3	32.9
3:30	27.5	21.4	31.6	22.0	39.5	33.6	15:30	46.8	33.6	40.2	31,3	38.8	32.1
3:45	34.7	28.6	29.6	26.0	34.4	30.7	15:45	48.5	34.8	_	32.2	39.5	33,4
4:00	31.4	26.7	26.7	24.4	31.2	28.1	15:00	-		37.9	32.1	43.8	33,9
4:15	29,9	26.2	26.4	22,9	29,8	25.6		40.7	32.8	38.5	30,8	42.6	32.5
4.30	28.1	25.6	26.8	22.7	30.0	24.3	16:15	37.7	31.7	45.9	30,6	36.3	32.4
4:45	28.7	24.7	26.6	23.5	27.5		16:30	47.3	31.2	40.0	29.7	36.3	31.7
5:00	28.4	25.2	28.2	24.8		24.4	16:45	40,8	30.6	38.8	30.3	37.9	31.1
5:15	28.2	25.2	27.8		28.1	25.5	17:00	42.1	30.4	33.3	29.3	34.8	31.3
5:30	27.9	25.4	27.2	25.2	28.0	25.7	17:15	36,6	30.7	32.1	29.1	35.2	31.5
5:45	29.7			23.8	28.2	25.1	17:30	34.5	32.1	32.7	29.5	34.1	31.7
5:00	31.0	26.7	28.5	26.2	30.9	26.6	17:45	35.9	33.8	31.2	28.3	41.0	28,9
		27.9	44.3	26.6	32.0	26.8	18:00	35.5	32.5	29.5	27.4	29.7	26,5
6:15	34.9	28.3	46.9	32,8	45.8	31.3	18:15	32.9	27.3	31.2	26.9	31.5	25.7
6:30	45,3	33.4	42.3	33.1	43.7	32.2	18.30	34,8	26.5	29.5	26.2	27.2	25.5
6:45	43.1	32.2	43.2	32.5	44.4	32.4	18:45	32.6	27.3	29,3	26.6	27.7	25.4
7:00	45.0	35.2	37.8	32.1	42.7	32.7	19:00	33.0	26.4	30.4	26.4	28.9	25.8
7:15	46.7	33.4	43,4	33.1	42.7	33,0	19:15	31.9	27.7	28.8	25.6	26.8	24.4
7:30	44.4	34.0	42.9	33.6	44.7	33.3	19:30	29.1	25.3	32.5	26,5	33.5	25.2
7:45	46.6	35.4	48,0	34.1	43.9	33,5	19:45	37.2	32.4	33.0	27.9	33.1	28.3
8:00	51.5	36.0	43.1	35.0	46.4	32.6	20:00	32.9	27.8	28.7	25.6	30.7	25,7
8:15	50,0	34.8	42.9	33.1	43.4	32.0	20:15	28.4	24.9	28.9	25.9	31,5	27.1
8:30	47.8	35.0	43.7	34,6	46.7	32.0	20:30	29.5	24.4	28.2	25.0	28.2	25.3
8:45	51,3	34.9	40.8	33.2	39.6	31,7	20:45	31.4	24.4	29.8	25.5	28.2	25.7
9:00	50.7	34.7	40.0	33.0	37.7	31.8	21:00	33.5	30.8	28.2	23.9	29,8	24.7
9:15	51.9	35.0	38,9	30.9	40.8	29.6	21:15	31.2	26.3	30.1	25.8	30.6	26.8
9:30	47.2	34.3	47.2	33.5	36.7	30.0	21:30	29.6	26.8	25,9	23.8	27.3	24,3
9:45	44,7	32.5	49,4	32.1	38,3	31.3	21:45	25.9	23.2	25.1	23.5	27.9	24.4
10:00	47,8	33.8	44,3	33.2	40.7	34.1	22:00	24.8	22.4	26.3	24.2	28.7	24.9
10:15	57.4	34.0	45.1	37,4	41.5	33.5	22:15	24.0	21.3	25.1	23.0	26.2	23.4
10:30	57.2	34.7	46.6	30.6	50.8	31.6	22:30	25.1	21.3	27.2	24.5		
10:45	54.1	34.1	37.0	29.7	48.4	30.5	22:45	28.9	24.2	28.2	26.4	27.6	25,5
11:00	57.2	33.9	42.5	32.9	41.2	31,7	23:00	31.8	29,3			29.3	27.5
11:15	52.3	32.0	36.6	30.1	33.5	30.1	23:15			28.1	25.1	32.7	29.7
11:30	51.4	34.6	38.4	30.7	36.2	30.8	205000	29.6	26.0	35.8	25.1	41.3	27.4
				2011	JUL	30.0	23:30	42.2	34.8	34.1	29.7	40.4	36.5



	Sta		RI	T	R1	I R	2 1				Sund	ay 9th	une 2	019			_				-	
	Tin	_	Lace		Larson			R2	- 1	R5	R	5	Star	_	R1	To	_					
-	0:0	_	38.0		35.7	28		25.	_	33.1	Lan	_	Time		Len	L <sub>AF9</sub>		R2		32	R5	T
- 1	0:1	_	32.4		28.2	24.	9	23,5	_		29.	-	12:00	0	52,4	37.		41.0		10.0	LAnn	-
- }	0:30	)	28.0		24.3	25.	1	22.0	-	28.8	26,	4	12:15	5	50.5	34.0	7	44.0	31		55.4	_
1	0:45		24.8		22.7	26.	1	22.2	+	26.5	24,	2	12:30		47.8	32.2		41.4	31	-	52.6	-
F	1:00		34,9	1:	24.4	28.5	-		+	27,3	23,5		12:45	T	57.7	33.5	-	50.1	31	_	56.2	1
1	1:15		33.7	1 2	9.6	25.0	_	26.7		34.0	31.3		13:00		49.6	34.2	+		32.	-	55.7	
	1:30		28.4	1 2	5.9	26.6	+	23.3	$\neg$	30.2	26.8		13:15		48.7	33.8	+	34.6	31.	-	57.1	
	1:45		27.2		3.4	25.9	+	23.7	3	1.8	28.1		13:30		48.1	33.2	+	36.4	31.0	1	55.6	
L	2:00	T	23.9		1.7	23.5	+	21.7	2	7.8	23,7		13:45	$\top$	51.5	33.5		48.5	31.1		61.1	1
L	2 15	T	25.0		.6		+	21,5	2.	5.0	22,4		14:00	_	43.0		_	37.5	31.8		48.4	3
	2:30	$\top$	23.6	21		24.8	1	20.6	25	5.0	22.2	1	4:15	_	48.0	33.0	-	38.4	31.8		55.0	4
	2:45	$\neg$	27.6	22.		23.6	1	21.2	24	.4	22.0		4:30	_	39.8	34.2	1 3	38.5	31.7		48.5	3
	3:00	_	41.5		-	35,5	1 2	22.4	37	.2	22.2	1	4:45	_	-	31,9	3	7.3	31.1	1	18.9	3
Г	3:15	1	86.9	30.	-	32.8	2	6.1	37.	3	33.8		5:00	-	11.7	31.3	3	9.5	30.2	1 4	7.7	36
	3:30		1.2	33.	-	28,4	2	5.0	33.	0	29.2		5:15	1	7.9	31.6	48	8.7	32.1	1 4	9.0	34
	3:45	_	7.8	26.9	-	25.6	2.	3.5	28.4	.	25.9		:30		3.0	32,0	41	1.3	32.9	_	1.1	33
	4:00		-	24.7	-	24.6	22	2.6	25.4		23.0				1.5	32.1	51	.8	32.9		5.6	31.
	1:15		8.3	24.6	-	24.6	22	.8	26.2		3.2		:45	_	3.7	30.9	47.	.2	31.5	1	0.2	31.
-	:30		3.7	25.2		26.4	23	.4	25.6		3.2	16:		53	1,3	33.3	44.	6	30.8	44	-	_
	:45	29		24,9		23.1	21,	6	25.2		2.8	16:		50.	.3	34.2	43,	0	31.1	44	-	30.,
	00	27	-	24.1	1	26.1	22,	0	26.1		2.9	16:	-	49.	7	35.4	37.9	9	30.8	43.		31.2
		29.	-	25.8	2	24.9	23.	1	25.2	1	-	16:4	-	43.0	0	34,8	39.7		30,5	45.	-	31.9
5:	-	28.	9	25,9	2	5.6	23.8	1	26.3		1.1	17:0	-	44.8	8	36.0	44.4		33.5		_	31.2
5:3	-	28.4	1	25.6	3	7.1	24.0	-	28.0	24	-	17:1	5	45.1	. :	36.2	45.3		32.8	47.3	-	32.4
5:4	-	29.6		25.4	28	8.5	25.4	+	28.4	25	-	17:30	0	39.9	3	7.9	37.1	_	3.5	41.7	-	33.2
6:0	-	34.4	1 2	9.7	38	3.7	26.6	-	_	25.		17:45		39.6	3	8.4	36.9		4.9	36,3	3	35.0
6:1	5	40,5	3	1.4	42	.8	32.2	_	32.5	26.	-	18:00		39.0	3	7.3	35.0	1	-	35.7	3	4.0
6:30	2	49.6	3	4.2	40.	.7	31.5	_	15.4	30.	-	18:15		37.7	36		32.4		3.4	35.2	3.	3.0
5:45		43.1	3	1.4	43.	-	34.0	-	0.0	31,6		18:30	3	35.3	33		30.1	-	0.6	33.2	3:	1.3
7:00		54.8	36	.9	40.	-	32.9		7.8	33.3		18:45	3	5.2	31	-	9.7	28	-	31.1	28	3.0
7:15	1 5	50.3	36	.4	43.7		_	1	2,2	31,4		19:00	3.	3.2	31,	-	1.7	27.		37.0	27	.4
7:30	_ 5	3.3	37	4	46.6	-	5.1	1	2.9	34.0		19:15	34	4.4	30,	-	_	27.	-	30.6	26	.7
7:45	4	9.6	34.	-	48.3	-	7.2	49	.1	34.8		19:30	31	1.5	28.8	-	0.2	27.0		36.1	26.	3
3:00	4	7.2	35.	-	44.8	-	9.0	52	.5	36.0	1	9:45	33	.8	29.6		0.3	26.4	1 :	36.3	26.	2
:15	47	7.5	35.0	-	46.8	1	5.7	48.	.5	34.6	2	0:00	35.	1	30.2	-	-	25.8	3	1.5	25.5	5
:30	55	.3	33.9	-	46.2	35	_	44.	8	33.6	2	0:15	32.	-	28.4	-	$\rightarrow$	27.9	3	1.1	25.6	,
45	48.	.з	35.5	-	46.3	35		49.	7	34.8	20	0:30	32.	$\rightarrow$	27.1	- 50	-	26.8	2	7.4	24.6	
00	45.	9	34.2	-	-	33.	-	48.8	3	33.3	20	:45	31.8	-		31.	-	28.7	30	0.9	25,9	
15	55.	0	35.9	_	43.1	33.	-	45.0		33,0	21	:00:	35.2	-	26.5	31.	-	29.0	30	1.8	26.8	$\neg$
10	49.9	-	35.9	_	53.8	34.	-	50.1		36.0	21	15	36.7	-	29.8	33,2	-	27.6	34	.9	24.6	
5	47.0	-	33.4	_	42.5	32.2	-	50.0		34.1	21:		33.0	-	28.7	30,3	-	26.4	26.	8	23.6	$\neg$
0	48.9	-	33.7	1	10.2	32.4		44.1		34.1	21:		34.7	+	28.1	32.6	1	26.9	28.	2	23.8	7
5	50.0	+		_	1.2	32.6		47.2	3	4.1	22:0	-		+	31.1	31.4		25.7	24.	5	22.8	-
0	59.3	+	34.5	1	8.5	32.0		44.0	3	1.1	22:1	-	35.6	+	33.4	30.3		26,8	26,7	,	23,4	1
5	52.1	+	40.0	1	4.5	32.2		37.3	_	1.1	22:3	-	33.4	1	31.1	37.4		26.2	27.0	1	22.4	1
		+	33.8	44	1.8	31.5	1	40.9		0.6	22:4	-	32.8	-	28,6	27.5	1 :	23.1	24.2	-	21.2	1
+	50.3		34.6	50	.5	33.3	1	16.9	32	_		_	43.2	1	25.8	27.4	1 2	22.0	28.1	+	20.3	1
-	48.3	-	36.3	42.	.6	33.0		14.2	32	-	23:00		38.3	1	23.6	26.9	2	2.1	22.7	$\neg$		1
+	55.5	+	35.6	40.	5	31.4	$\overline{}$	8.2	30.	-	23:15	-	29.3	2	24.3	27.3	_	3.7	26,2		20.0	1
	50.4	1	35.6	42.5	9	32.0		4.3	34.	-	23:30	-	30.2	2	4.2	28.8		2.2	25.8		21.7	
					_				34.	-	23:45	1 0	27.5	3.5	3.8		-		-2.0	1 2	0.3	M)

