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.

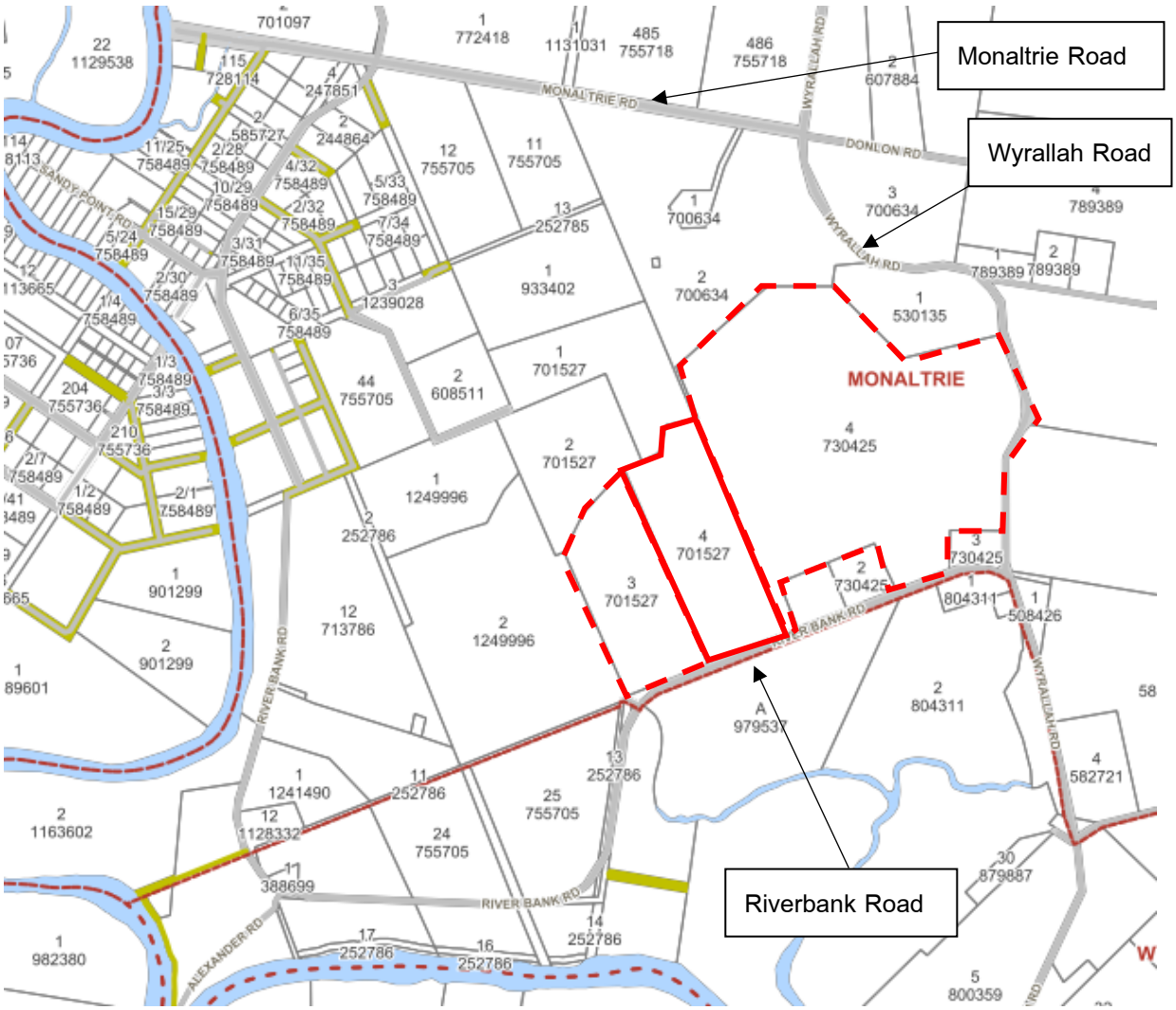


Figure 1 | Site location, *Source of map: Lismore IntraMaps 2019*

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 15,000m^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 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 level	The single-figure background level representing each assessment period.
Background noise	The underlying level of noise present in ambient noise, generally excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{AF90} descriptor.
Best available technology achievable (BATEA)	Equipment, plant and machinery incorporating the most advanced and affordable technology available to minimise noise output.
Best management practice (BMP)	Adoption of particular operational procedures that minimise noise while retaining 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 will 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.
Evening	The period from 6pm to 10pm.