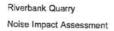


Riverbank Quarry

				_		-	tonda	ay 10th	une 20	19		_		R2	R2	T	R5	R5	
				-	R2	RS		5	Start	1	R1	11 28"	R1	Lara	Larse	00	Larg	Laison	-
Start	R1	R1	R2 Lans	11.0	V90.0	Lars		900	Time	-	50.3		7.4	516	32.	0	41.5	29.7	-
Time	26.0	23.7	24.3	2	1.B	22.2	-	9,9	12:00	-	55.7	3	37.8	47.8	33.	.8	58.3	32.7	
0:00	26.2	23.4	25.1	1 :	22.4	22.9	-	0.1	12:3	-	49.2	3	36.7	46.9	32	.8	49.3	32.2	-
0:15	28.0	23.8	25.1		22.0	24.2	+	1.5	12:3	_	50.8	1	36.B	46.6	32	.3	46,8	32,8	$\dashv$
0:30	27.0	23.7	24.4		21.9	24.7	-	21.4	13:0		49.9	1	33.3	39.3	32	2.3	45.0	32.2	$\neg$
0:45	32.3	28.7	25.4		22.7	24.9	-	21.3	_	_	46.3	$\top$	33.6	39.3	3	2.3	48.4	33.8	_
1:00	31.9	28.7	25.		22.7	24.4	1	21.4	13:1	_	49.6	+	34.5	37.1	3	1.9	45.5	31.	_
1:15	34.7	24.4	24.5	9	22.8	22.0	-	19.1	_	-	47.3	1	34.8	37.5	3	2.1	42.4	30.	
1:30	37.9	22.9	27.	1	22.1	24.3	1	19.3	13:	-	51.2	+	36.6	40.0	1	33.7	50.7	30.	
1:45	-	22.7	27	.5	23.9	24.7	1	21.5	14:		45.3	-	33.7	42.5		32.5	48.2	31	
2:00	25.7	24.5	-	.0	23.4	26.0		20.3	14	7.4	48.1	-	32.7	37.2		32.6	56.8	31	
2:15	28.4	-		.6	22.8	28.	5	20.8	-	:30	38.4	-	30.4	38.4		32.3	44.3	-	1,3
2:30	29.9	-	-	5.1	22.2	24.	0	19.9	-	:45	43.5	-	31.8	39.	1	32.0	36.1	_	3.2
2:45	30.3	1 25	-	1.3	25.4	28	9	21.2	-	5:00	48.	-	32.1	51.	1	31.8	49.	-	89
3:00	32.8	-	-	6.0	22.0	23	0	19.5	-	5:15	46.	-	32.7	47.	6	34.7	42.	-	8,9
3:15	33.2	-	-	0.2	23.9	28	.3	21.8	-	5:30	44	-	35.5	49	1	34.8	42.	-	0.6
3:30	29.	-	_	32.0	24.6	28	.4	21.2	-	5:45	+	.1	34.5	51	.4	33.7	47		30.1
3:45	36.	-		28.9	24.5	2	7.1	22.5	_	16:00	-	5,3	34.9	41	.8	31.7	44	-	29.3
4:00	30	-	_	30.5	25.7	2	9.0	23.2	-	16:15	-	2.8	34.6	31	3.4	31.7	_	-	30.8
4:15	-	-		32.8	27.8	3 2	8.7	23.4	-	16:30	_	9,9	35.4	4	0.1	33.3	-	5.9	30.6
4:30	-		8.9	30.8	27.	0 2	8.9	25.5	_	16:45	_	7.5	37.0	4	4.1	34.9	_	8.1	33.7
4:45	-		8.3	33.3	27.	4	0.0	26,4		17:15	-	11.4	38.3	4	1.5	34.8	-	8.2	33.8
5:00	-	3.6	29.0	33.0	28	6	28.2	25.	_	17:13	-	40.7	38.8		15.4	41.4	_	7.7	34.8
5:1	-	4.0	30.2	32.4	28	.5	30.4	27.	_	17:45	-	40.7	39.		49.8	47.3	_	39.1	35.4
5:3	-	36.2	32.8	33.1	29	.8	31.9	27.		18:00		39.7	37.	8	45.3	43.4		38.1	31.0
5:4	-	38.9	34.8	41.5	25	9.9	34.9	27		18:15		37.1	35	1	42.1	33.	_	34.7	28.8
6:0	-	47.8	35.8	45.0	3	5.1	47.6	34	-	18:30	-	37.2	35	.3	31.7	29.	6	32.3	28.8
6:1	-	45.3	37.0	42.5	3	6.6	38.1	-	.6	18.4	_	39.3	35	.7	33.5	28	_	36.7	28.6
	45	51.9	38.8	43.1	. 3	7.3	49.6	-	4.5	19:0	-	39.1	1 30	.7	29.8	27	_	32.2	28.4
-	00	46.3	37.7	42.5	3	6.B	52.2	-	5.6	19:1	-	40.0	0 3	1.0	30.9	28	_	31.6	27.2
_	:15	48.0	39.2	46.	8	37.7	52.5	-	5.8	19:3	_	38.	3 3	2.8	32.6	+	3.0		27.4
-	:30	47.3	38.6	45.	_	38.0	47.7		35.2	19:	_	39.	.3 3	1.5	30.5	-	8.3	40.6	27.6
-	:45	46.6	36.3	47.	.9	37.1	55.3	-	37.2	20:	-	43.	.1	2.6	49.3	-	0.7	45.5	26.9
	3:00	47.0	38.9	44	.3	38.3	48.	-	36.5	-	:15	48	3.2	33.0	53.9	-	6.6	33.1	27.9
-	8:15	50.3	40.8	44	.5	39.9	49.	-	36.5	-	:30	31	1.4	28.0	33.1	-	26.5	33.4	29.5
	8.30	50,1	42.7	46	5.2	40.2	46	_	39.9	-	:45	32	2.6	27.9	29.	-	26.5	32.5	29.2
	8:45	52.5	46.0	_	7.0	40.2	47	0,5	39.3	-	1:00	3:	1.4	27.3	31.	-	26.5	30.6	26.8
	9:00	53.8	40.0	_	5,5	39.3	-	9.5	37.3	2	1:15	3	1.8	27.3	28	-	26.5	31.1	27.6
	9:15	50.9	40.8	-	1.3	37.4	-	5.4	38.5	2	1:30	3	32.4	26.7	29	_	28.0	31.5	28.2
	9:30	50.6	37.6	_	7.8	36.3	-	4,3	35.0	2	1:45	3	38.6	26.7	31	-	25.0	30.8	-
	9:45	50.8	37.8	_	41,3	34.2	-	4.0	33.7	1	22:00	1	32.2	26.1	-	3.9	26.7	29.6	
	10:00	53.6	35.0	_	43.1	33.1	-	13.5	34.2		22:15		32.9	27.3	_	2.0	25.5	27.4	
+	10:15	49.7	35.5	-	38.3	33,6	_	44.7	37.0		22:30		40.6	25.6	_	9.7	25.0	26.	
-	10:30	47.4	33.8		41.6	33.5	-	56.6	41.9		22:45		29.6	25.7	-	8.1	23.6	25.	- 22
-	10:45	51.9	35.4	1	42.7	33.7	-	61.5	44.7		23:00		28.7	24.8	-	6.7	26.3	29	-
1	11:00	52.9	38.	5	42.3	34.7	-	54.9	42.5		23:15		30.7	25.9	-	32.3	22.3	35	-
t	11:15	52.1	37.	9	49.9	34.9	-	54.1	34.4		23:30		36,6	30,2	-	33.5	24.3	28	
t	11:30	55.7	39	.0	44.4	33.	-	47.6	32.		23:45		32.4	24.5		33.3			



					Т	uesday 11	June 2019						
Start	R1	R1	R2	R2	R5	R5	Start	81	R1	R2	R2	R5	RS
Time	Laca	LAISOD	Larg	Lugaa	Lang	0.000	Time	Laco	Largan	Larg	LAFOO.O	LAna	31.3
0:00	32,2	25.1	29,6	23.7	32.9	20.6	12:00	49.5	38.4	51,0	33.1	43.0	200,000
0:15	32.1	26.6	33.6	24.8	27.4	22.9	12:15	51.8	37.7	44.4	34,4	45.9	30.4
0:30	33.1	26.7	30.8	26.0	31.4	23.5	12:30	49.5	39.5	43.7	32.9	48.0	30,5
0:45	31.1	26.7	31.2	27.6	25.6	22.0	12:45	50.2	37.4	45.8	33.1	43.0	28.2
1:00	31.0	26.7	33.7	27.5	29.6	23.8	13:00	57.5	39.0	48.1	34.2	42.8	29.6
1:15	33,9	25.3	36.0	27.9	30.6	24.8	13:15	55.0	41.1	44.2	35.1	52.6	32.5
1:30	31.5	26.0	31.7	26.1	28,4	21.5	13:30	49.6	33.9	45.4	33.4	50.4	28.5
1:45	34.0	25.4	31.8	24.1	29.5	20.7	13:45	51.1	36.2	49.2	38.1	48.1	28.6
2:00	37.0	25,4	32.1	25.1	30.5	22.7	14:00	51.2	37.5	48.8	39.3	40.4	29.8
2:15	36.3	30.2	30.9	24.3	29.1	23.1	14:15	55.3	39.4	48.4	39.8	46.0	30.2
2:30	31.7	25,9	22.7	21.1	23.9	19.2	14:30	57.8	40.6	57.2	38.9	55.7	30.3
2:45	28.0	24.4	24.7	22.2	25.1	20.0	14:45	49.4	38.9	47.3	38,B	48.1	34.8
3:00	28.1	23.7	33.0	23.9	28.0	20.6	15:00	54.8	43.8	53.1	38.7	48.7	32.7
3:15	34.7	28.8	36.4	28.2	30.2	25.1	15:15	51.0	42.2	50.1	36.5	41.8	35.6
3:30	33.2	28.3	32.2	27.7	27.6	23.9	15:30	51.8	43.3	44.2	35.8	41.8	36.1
3:45	34.8	29.2	35,0	26.1	27.5	22.7	15:45	47.9	41,8	41.1	34.6	41.5	37.8
4:00	34.0	29.1	33.5	28.6	30.3	25.4	16:00	54.6	41.6	42.4	36.0	42.6	35.5
4:15	32.8	28.0	32.2	27.9	28.2	24.2	16:15	51.2	37.4	41.2	33.4	39.1	33.6
4:30	32.2	27.8	31,4	27.8	29.6	26.5	16:30	41.4	35,8	41.0	32.2	39.1	33.9
4:45	34.1	29.8	33.9	30.0	29,9	26.8	16:45	50.3	38.0	47.0	34.0	40.1	35.5
5:00	33.7	30.3	33.4	29.9	30.2	26.1	17:00	45.2	38.3	44.0	33.3	41.9	35.6
5:15	36.2	31.9	34.7	32.0	32.6	29.8	17:15	40.9	37.6	38.8	31.8	39.9	35.4
5:30	36.7	32.6	35.4	32.8	33.1	30.3	17:30	40.9	38,0	33.6	31.2	39.6	35.6
5:45	38.3	35.0	37.7	34.4	37.0	32.1	17:45	41.1	36,3	35.4	31.6	38.4	34.2
6:00	40.4	37.5	40.2	36.6	38.3	34.0	18:00	37.2	34.9	36.1	34.2	39.6	33.
Paragraph I a	44.8	39.6	42.3	39.3	46.5	36.4	18:15	38.9	34.3	32.3	29.3	38.5	31.7
6:15	-	40.1	43.5	39.1	44.7	37.5	18:30	37.8	32.8	30.9	28.4	36.6	31.
6:30	49.1	42.5	45.9	41.6	46.5	38.6	18:45	35.8	32.5	31.9	29,1	39.5	30,5
6:45	49.3	42.9	49.8	43.0	43.4	38.3	19:00	35.3	32.1	31.8	28.2	34.6	27.2
7:00	54.4		50.9	47.1	45.2	40.0	19:15	34.7	31.5	33.0	30.4	36.0	28.
7:15	56.9	44.2			45.4	41.0	19:30	35.6	32.7	33.1	29.0	41.4	26.3
7:30	51.9	44.6	53.4	46.6 45.7	45.4	41.1	19:45	35.1	31.5	32.7	28.9	31.5	26.
7:45	51.9	44.7	51.5		_	1970	20:00	40.3	33.2	45.1	30.7	36.6	25.4
8:00	55.5	45.8	49.5	44.4	49.4	41.4	20:00	38.9	32,5	33.6	29.7	32.4	26.4
8:15	52.5	44.9	48.6	43.8	46.0	39.5	20:13	35.8	32.6	33.2	28.0	32.9	23.0
8:30	49.3	44.2	47.9	43.6	45.8	39.3	20:30	38.0	31.0	34.6	29.0	32.9	24.
8:45	48.2	43,3	49,1	43.3	45.5		700000		30.5	36.5	32.3	38.3	28.
9:00	51.4	42.3	49.3	40.4	47.9	39.3	21:00	37.0	31.6	34.9	29.6	27.8	23.
9:15	49.2	39.2	42.9	38.7	43.9	37.9	21:15	_	28.0	33.4	26.5	38.0	22.
9:30	51.2	40.3	47.8	38.4	49.7	38.0	21:30	32.0		36,6	28,3	29.6	23.
9:45	54.1	38.9	46.4	36.8	43.0	35.7	21:45	33,9	29.2		29.2	27.7	24.
10:00	54.2	38.6	41,9	36.1	43,5	34,0	22:00	34.5	29.4	38.2	26.6	29.4	23.
10:15	49.5	37.3	45.0	38.1	43.0	34.0	22:15	32.9	28,5	42.6	100000	28.2	20.5
10:30	53.1	39,0	42.8	36.0	44.3	33,0	22:30	33.5	29.6	33.1	24.1		19.
10:45	52.1	36.2	39.2	35.4	54.7	32.7	22:45	36.0	25,8	32.6	23,1	24.2	-
11:00	45.9	36.7	42.2	35,4	49.6	34.0	23:00	37.6	26.3	30.7	24,8	26.8	20.
11:15	50.5	36.8	39.3	34.0	37,4	31.3	23:15	39,5	26.4	29.7	23.9	25.6	20.
11:30	51.0	38.2	38.7	34.3	44.4	32,2	23:30	30.3	24.5	28.9	23.8	25.5	20.
11:45	52.2	38.5	41.6	35.7	40.2	31.9	23:45	35.5	25.8	31.2	25.6	30.6	22.