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 mitigation	Noise mitigation that can be engineered and is practical and the benefits of which 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.
$L_{AF90,\ 15min}$	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.
$L_{Aeq,\ T}$	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	Land uses that are sensitive to noise, such as residential areas, churches, schools and recreation areas.
Operator	Noise-source manager.
Project noise trigger levels (PNTL)	Target noise levels for a particular noise-generating facility. They are based on the most stringent of the project intrusiveness level and the project amenity noise level.
Proponent	The developer of the industrial noise source.
Rating background level (RBL)	The overall, single-figure background level representing each assessment period over 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 Road	Bruel & Kjaer 2250L Sound Level Meter	2602785	Oct 2018
	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 7th – 17th 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 16th. 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 Period Receiver Background Noise Monitoring Summary - June 2019												
Receiver	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**	**13th**	**14th**	**15th**	**16th**	**Non-Quarry RBL**	**All days RBL**
	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/**35**
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 NPfI day period minimum of 35 dB(A).

IVD – Insufficient Valid Data

Table 4 | Summary of evening time background noise levels

Evening Period Receiver Background Noise Monitoring Summary - June 2019											
Receiver	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**	**13th**	**14th**	**15th**	**16th**	**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/**30**
R2	24.9	24.4	27.1	26.7	29.2	29.3	31.1	27.9	25.3	IVD	27.1/**30**
R5	25.0	24.4	23.6	26.9	23.0	24.1	27.4	25.2	25.8	IVD	25.0/**30**

The evening RBL has been adjusted to the NPfI evening period minimum of 30 dB(A).

IVD – Insufficient Valid Data

Table 5 | Summary of night-time background noise levels

Night Period Receiver Background Noise Monitoring Summary - June 2019											
Receiver	**7th**	**8th**	**9th**	**10th**	**11th**	**12th**	**13th**	**14th**	**15th**	**16th**	**RBL**
	Fri	Sat	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	
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

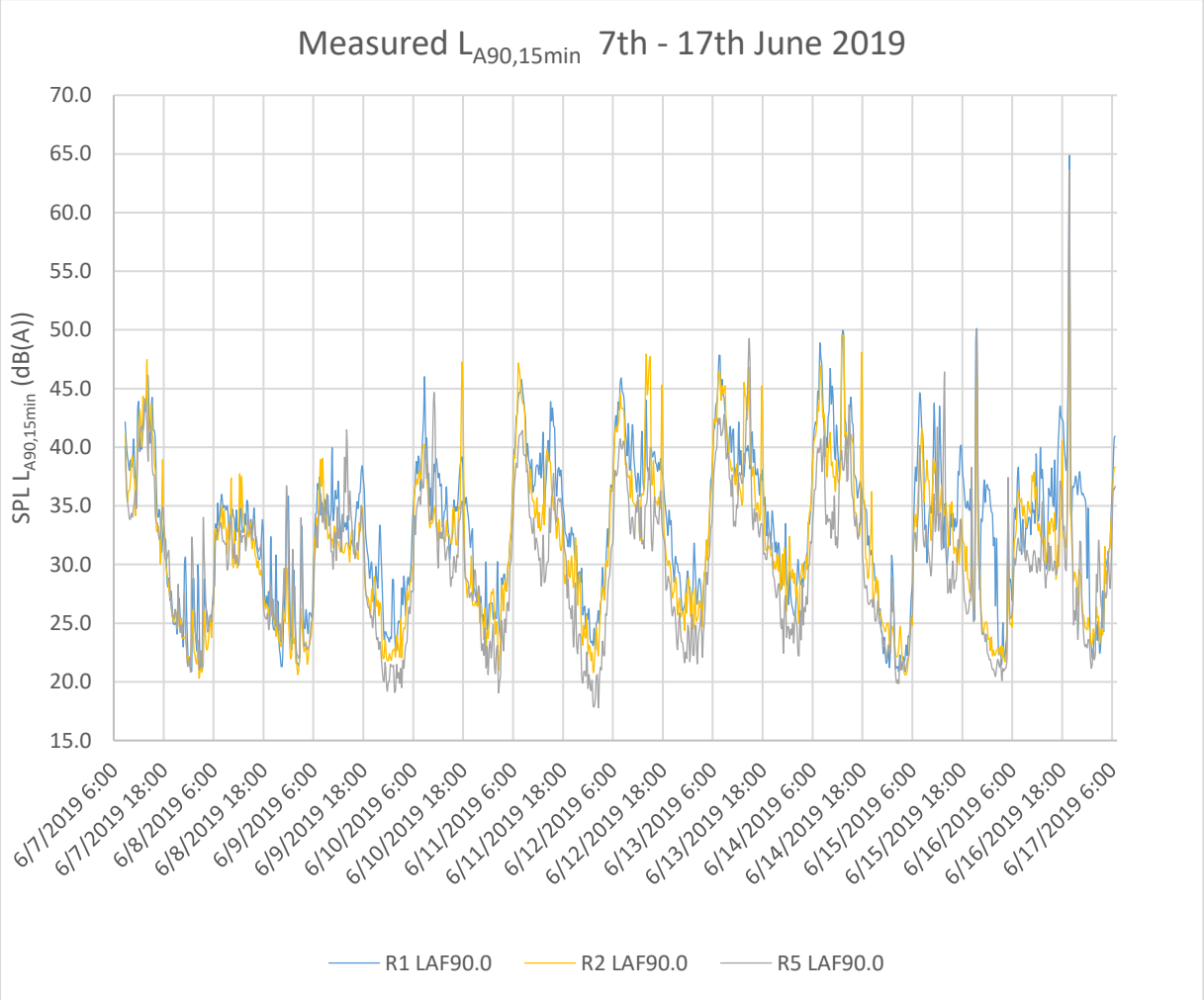


Figure 4 | Measured $L_{AF90,15\ min}$ 7th – 17th June 2019

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 NPfI 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 NPfI.

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 12th 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.

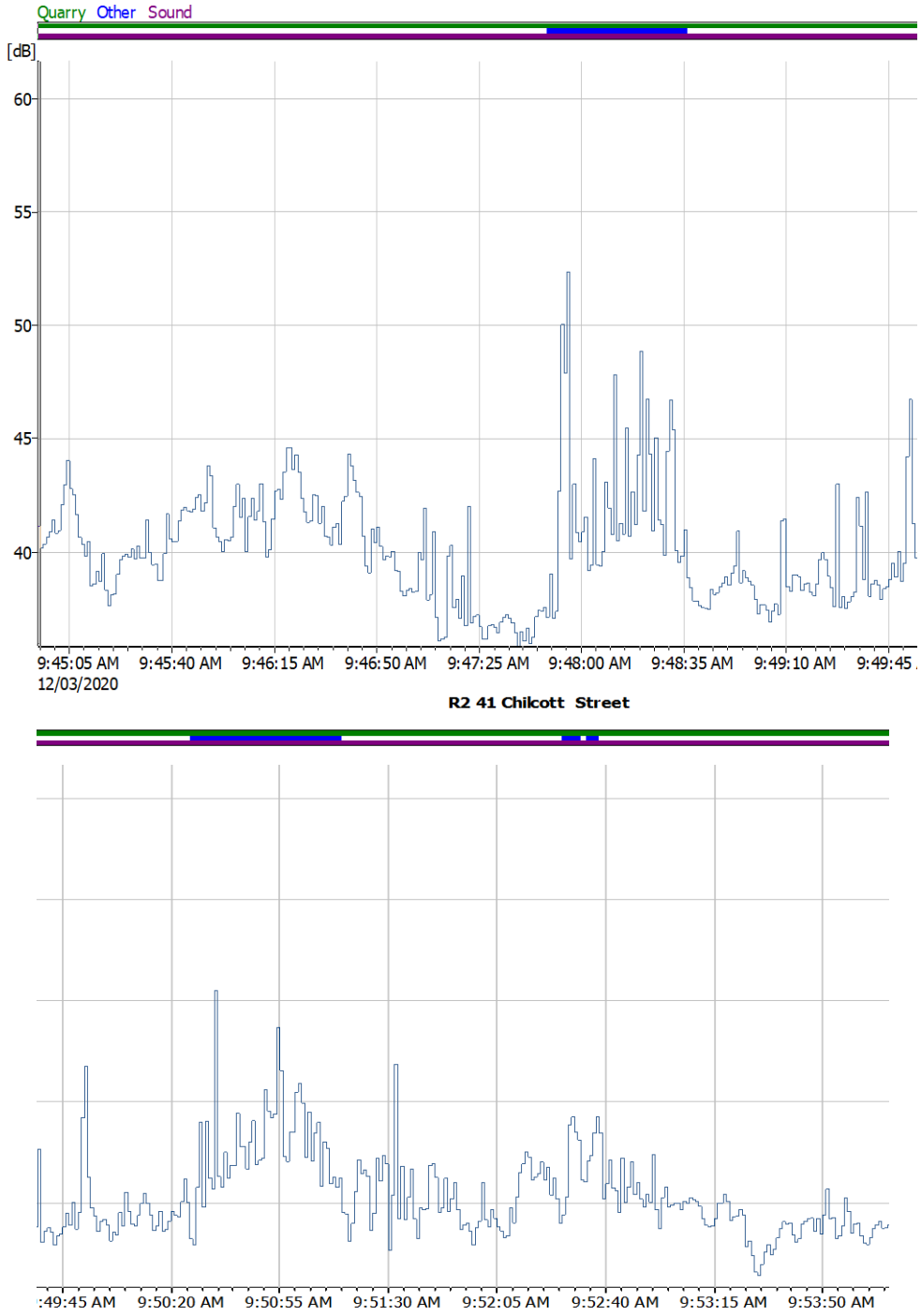
Test results are provided in Table 6.