					V	Vednesday	12th June 20	019					
Start	R1	R1	R2	R2	R5	R5	Start	R1	R1	R2	R2	RS	R5
Time	Larg	L <sub>AF90.0</sub>	Lang	Largo.o	Long	Larso o	Time	Lawa	Larence	Leea	Lauson	Larg	LAMO
0:00	30.3	25,3	30.3	22.5	29.0	19.5	12:00	52.4	37,8	42.7	34,6	62.6	36.0
0:15	32.2	26.2	31.5	23.1	30.3	20.6	12:15	50.9	37.2	55.7	35.5	62.3	34.1
0:30	30.3	23.7	27.5	22.9	25,9	19.7	12:30	49.9	35.8	46.7	32.0	62.1	32.3
0:45	28.5	23.3	28.7	21,8	27.7	19.3	12:45	50.3	38,6	48.9	35.4	57.6	34.9
1:00	33.4	23.5	35,5	22.5	32.3	20.1	13:00	51.3	41.4	42.4	36.0	45.8	31.8
1:15	32.8	23.1	27.3	20.8	24.5	17.9	13:15	53.3	37.2	41.7	35.9	49.2	32.1
1:30	30.8	24.6	28.4	21,3	26,5	17.9	13:30	45.3	36,4	42.8	36.5	45.2	31.4
1:45	30.4	22.7	29.3	23.1	24.9	18.6	13:45	49.6	39.1	50.7	43.0	48.5	34,9
2:00	30.2	25.0	29.4	24.7	28.6	20.4	14:00	48.7	44.0	52.0	47.9	44.5	35.1
2:15	31.7	25.1	30.7	23.1	29.1	20.6	14:15	47.5	38.4	48.1	44.6	48.6	35.6
2:30	32.3	26,1	28.4	22,2	26.2	17.8	14:30	43.7	37.9	48.7	45.4	58.0	37.4
2:45	32.9	25.0	34.0	24.3	29.2	20,2	14:45	61.8	37.3	50.5	47.4	57.9	38.3
3:00	31.1	26.6	31.3	25.9	27.2	21.3	15:00	49.4	39.9	50.7	47.7	53.8	36.6
3:15	31.3	27.2	30.9	27.4	26.1	21.0	15:15	53.0	39.8	48.7	36.8	47.7	32.2
3:30	34.6	29.8	33.2	28.1	30.3	23.5	15:30	47.5	39.2	43.4	36.8	44.8	
3:45	32,2	28.0	30.8	27.6	28.7	22.3	15:45	47.1	39.4	48.9	38.9	47.4	31.2
4:00	30.1	27.1	30.8	27.0	28.0	22.2	16:00	43.5	39.6	40.5			33.4
4:15	34.3	29.6	35,6	29.8	30.3	25.8	16:15	52.3	38.7	41.5	35.9	44.7	35.8
4:30	35.1	31.5	34.7	30.3	31.4	25.7	16:30	55.6	38.5	_	35.3	46.6	34.1
4:45	37.0	33.0	35.4	29.8	32.8	27.5	16:45	43.0		41.9	35.4	45.8	34,1
5:00	35.4	31.5	34.6	31.3	32.5	28.8	17:00	47.3	37,9	42.8	35.1	39.8	33.5
5:15	39.3	35.0	36.5	33,8	32.4	29.2	17:15	-	38,7	42.8	35.7	38.2	33.5
5:30	39.7	36,8	38.6	36.5	33.5	31.1	17:30	44.3	38.1	37.5	34.7	38.9	35.4
5:45	39.2	36.2	38.9	36.4	33.9	31.6	17:45	46.2	39.1	47.5	35.2	42.7	36,2
6:00	40.4	37.0	39.4	36,4	40.4	31.8	18:00	39.8	37.8	46.1	45.2	38.0	33.6
6:15	45.8	39.5	47.0	39.1	40.9	34.8	18:15		37.7	43.1	40.3	36.1	32.6
6:30	48.5	41.7	45.8	41.1	47.7	38.0	18:30	38.6	36.4	34,7	33.1	35.6	32,2
6:45	51.8	42.7	50,4	41.8	45.7	37.6		37.4	35.3	33.8	32.1	35.4	31.6
7:00	49.3	41,6	46.7	41.3	43.2	37.7	18:45	43.4	34.4	35,2	30.9	40,1	27.8
7:15	53.9	43.8	44.6	42.0	43.4	38.5	19:00	36.4	33.5	33.0	30.2	32.9	28.0
7:30	50.1	43.2	47.2	42.3	48.2	39.9	19:15	36,0	32.5	32.1	29.9	32.8	29.0
7:45	51.7	45.4	48.7	44.6	46.5	40.7	19:30	36,7	34.6	44.8	30,3	37.0	28.7
8:00	50.7	45.9	46.4	43.3	44.5		19:45	39.9	33.4	36.3	29.8	33,8	28,2
8:15	51,2	44.8	48.7	43.3		40.0	20:00	36.8	33.7	32.1	29.0	32.9	26.9
8:30	61.1	44.5	48.7	43.3	44.0	39.9	20:15	37.9	30.6	41,6	27.2	39.7	25.6
8:45	52.6	43.8	46.8	42.4	44.4	40.5	20:30	35.3	29.7	30.9	27,5	29.4	26.0
9:00		- Version			43.3	40.2	20:45	33.3	28,5	31.4	27.7	28.7	26,4
9:15	52,7	40.6	43.2	38.5	42.0	39.4	21:00	35.5	30.6	31.6	28.9	30,8	25.6
9:30			45.6	38.7	43.8	37.9	21:15	42.5	30.1	32.2	28.5	28.7	24.1
	50.0	39,3	47.7	37.8	43.1	36.4	21:30	35.6	30.1	30.3	25.8	28.7	22.7
9:45	56,4	42.0	46.5	37.4	44.2	35.8	21:45	36.1	29.3	30.8	26.5	28.5	24.2
10:00	51.5	38.1	54.4	37.6	52.3	33.7	22:00	37,2	29,3	30.4	27.1	30.7	25.9
10:15	52.4	38,1	44.4	35.7	41.3	32.6	22:15	36.5	28.1	28.4	25.5	28.0	24.4
10:30	53.1	40.4	48.2	38.1	45.7	33.9	22:30	35,4	26.5	29.9	25.7	29.2	23.4
10:45	56.8	41.9	45.6	35.6	50.5	34.0	22:45	33.1	25,9	30.0	26.0	29.9	23.3
11:00	52.5	39.4	46,9	35.2	44.6	32.7	23:00	32.4	26.3	30.0	25.7	30.1	22.5
11:15	63.1	38.2	43.6	35.1	45.4	32.2	23:15	32.8	26,5	40.6	24.4	35.6	21,6
11:30	52.6	37.2	39.6	34.9	53.9	35.0	23:30	35.2	27.4	36.7	27.5	27.7	22.5
11:45	47.5	36.2	39.7	35.3	57.8	34.4	23:45	35.1	28.6	34.8	25.9	30.9	22.0



		Start		R1	R1		22				Thursd	lay 1	3th Jun	e 20	019		-	_					
	-	0:00	-	den	LATSO		12 Ing	Lars		KD	R	5		art		R1	_						-
	-	1/3/5/16		4.4	29,5		.4	28.		33,4	Las		477	me		Ana	Las	1	R2		R2	R5	7
	1	0:15	-	5.2	28.1	39	.5	28.8	-	30.3	24,	-	12:	:00		7.5	37	-	44.1		1400	Ling	1
	-	0:30	34	.8	28.1	35	0	26.8	-	7.7	24.	-	12:	15	54	.4	42.	1	43.2		5,9	45,3	1
	$\vdash$	0:45	31	2	26,2	31.	0	25.6		7.8	21.:	-	12:3	30	52	.6	38.	-	41.2		7.0	45.0	1
	_	1:00	30	7	27.2	31.	7	27.7	+	-	23.8	-	12:4	15	47	.5	39.	,	10000	36	-	45.8	1
		1:15	32.	7	28.0	31.4	1	24.5		9.2	25.8		13:0	0	51.	1	37.7	-	40,5	36		46,1	1
		1:30	33,		31.8	30.2	+	25.1		6.6	22.3		13:1:	5	53.	9	37.7	+	40,3	35,	-	47.3	
ł		:45	32.5		30.0	33,4	1	28.0	24	-	22.3		13:30	)	49.3	1	37.5		57.1	35,	6	47.2	
ŀ	- 3	:00	31,9		27.8	32.5	+	25.2	28	-	24.8		13:45		50.2	1	38,8		55.1	45,4		53.7	
F	1000	15	31.0		26.6	33.9	+	25.3	29.	-	24.7		14:00		53.5	1	39.9	_	8.03	44.5		46.6	
1		30	31,8		28.0	32.1		25.6	26.	-	21.5	1	14:15	1	49.0	+	39.7		3.7	44.2		53,8	1
L	2:4	45	34.8		28.8	34.6	1		27.0	_	23.5		14:30	7	55.0	+	40.1		8.4	42.3	1	2.5	
L	3;0	00	32.2	1	28,5	33.2		26.9	30.4	1	24.4		14:45	1	48.8	+		_	3.2	43.8	5	6,1	-
L	3:1	5	32.2	1 2	7.4	32.7		26,3	30.9		25.0	1	15:00	+	46.1	1	39.2	50	-	46.7	5	7.8	4
	3:3	0	33.5	1	5,5	30.4		6.5	32.0		26.1	1	15:15	+	47.4	1	38.2	64	_	38.6	5	3.3	4
	3:45		31.0		7.1	33.1		4.7	29.3	1	22.1	1	5:30	+	49.3	_	10.5	44.		38.5	51	1	3
	4:00		33,0		1.2			3.1	29.0	2	4.1	1	5:45	-	54.1		1.3	48.5	9	37.6	46	.1	34
	4:15		34.7	29	_	34.4	29	-	31.9	2	5.0		6:00	1	56.8		8.7	45.7	1	38.3	45.	0	33
	4:30		36,6	31	-		29	.9	31.0	2	7.4		5:15	1	4.2	_	9.8	45.6		37.0	48.	5	34
	4:45		36.2	31.	-	36.3	32.	-	34.1	29	9.4	_	:30		-	_	7.7	42.1		35.2	42.	5	33.
	5:00		38.0	32.		35.1	30.4	-	31.7	28	.3		45	-	3.4	37	-	42,9	3	4.6	48.2	-	34.4
5	:15	3	9.4	34.0	-	36.0	32.4	1	33.7	30.	.4	17:			9.1	38	-	43.4	3	5,3	45.0	1	34.0
5	:30	3	9.9	37.0	-	39.9	34,6		35.2	30.	9	17:			7.2	37.	_	43.4	3	4.8	45,5		2.8
5	:45	40	0.2	37.5	13	8.6	35.9		38.4	33,	1	17:3	-	40	-	35.	-	38.4	33	3,8	35.7		2.4
6:	00	41	.7	39.2	_	9.7	36.6	1 :	6.1	33.3	1	17:4	-	39.	-	37.:	1	40,6	34	.7	36.5		3.4
6::	15	47	.в	41.3	_	3.9	39.3	3	8,5	35.0		18:0	-	40.	-	37.2		47.8	44	9	38.5	1	3.5
6:3	30	47.	2	41.8	46	_	42.3	4	7.2	37.8	1	18:15	-	40.0	-	38.0		46.6	41,	9	38.7	33	_
5:4	5	51.		43.6	45		12.0	46	5,2	38.7		18 30	-	38.5	-	35.1	1	10.4	35,	5	33.8	30	-
:0	0	52.	.	13.8	46.	-	2.5	44	.0	39.7		8:45	-	40.5	-	35,8	3	5.7	32,6	;	34.2	31.	-
:15	5	52.1	-	5.2	48.		2.2	47	.6	40.0		9:00	-	38.2	-	34.2	3	4.2	31,3		33.3		_
30		52.2		7.8	49.7	-	5.6	50.	1	42.4		9:15		35.8	1 3	2,5	3	7.3	31.2		35.6	30,	_
45	$\exists$	51.8	+	7.8	50.0	-	.5	47.	1	42.0		9:30	_	9.0	3	4.5	35	2	31.4	_	5.2		_
00	$\neg$	50.0		.4	49.8	46	.4	48.6	5	12.5	1	1:45		8.8	3	3.0	44	.2	31.6		8.9	32.0	_
5	1	50.5	45	_	47.9	44	.0	48.4	1	1.0		:00	_	8.1	32	2.6	36	7	31.4		5.3	32.8	
0	1	49.9	44	-	47.5	45.	2	44.6	1 4	1.2	20:	_	_	5.3	32	.0	34.	1	30,7	34	-	32,4	-
5	$\top$	48.9		-	48.3	44.	5	45.2		1.6	20:		37	_	34	.5	34,	2	30.8	36	-	31,3	-
)	1	49.2	44.	_	49,1	45.0		46.9		8.5	20:4	2.50	37.	-	33,	7	32.8		29,6	34.	-	31,8	4
	1	53.1	42.1	-	49.1	45.2		49.5	41	-	21:0		37.	-	32.	5	33.5		30,3	40.	-	29,2	-
_	1	51,3	40.7	+	46.3	40.7		43.5	39	-	21:1	-	36.2	-	31,	1	33.4	1	29.6	31.	_	28.8	-
	1	1,0	39.2	-	44.8	40.9		45.8	39.	5	21:3	200	52.1	-	31,5		34.7	1 2	9.9	31.4	-	28.0	1
	1	4.4		+	47.9	40.3		43.5	39.	-	21:45		34.5	1	30.6		35.4	3	0,9	32.1	+	27.2	1
	_	1.8	40.8	-	42.6	39.1		44.2	37.5	-	22:00	-	36,8	1	31.8		34.5	25	9.4	32.6	+	27.4	1
	54	-	41.7	_	42.8	38.8	1	19.4	37.1	-		-	36,8	1	31,4		36.5	_	0.8	35.3		28.3	1
	52	-	39.6	_	1.9	38.0	1	12.4	35.8	+	22:15	-	34.1	1	29.6		32.4	27		30.9	_	8,4	
1	51.	-	41.1	1 4	1.7	38.2	1 4	8,9	37.6	-	22:30	-	46.8	1	27.9		32.5	28.		_	_	5.7	
+		-	41.5	4	1.9	38.1	1	3.0	33.3	+	22:45	1	33.1		29.5		33.5	30.	-	28.8	-	4.5	
+	56.	-	37,5	4	1.2	37.3		3.2	33.7	+	23:00	-	32.9		28.3	1	3.1	28.2	-	29,9	-	ξ,3	
+	52.8	-	38.1	41	.6	36.8	44	-	33,3		23:15	1	34.2		28.8	_	5.3	31.4	-	25.6	22		
L	50.6	'	38.3	62	.8	38.6	43.	-	35.1		23:30	1	35.0	3	33.5	1	3.2	28.6	-	37.8	26.		
				-			-	-	-3.1	1 2	23:45	1 :	32.4		8.5	-		-0.0		34.7	27.	3	



Riverbank Quarry

					_	_		Friday	14th Ju	une 20	19			R1	R2	R2		R5	R5	1
					1 0	. 1	R5	R		Start		R1	1.0	K1	Larg	Larson	_	Arts	31.5	7
Start	R1		R1	R2	0.000	2 50 0	Lacq	LAP		12:00		49.7	_	40.1	43.6	37.5	-	55.6	34.3	7
Time	Lan		28.1	31.8	28	3.0	34.7	24	-	12:1	-	49.0	1	38.6	45.8	37.0	-		38.7	7
0:00	32.	_	26.6	32.0	2	9.3	33.2	-	4.7	12:3		47.0	1	38.0	43.8	37.	-	50.6	38.9	
0:15	32.		29.4	36.3	3	2.4	30.7	-	3.7	12:4		58.6	T	40.2	48.7	38.	-	52.3	39.7	$\neg$
0:30	34	_	27.4	36,8	7	8.9	33.7	+	4.5	13:	-	54.1	1	47.9	55.7	49.	-	52.9	38.1	$\neg$
0:45	35	_	26.6	32.0		28.8	36.1	+	4.0	13:	$\overline{}$	54.9	1	50.0	54.0	49	-	47.6	38.0	5
1:00	_	1.7	26.2	34.0		29,6	32.4	+	25.0	13		53.1		49.5	53.4	-	.5	48.3	39.	1
1:15	-	0.1	25.7	33.	2	28.4	33.9	+	23.3		:45	50.4		42.6	46.2	-	0.9	57.0	40.	9
1:30	_	2.7	25.7	35.	4	29.3	38.4	-	25.3	-	:00	49.0		42.0	48.7	-	1.3	55.0	37	.1
1:45	-	2.9	26.7	32	.8	27.3	32.4	-	24.8	-	4:15	45.	3	39.9	46.5	-	9.5	47.4	37	.3
2:00	-	34.0	28.6	33	.0	28.1	30.	_	22.3	1	4:30	50.	5	40.4	47.8	-	41.6	51.8	4.	3.4
2:15	_	34.7	30.4	35	6.6	26.1	36.	-	22.2	1	4:45	47	.6	42.4	47.	-	39.9	51.7	-	1.7
2:30	_	35.2	29.2	25	9.7	25.1	25	-	26.1	_	5:00	48	.7	43.4	43.	-	41.1	49.	-	7.9
2:45 3:00	+	34.7	28.3	3	5.3	29.0	33	-	23.6		15:15	50	3.3	44.2	46	-	40.6	46.	-	5.9
3:00		35.5	28.5	3	6.0	28.9	-	1.8	28.4	-	15:30	4	7.6	42.2	47	-	40.1	48.		35.6
3:35		35.7	28.8	1	6.8	30.1	-	1.6	24.9	1	15:45	4	9.4	41.8	-	1.6	35.0	43	.3	34.0
3:45		33.4	28.	1	34.4	29.5	-	1.0	26.3		16:00	4	6.2	37.8	-	1.3	34.3	49	.3	33.3
4:0		35.0	30.	1	35.4	28.	-	4.6	26.0	_	16:15	14	7.1	37.5	-	0.8	34.4	4:	2.2	34.2
4:1		34,3	30.	2	34.9	29.	-	30.8	27.		16:30		47.4	37.2	-	9.4	32.8	4	1.7	32.5
4:3		36.7	30	.7	34.5	30	-	31.9	26.	7	16:45		43.8	35.7	-	12.9	32.7	1 4	5.3	32.2
4:		37.0	31	.1	35.7	29	-	33.3	29	.7	17:00		43.0	36.	-	35.5	32.5	1:	8.6	33.5
-	00	38.3	3	3.6	37.1	-	0.0	32.3	30	0.1	17:13	,	39.2		-	46.9	34.3		37.7	33.4
	15	38.4	3	3,4	37.5	-	4.6	34.1	31	1.9	17:3	0	39.2	70	-	48.9	47.8		38.6	36.5
5	:30	39.	9 3	4.6	37.6	-	6.0	33.9	3	1.8	17:4	5	38.3	75	-	45.5	43.0		33.8	30.7
5	:45	39.	-	6.0	37.9	-	8.2	36.8	3	3.5	18:0	10	37.	-	5,5	37.5	35.5	5	33.0	29.9
1	5:00	42	.6	38.8	41.7	-	40.2	47.4	3	4.9	18	15	38.	-	4.9	43.1	35.	5	34.8	28,1
	6:15	48	-	40.7	45.6	-	40.7	44.9		36.4	18:	30	38.	-	4.8	33.9	30.	,6	32.4	28,0
	6:30	50	0.6	41.7	44.8	-	41.0	47.1		36.5	18:	Avenue -	37		4.4	35.1	30	.4	34.9	28,2
	6:45	51	0.4	42.2	47.	-	41.8	46.4	4	38.7	-	:00			31.7	31.7	28	3,8	31.6	26.9
	7:00	_	9.1	42.0	48.	-	43.5	43.	7	39.9	-	:15	-	3.2	32.4	32.6	25	9.0	35.0	26.6
	7:15	-	0.7	44.8	48.	-	43.1	46.	4	39.5	-	3:30	-	0,0	31.1	45.9	3	1.2	37.2	26.7
	7:30	_	1.9	44.1	50	-	45.9	43	.1	39.9	1	0:00	-	10.9	30.8	37.8	3	2.6	32.3	27.0
	7:45	_	52.9	47.6	-	.2	46.9	44	.7	40.6	-	0:00	+	35.6	31.2	41.2	_	36.1	30,6	26.4
	8:00	+	54.3	46.9	-	0.0	44.4	44	1.7	38.0	-	0:15	-	32.7	30.0	32.		26,6	33.0	1 07.
	8.15	-	52.9	43.6	-	8.6	42.5	4	7.9	39.3	- 1	20:45	-	33.2	30.1	29.	-	27.2	28.2	75.3
	8:30	-	52.0	42.0	_	8.6	42.9	-	8.0	40.8	_	21:00	+	34,3	28.6	30.	-	27.8	27.7	
1	8:45	-	52.0	39.2	1	8.0	41.7	-	8.2	36.2	-	21:15	+	32.3	28.9	30	_	29.0	28.5	-
1	9:0	-	51.9	40.8	-	48.5	39.5	_	12.1	33.5	-	21:30	1	35.4	27.6	_	.1	27.5	32.	200
1	9:1	_	54.2	40.0	_	44.7	37.5	-	44.0	34.2		21:45	1	31.0	27.9	_	2.6	28,6	28.	25
	9.3	-	57.3	42.	5	57.2	39.5	-	49.4	33.5		22:00	-	28.6	25.8	_	7.9	25.9	28	ar
	9:		55.8	43.	2	45.9	40.4	-	46.5	33.		22:15	-	29.5	26.2	-	7.9	25.5	-	.5 24
	-	:00	56.5	46	.7	48.0	41.	-	56.1	32	_	22:3	-	29.5	24.4	_	9.1	25.0	1 2	5.9 23
	-	:15	54.2	43	.7	46.1	38.	-	48.4	34	-	22:4	_	28.3	24.	-	27.7	24.8	-	7.5 2
	-	0:30	53.0	45	.2	50.7	38	-	47.4	33	-	23:0		26.9	22.	*	27.6	24.5	-	5.7 2
	_	1:00	53.1	4	3,5	47.7	37	-	48.5	-	5.9	23:	.5	29.6	23.	-	28.5	24.	-	7.4 2
	-	1:15	50.2	3	9.8	47.6	37	_	54.5	-	1.7	23:	30	26.9	22	_	27.0	24.	-	23.4 2
	-	11:30	51.4	1	9.0	47.9	30	5.3	55.7	-	2.4	23:	45	24.1	21	,6	26.3	2.4.		