Table 6 | Measurement results

Test location	L_{Aeq}, 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	

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	


Quarry Other Sound
[dB]
60
55
50
45
40
9:45:05 AM
9:45:40 AM
9:46:15 AM
9:46:50 AM
9:47:25 AM
9:48:00 AM
9:48:35 AM
9:49:10 AM
9:49:45
12/03/2020
R2 41 Chilcott Street
:49:45 AM
9:50:20 AM
9:50:55 AM
9:51:30 AM
9:52:05 AM
9:52:40 AM
9:53:15 AM
9:53:50 AM

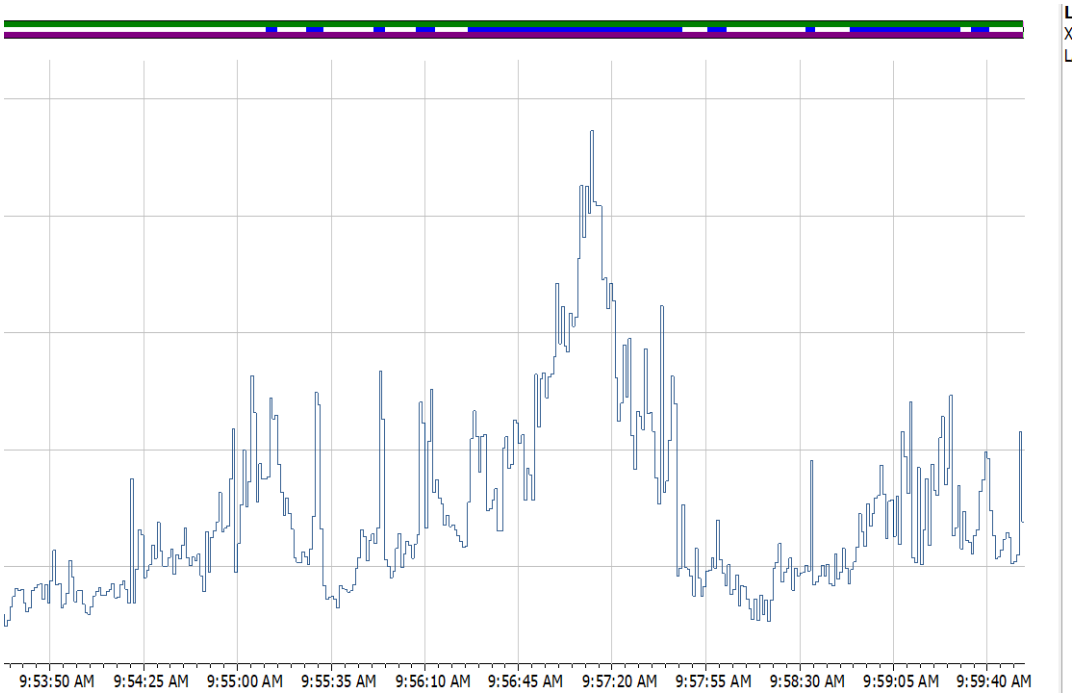


Figure 5 | R2 noise test graph

Figure 6 | The hopper being loaded gently

Figure 7 | Insulation placed over plant (1)