		art	RI	T	RI	R	1	0.7		S	aturda	y 15"	June	2019	9			_	_			
- 1	Tin		LA	1	LAISOD	Lar		R2 Largo		R5	R5		Star	_	I R1		R1	Т.				
ł	0:0	_	33,0		21.9	29,	7	25.0		4.0	22.5	_	Time	_	Laco		1900	100	R2	R2 Luigo	8 11 9	15
ŀ	0:1	_	25.9	-	23.0	27.3		24.8	_	6.4	23.1	-	12:00	_	58.5		8.7	41	-	34.2		2.5
H	0:3		28.4		21.2	24.7		22.7		1.3	22.9		12:15	-	55.7	3.	5.9	43	2	35.9	51	-
H	0:45		39.5	1	23.7	33.9		22.5	-	.8	22.5	-	12:30	-	60.5	43	.4	44.	.3	34,5	46	.
H	1:00	-	34.7	1	30.7	27.8		24.8	35	-	28.8	+	12:45	-	58.0	40	.2	41,	9	35,3	52	-
+	1:15	$\rightarrow$	41.3	-	29.7	32.1		24.6	35	-	26.0	-	13:00	-	47,6	36	7	42,5	5	36.7	46.	-
H	1:30	-	35.5		26.9	28.2	T	24.0	33.	-	26.7		13:15	+	48.5	34.	0	44,5	5	36.2	45.	-
H	2:00	+	36,0	1	23.1	25.5		23.1	28.	3	22.2		13:30	+	44.0	31.	1	42.3		34.7	50.4	_
1	2:15	+	24.2	1 2	1.2	24.6		22.2	23.9	,	20.5		13:45	+	54.7	35.	2	42.9		34.2	52.5	-
H	2:30	+	23.5	2	1.2	23.5	1 2	2.1	21.7	_	19.9		4:00	_	47.5	31.9		44.1		35.3	49.9	32
-	2:45	_	23.5	2	1.3	24.0	2	2.3	22.2	1	20.2		4:15	_	39.3	30.0		42.9		34.3	42.8	30
-	3:00		24.4	_	0.9	38.8	2.	2.9	23.3		19.9		4:30	-	52.7	30.7		49.6		32.9	45.2	27
	3:15	_	27.4	-	2.3	26.8	24	1.7	25.1		21.9	_	4:45	+	52.3	32.7		47.7		31.6	48.1	27.
_	3:30	_	27.0	21	-	27.1	23	.9	24.4		21.1		:00	-	55.6	31.7	1	42.1	1 3	35.0	41.6	28.
-	3:45	1	23.1	21.	-	25.1	22	.3	22.5	1	1.2		:15		3.5	34.5	1	42.5	3	4.4	35.5	27,
	1:00	_	6.5	22.	-	25.2	21	.8	24.1		1.7	15:	_		2.8	33.2	4	14.1	3	5.3	43.0	29.0
_	:15	+	5.8	21,	-	24.3	20.	8	24,5		1.8	16:	_		1.8	34.4	4	5.7	3	2.5	48.4	30.3
-	:30	-	5.8	21,9	_	23.8	20.	6	23.1	1	0.9	16:			0.5	32.9	4.	2.4	31	1.0	54.1	28.0
_	:45	28	5.6	23.2	_	23.9	20.	5	23.7	21		16:3	-	43	-	33.9	40	0.2	31	.5	43.5	28.6
_	00	27	-	22,2	-	22.9	20,9		24.1	21	-	16:4	-	45.	-	33.2	40	0.4	31	.3	35.4	28.6
5:		27.	-	23,9	1	4.6	21.8		24.7	22.	1	17:0	-	51.	-	33.7	41	.5	30.	.2	45.2	30.3
5:3	_	28,	-	23.8	2	6.1	22.7		25.1	22.	5	17:1	-	47.	-	37.9	42.	.0	32.	1	46,5	32.1
5:4	5	30.5	_	25.5	$\neg$	8.6	25.4	2	6.5	24.0	0	17:30	-	41.5		37.6	37.	.5	30.	0	35,2	31.5
6:0	-	41.1	-	27.4	1	9.7	25.3	2	9.5	25.4		17:45	-	42.1		0.0	34	5	32.6	5	35.6	33.8
6:1	5	46.5	_	28.3	1	3,4	24.8	3	0,6	25.7		18:00	-	39.9		0.2	38.7	-	33,9		34,8	33.2
6:30	2	49.1	_	32.5	43		31.3	3	9.8	31.3		18:15	+	38.7	+	8.1	39.3	-	32.2	3	3.6	30.4
6:45		50.5	-	8.3	45		33.4	52	2.5	32.5		18:30	_	37.4	-	7.2	34.5		31.9	3	2.6	29.0
7:00		53.1	-	7.1	48.	-	34.3	49	.2	32.7		18:45	_	36.6		5.1	34.0	-	31.7	3	1.0	27.0
7:15		47.7		9.4	41.	_	3.2	39	.5	31,1		19:00	_	6.4	35		32.7	+	29.4	30	0.6	26.7
7:30		52.7	_	1.8	41		5.2	42.	5	33.6		19:15	-	6.5	35		33.7	+	31.5	31	.5	25.8
:45		56.7	44	_	41.4		5,9	51.	6	35,1	1	19:30	_	7.3	34,		32,2	-	28.8	30	.4	25.8
:00	5	58.3	43		49.2	-	3.3	46.4	_	40.1	1	9:45	+	5.6	34.	-	32.6		28.7	32	.1	26.0
15	5	52.6	41	-	47.2	-	.6	41.5	-	37.5	2	0:00	49	_	36.	-	30.4	1	27.7	32.	2	27.0
30	4	9.7	40.	-	47.6	41	-	44.9	-	36.0	20	0:15	47	_	30.8	-	18.3		7,5	45.	0 :	7.0
45	6	7.1	38.	-	58.6	39	_	41.1	1	33.2	20	0:30	56.		27.6	-	2.4		9.7	59,3	-	8,3
00	47	7.3	33,0	-	43.5	35.	_	50.3	3	1.7	20	:45	30.	9	25.2	-	7,8		8.6	35,2	-	8.3
5	52	.3	33,4	-	44.2	37.	-	41.1	3	1,5	21	:00	42.5	-	25.3	_	0.6		5.1	28.1	2	5.1
0	41.	.9	30.2	_	48.3	37.	-	46.1	3	3.1	21:	15	59.5	5	49.1	_	0.6	27		47.1	2	7.7
5	45.	4	32.2		43,4	38.9	-	45.7	32	2.0	21:	30	64.0	1	50.1	56		43		57.2	45	.7
0	45.	9	34.1	-	47.1	37.2	-	43.0	31	.4	21:4	45	53.2	1	35.8	48	-	46.		59.6	49	9
5	47.9	9	35.0	-	47.1	37.1	+	44.2	30	.7	22:0	00	34.1		29.7	33	-	32.		53.9	38	8
)	48.8	3	34.4	$\neg$	46,5	34.0		42.4	29.	8	22:1	.5	32.1	1	27.9	30.		29.1	-	35.1	30,	9
	51.3		35,5	_	11.6	33.6	_	39.2	29.	-	22:3	0	34.8	1	33,9	28.	-	29.1	-	32.7	28,	
	49.5		39.0	1	3.0		1	12.2	30.	8	22:45	5	34.4		33.7	27.	-	26.4	-	28.4	25.6	;
	51,5		43.8	1	4.3	38.9	-	13.2	33.7		23:00		37.7		35.0	26.3	-	25.2	+	28.0	24.3	
	52.3		38.8	1	6.5	37.8	1	5.7	36.0	-	23:15		38.9	1	37.2	26.8	+	24.1	+	29.8	24.2	
	55.4	$\overline{}$	35,5	1	5.1	38.7	-	0.2	32.8	1	23:30		43,6		35.3	35.4	-	24.5	_	25.7	24.2	
- 77		_		1 /	_	37.9	1 4	5.9	34.0		23:45		37.4	-	200254	33.4	-	25.0	- 1	25.4	23.4	



Riverbank Quarry

			_	_	_	_	9	unday	16th Ju	ne 20	19				R2	R2		R5	R5	
			_	22	B	2	R5	RS		Start		R1	100	1	Lang	Lus	-	Leeg	LATSO	200
Start	R1	R1	. 1	R2 Lars	12	100	Laco	Lass		Time		51.0	_	5.3	46,5	33	9	35,9	29.3	-
Time	37.6	36.8		27.2	24	4.7	24.8	22		12:00	-	49,9	3	3.7	42.4	32	.9	44.1	30.	
0:00	37.8	36.	_	26,8	2	3.6	23.9	22	_	12:15	-	51.7	3	4.4	42.5	33	,5	45.7	30.	_
0:15	37.1	36.	_	25.3	2	3.7	24,2	-	.9	12:30	-	53.9	4	0.0	41.4	33	2,5	42.8	29.	
0:30		35.	_	25,0	1 2	2.7	23,4	2:	1.9	12:4:	-	49.0	1	37.4	44.1	3	2,3	59.5	32	-
0:45	36.6	34	-	25.6	1	23.8	26.9	2	1.4	13:0	-	55.6	+	38.1	40.1	3	2.0	59.2	35	
1:00	35.7	34	-	24.0		22.2	23.4	2	1.1	13:1	-	_	+	35.6	42.5	3	1.6	51.1	30	0,6
1:15	35.0	-	.6	24.9	T	22.7	25.0	2	1.1	13:3	_	52.4	-	32.7	41.2		2.2	52.1	31	0.1
1:30	34.3	-	2.2	24.5	+	22.3	23.9	1	8.00	13:4	-	45.5	+	30.3	39.9		30.1	41.4	2	8.0
1:45	32.9	-		24.1	+	22.4	21.7		20,5	14:		40.1	+	29.6	39.6		30,9	39.6	2	9.1
2:00	32.2	-	6.5	25.0	+	22.7	22.7		21.3	14:	15	44.9	+	31.6	42.5		31.8	46.5	3	9.4
2:15	34.5	-	2.2	25.5	-	22.8	23.4		21,9	14:	30	45.8	-		47.	_	33.7	45.	3	31,9
2:30	27.9	-	5.7	-	_	22.B	23.	, 1	21.6	14	45	45.8	-	36.5	44.	-	32.6	49.	5	29.5
2:45	26.6	-	22.4	25.5	-	22.3	23.	_	21.2	15	:00	47.9	-	36.1	43	_	33.7	54	4	31.6
3:00	29.8	-	22.8	26.	-	23.0	24.	_	21,8	15	:15	47.4	1	35.8	+	-	33.9	42	.2	29.9
3:15	30.4		22.4	26.	-	22.0	22		20.1	1	5:30	47.5	9	38.2	47	_	33.4	37		29.5
3:30	27.7	2	21.6	24.	-	100000000000000000000000000000000000000	24	-	21.1	1	5:45	44.	7	35.3	41	-	32.8	+	5.0	29.7
3:45	32.	5	25.0	26	_	23.0		.0	20.9	1	6:00	46.	.1	35.0	-	7,5	34.3	-	0.6	30.3
4:00	26.	0	22.6	25	-	22.1	_	.9	21.1	1	6:15	50	.4	38.9	-	5,4	28.9	_	5.5	29.1
4:15	25.	8	22.0	-	.2	21.7	-	3.4	21.2		16:30	48	.9	33.1	_	9.4	29.8	-	8.6	29.3
4:30	29	.1	23.3	24	1.7	22.2	-	7.9	22.0		16:45	45	8.6	34.4	_	9.2		-	7.8	30.5
4:45	44	.8	24.3	3	8.8	23.0	-	-	37.4	+	17:00	48	8.0	39.6	-	1.7	31.7	-	36.2	33.4
5:00	-	.6	35.8	3	8.8	33.3	-	5.1	28,2	+	17:15	4	3.4	41.6		33.7	29.8	-	38.8	37.1
5:15	1 2	2.1	28.6	2	8.4	26.	-	3.8	25.4	+	17:30	4	4.4	43.5		35.3	33.8	-	37.8	36.7
5:30		2.7	28.8	1 2	7.5	24.	-	8,8	25.5	+	17:45	1	3.7	42.	5	44.8	34.0	-	37.7	35.8
5:4	1 2	0.5	28.2		27.2	24	-	27.4	25.9	-	18:00	1	13.5	42.	4	45.1	40.	_		32,9
6:0	_	2.9	27.0	1	40.5	24	.7	29.5	_	_	18:15		43.2	42	1	34.3	32.	_	36.3	33,3
6:1		17.4	30.3	3	43.3	28	.7	48.2	27.8	-	18:30		41.8	40	.1	34.8	32.	-	35,6	29.8
6:3	-	17.2	34.0	6	43.4	31	.,9	49.7	30.5	_	18:45		41.0	39	.0	35,5	31	_	36.3	29.5
6:4	-	50.0	34.	8	41.7	3	2.4	42.5	30.	-	19:00		40.9	38	.1	37.2	32	.2	36.6	35.3
-	-	46.8	33.	9	41.5	3	3.2	43.3	30.	_	19:1		54.1	40	0.7	52.3	34	.7	51.4	47.9
7:	-	52.0	37	.4	42.8	3	5.7	41.3	31		19:3		68.6	5	0.1	63.7	44	1.1	60,5	63.7
	15	52.6	38	.3	44.6	1	6.3	52.2	32	-	19:4		69.9	6	4.9	64.7	6	0.6	68.1	U. Salarani
	30	50.1	34	1.9	42.4		35.3	42.9	31				49.0		5.4	50,9	3	6.7	62.2	41.4
	:45	51.4	-	3.4	42.5	5	35.4	41,6	-	.2	20:0		37.0		33.5	39.6	3	2.6	41.1	35.3
	:00:	48.0	-	0.9	46.	1	35.6	41.9	-	1.7	20:	-	38.	-	36.6	32.6	1	30.6	36.7	31.1
-	3:15	52.0	-	3.9	42.	9	34.1	48,0	-	3,0	20:		37.	-	36,6	31.8	3	28.6	32.2	_
-	3:30	47.6	-	2.0	44.	_	35.0	40,8	-	1,9	20:	_	42	-	36.9	40.	2	29.3	38.6	_
-	8:45		-	31.0	46	-	34.4	41.		0.9	-	:00	42	-	37.6	35.	3	29.0	35.6	_
-	9:00	48.5	-	33.1	43	_	33.2	42.	2 3	30.3	-	:15	-	3.0	37.0	38.	1	28.4	42.4	_
	9:15	51.0	+	33.1	-	.2	33.6	43.	8	31.2	-	:30	-	_	36.0	29	.8	26.5	26.	_
	9:30	50.8	-	33.5	+-	1.5	35.3	46	.4	30.7	+	L;45	-	6.8	37.3	34	-	29.6	34.	_
	9:45	53,3	-		-	4.7	34.9	38	.3	30.3	-	2:00	-	9.4	37.9	-	7.3	29.2	40.	.1 32
	10:00	49.7	-	34.0	+	7.3	34.5	42	.1	29.4	-	2:15	+	4.3	36.7	_	7.9	29.0	43	.5 31
	10:15	49.	_	33.9	-	3.5	34.4	4	5,3	29.9	-	2:30	-	13.2	72.55	_	1.2	27.0	29	.2 26
	10:30	46.	-	32.5	-	4.0	37.6	4	4.6	29.5	1	22:45	-	38.6	36.0	-	8.6	25.9	27	7.9 25
	10:45	55.	4	35.2	-	-	37.1	1 4	2.7	30.7	1 :	23:00	-	37,3	36.1	-	1.0	25.6	30	0.9 2
	11:00	49	.6	34.4	-	50.0	37.8	-	1.2	31.2		23:15	_	38.3	35.8	-	28.6	24.7	2	7.5 2
	11:15	54	.0	34.6	-	53.6	35.6	-	8.6	30.9		23:30		39.1	35.6	-	28.5	24.6	3	1.3 2
	11:30	49	.9	33.6	+	44.9	36.6		12,6	29.8		23:45		48.0	34.9		.0.0	-		