Figure 8 | Insulation placed over plant (2)

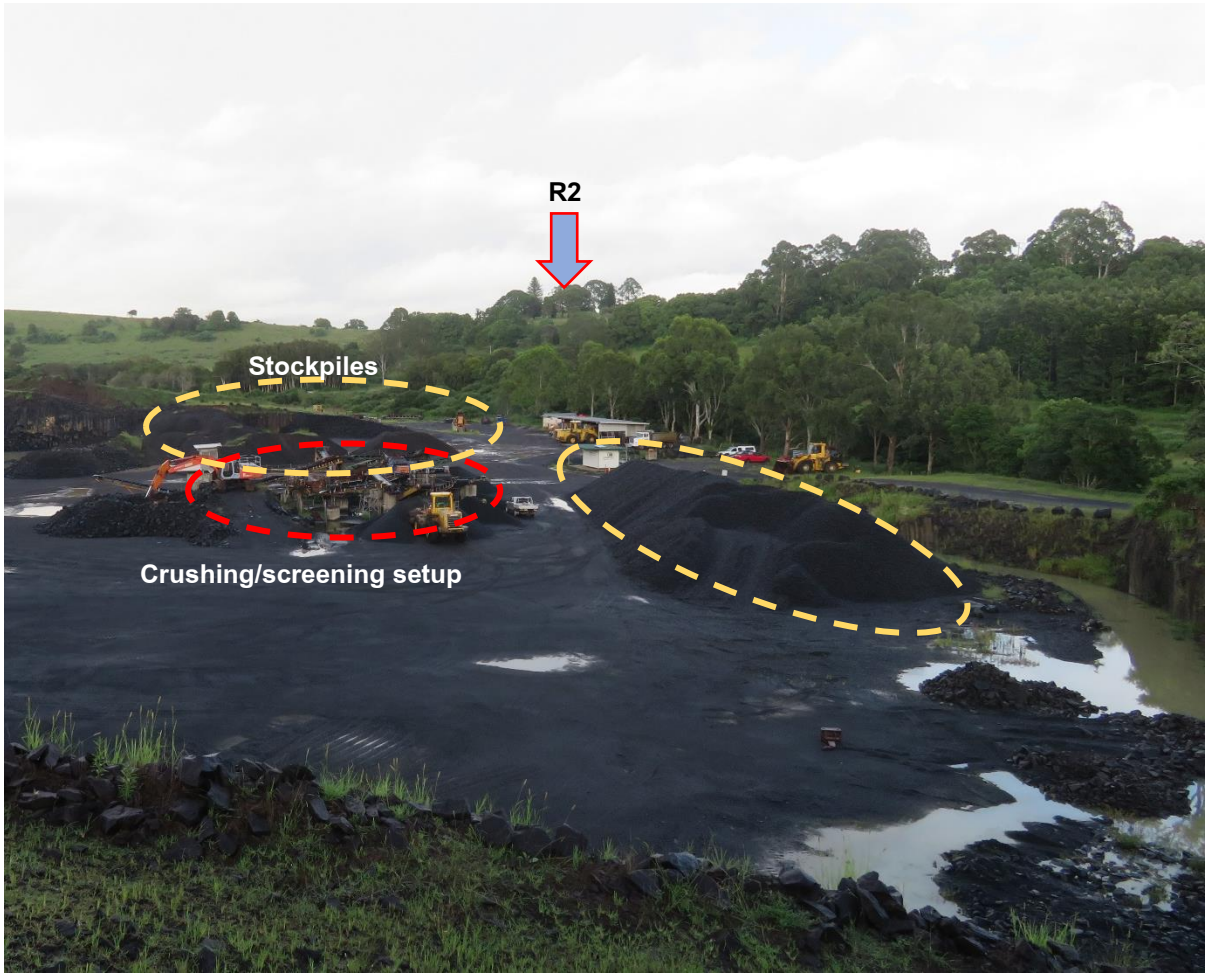


Figure 9 | Quarry floor layout with respect to R2

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 15th 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 29th of August 2019.