# NGEN

Start Time	R1 Lacq	R1 Largoo	R2 LAng	R2 Largo o	R5 L <sub>Acq</sub>	R5 LAFOO
0:00	35.0	28.8	26.6	24.5	24.4	22.9
0:15	36.3	34.8	29.7	25.5	25.9	23,6
0:30	36.5	29.6	26.1	24.6	26.4	23.5
0:45	30.2	23.5	28.4	24.0	25.6	22.3
1:00	31.7	23.2	26.5	23.1	23.5	21.2
1:15	24.8	22.0	25.3	23.1	24.2	21.6
1:30	27.3	22.5	27.7	24.5	27.2	22.8
1:45	34.9	24.0	27.6	23.8	28.6	21.9
2:00	27.6	24.0	28.6	23.8	28.3	22.6
2:15	30.4	24.9	33,6	26.4	33.2	29.1
2:30	30.8	23.5	30.5	25.5	33.0	27.7
2:45	30.4	25.2	32.8	25.6	36.4	32.0
3:00	36.6	22.5	31.3	23.3	34.1	30.5
3:15	26.5	23.0	27.6	24.4	31.1	27.1
3:30	41.6	25.2	46.6	24.5	39.9	26.2
3:45	31.2	27.8	30.4	24.0	27.5	24.6
4:00	29.8	24.3	29.7	25,3	30.4	27.3
4:15	33,4	29.4	36.1	31.5	30.4	27.7
4:30	35.4	29.8	34.5	28.4	29.9	27.1
4:45	34.3	30.2	32.4	29.5	31.9	27.6
5:00	35.1	30.7	32.9	29.5	32.7	31.1
5:15	34.4	31.3	33.9	31.2	32.2	29.5
5:30	34.1	31.6	33,6	31.4	30.2	28.0
5:45	37.6	34.0	37.2	33.6	33.8	29.6
6:00	41.4	35.9	39.3	34.6	36.6	33.0
6:15	45.8	38.2	43.1	37.2	49.4	36.5
6:30	49.6	40.7	48.6	38.1	45.3	36.4



# APPENDIX B - EQUIPMENT MEASUREMENT SPECTRUM DATA

Santin Quarry Equipment Measurements Spectrum Data 12032020

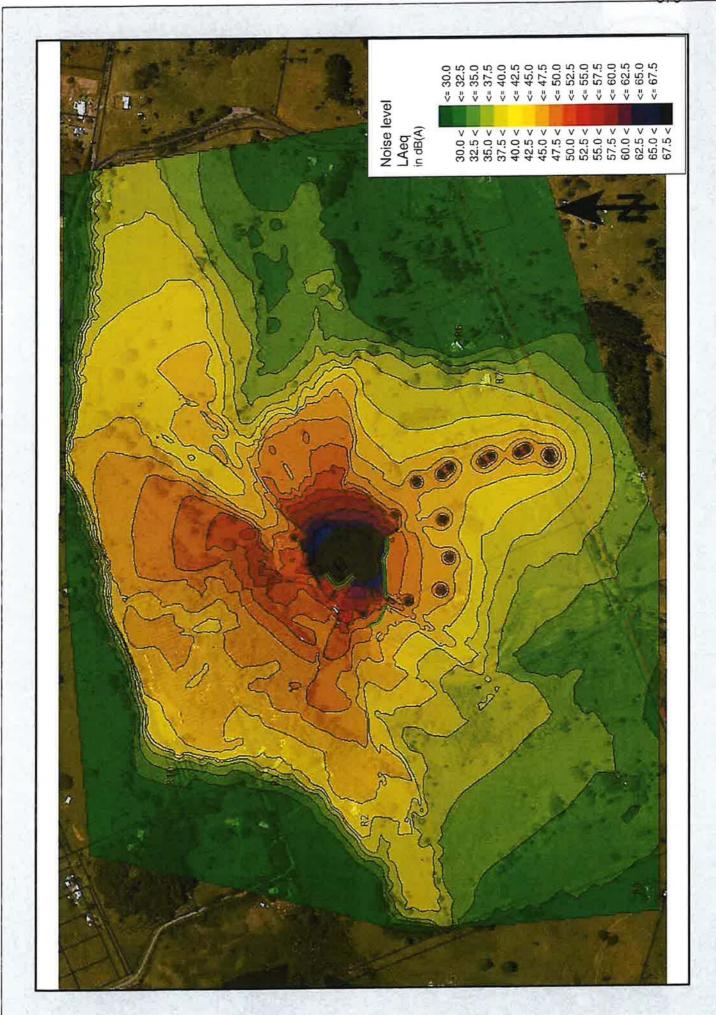
	M1	M2	M3	ML4	MIS	MIG	ML7	ML8
Frequency	Post A LZeq [dB]	Post A LZeg [dB]	Post A LZeg [dB]	Post A LZeq [dB]	Post A LZeg [dB]	Post A LZen [dR]	Post A LZen [dB]	Post A Lizon Falo
12.5 Hz	5.7	7.6	9.7	15.0	9.9	-3.2	-1.7	
16 Hz	14.6	15.5	19.0	24.0	19.2	6.3	8.0	13.8
20 Hz	21.9	17.9	25.6	24.4	24.4	18.0	18.7	20.1
25 Hz	36.8	34.0	33.3	27.9	28.8	28.9	29.0	28.7
31.5 Hz	30.2	27.5	30.2	31.5	32.2	27.1	28.4	38.1
40 Hz	42.3	45.2	50.9	51.8	54.9	41.5	49.6	35.0
50 Hz	47.4	47.9	44.9	44.3	42.3	51.5	50.6	48.9
63 Hz	59.9	54.0	53.0	49.6	59.2	53.4		51.9
80 Hz	79.8	73.7	71.1	59.5	65.5	64.1	53.8 65.8	60.7
100 Hz	61.9	57.9	56.5	54.9	53.7	52.6	56.2	80.6
125 Hz	60.7	58.8	56.0	55.4	55.9	56.7	58.8	63.6
160 Hz	65.1	62.5	59.5	55,8	57.0	59.9	60.8	63.8
200 Hz	65.1	60.9	59.9	56.5	57.5	59.0		69.9
250 Hz	65.6	63.6	60.5	58.6	57.6	59.5	61.2	70.9
315 Hz	67.8	64.1	62.2	63.5	61.8	60.1	61.9	76.3
400 Hz	71.1	67.6	67.4	66.0	67.7	63.1	62.0 64.5	71.4
500 Hz	70.1	71.1	67.9	66.8	64.7	63.6		78.5
630 Hz	72.7	73.2	69.3	68.2	66.1	64.7	64.3	78.2
800 Hz	74.0	73.5	69.7	67.8	66.7	65.3	65.6	79.1
1 kHz	74.7	71.4	72.0	69.9	67.4	66.4	67.2 69.1	80.1
1.25 kHz	75.4	71.3	70.9	68.4	66.4	66.4	67.8	81.3
1.6 kHz	74.2	70.9	70.4	66.6	65.7	66.2	68.2	80.2
2 kHz	74.4	70.0	69.7	65.6	65.5	64.7	67.2	79.6
2.5 kHz	74.0	70.3	70.0	65.6	64.8	64.1	67.8	79.7
3.15 kHz	72.4	70.1	68.1	64.1	63.9	62.0	66.2	79.5
4 kHz	70.9	66.5	66.5	62.2	63.1	60.1	64.5	78.2
5 kHz	68.1	63.1	64.1	60.2	61.7	57.4	61.6	76.5
6.3 kHz	65.5	60.2	61.7	58.7	59.0	54.5	58.4	74.2
8 kHz	62.2	56.9	59.2	57.6	58.3	51.7	54.6	71.7
10 kHz	59.3	54.2	57.7	56.3	56.7	48.0	51.9	68.2
12.5 kHz	54.0	48.7	54.0	51.8	50.1	43.1	47.3	66.2
16 kHz	45.1	40.5	45.6	44.2	41.3	33.8	36.9	61.6
20 kHz	38.4	35.1	39.6	37.9	34.2	25.4	30.1	52.7
Α	85.5	82.4	80.8	78.0	77.3	76.0	78.2	46.8
С	101.9	96.2	94.0	88.1	91.9	88.6	90.5	90.7



Start Time	7:50:27 AM	7:50:27 AM	8:50:27 AM	9:50:27 AM	8:11:05 AM	9:44:54 AM
Elapsed Time	02:45:44	01:00:00	01:00:00	00:45:44	02:36:48	00:15:00
Hz			(0.000,	Top of Quarry East M4	Top of Quarry West	R2 41 Chilcott Stree
31.5	17.6	16.8	17.2	19.0	17.2	5.3
40	34.1	31.9	35.3	34.7	32.0	16.1
50	30.1	32.0	28.5	28.4	31.1	16.9
	42.9	42.6	43.6	42.0	36.0	19.8
63	51.1	49.1	52.1	51.7	52.0	31.9
80	40.1	42.3	37.6	38.9	37.4	27.8
100	36.9	37.4	36.4	36.7	37.9	24.6
125	36.3	34.9	36.4	37.6	41.5	26.7
160		41.4	41.3	41.4	38.9	25.8
200	41.4	41.4	44.6	44.2	39.8	22.7
250	43.7	43.1	45.2	44.8	44.6	23.9
315	44.4		56.1	54.3	52.4	28.8
400	54.7	53.1	52.0	51.3	51.0	26.5
500	51.0	49.5		50.0	52.2	26.0
630	49.2	47.3	50.1	52.3	50.9	28.4
800	51.7	49.9	52.5		53.2	29.5
1k	51.1	49.7	51.9	51.6		29.5
1.25k	51.4	50.2	52.2	51.7	53.2	29.3
1.6k	50.2	49.1	50.9	50.5	52.1	
2k	50.1	49.0	50.8	50.4	51.5	28.9
2.5k	50.0	48.8	50.7	50.3	51.3	27.3
3.15k	49.3	48.3	50.0	49.7	49.2	25.5
4k	47.4	46.3	47.9	47.8	46.8	25.3
5k	46.4	44.8	47.0	47.1	44.6	22.9
6k	43.2	42.0	43.9	43.7	42.0	18.8
8k	41.4	39.7	42.3	42.0	38.9	15.6
10k	35.7	34.0	36.7	36.2	29.8	11.9



# APPENDIX C - NOISE CONTOUR PLOT





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→ The Power of Commitment