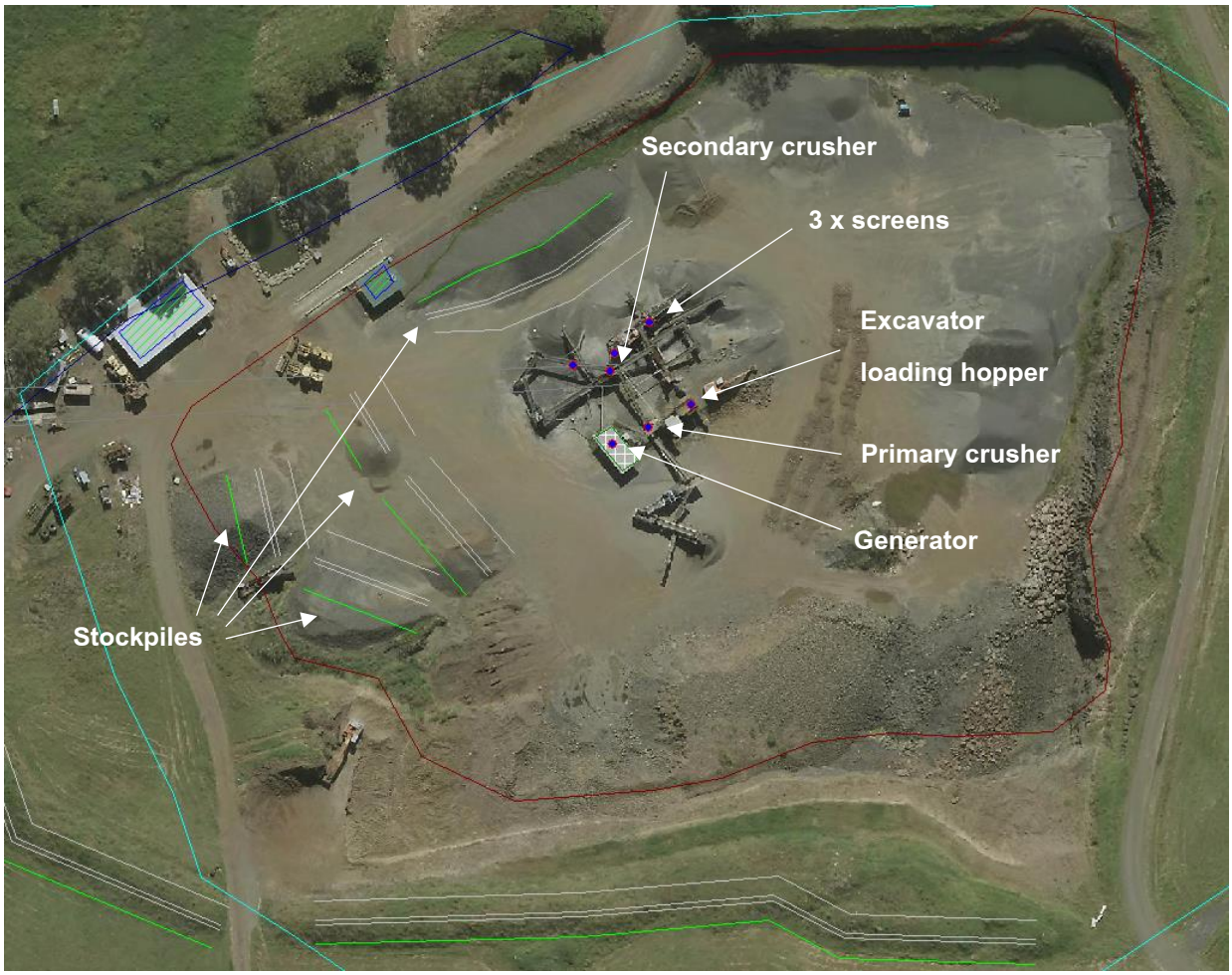


Figure 10 | SounPLAN quarry pit layout, *Source of aerial image: Intramaps 2018*

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_{eq} levels. However, at the receiver (R2), where the need for modifying factor corrections is assessed in accordance with section C1 of the 2017 NPfI, 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	Y	Y	Y	Y	N
SA03	Y	Y	Y	Y	N	Y
SA04	Y	Y	Y	Y	Y	Y
SA05	N	N	N	N	Y	N
SA06	N	N	N	N	Y	Y

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	41
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	41	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 plan) 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.

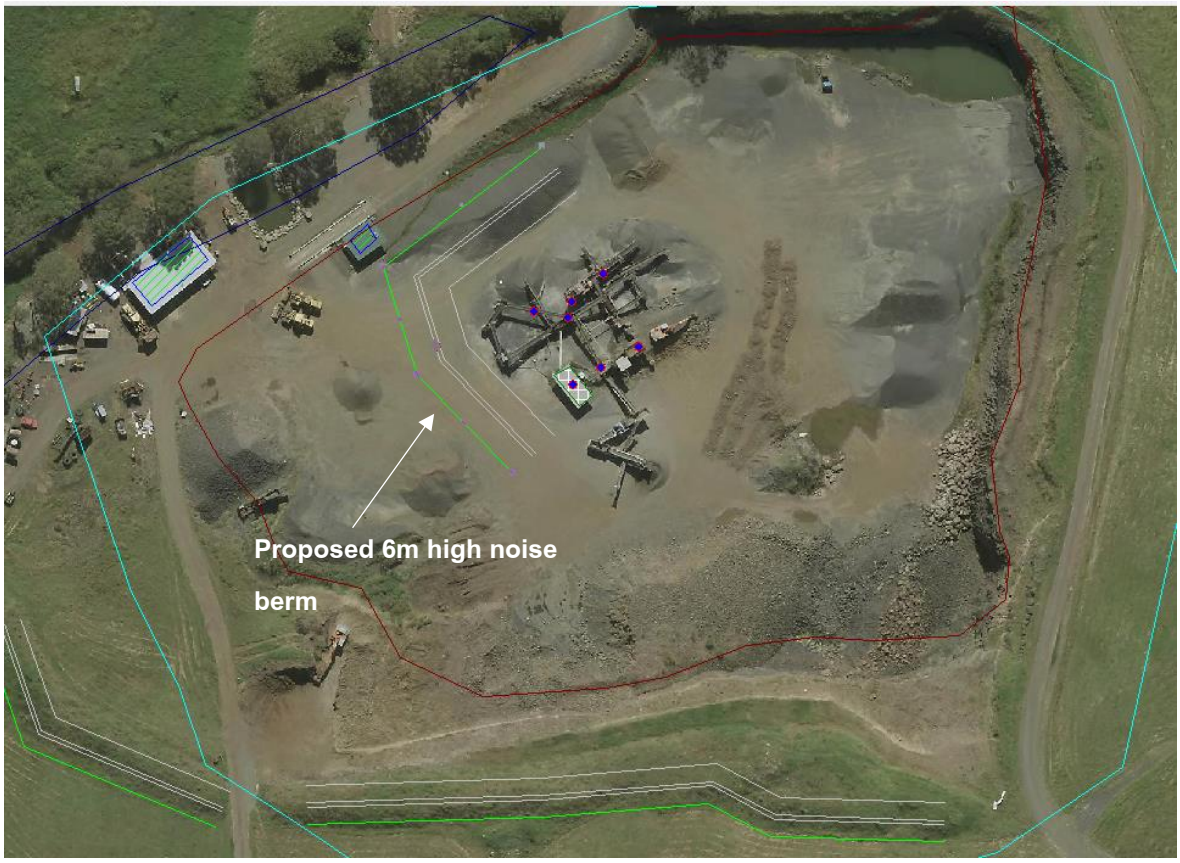


Figure 11 | Proposed noise berm in quarry pit

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	Y	Y	Y	Y	N	N
SA12	Y	Y	Y	Y	Y	N
SA13	Y	Y	Y	Y	N	Y
SA14	Y	Y	Y	Y	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 12th 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 12th 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 12th 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): $L_{Aeq,15hr}$ = 60 dB(A), external
- Night (10pm – 7am): $L_{Aeq,9hr}$ = 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): $L_{Aeq,15hr}$ + 12 dB(A), external
- Night (10pm – 7am): $L_{Aeq,9hr}$ + 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

	Background traffic		Quarry traffic		Total 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

ID	Background traffic		Quarry traffic		Total traffic	
	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, dB(L)	Peak Particle Velocity, mm/s	Reference/Source
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 12th 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, 22nd September 2015

Environmental Impact Study for proposed quarry extensions Riverbank Road, Wyrallah, Australian Blasting Consultants Pty Ltd, 1992

APPENDIX A – BACKGROUND NOISE SURVEY RESULTS

Friday 7th June 2019

Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
12:00	51.0	43.9	47.2	40.2	48.9	40.1
12:15	46.9	39.7	46.6	43.2	50.2	41.1
12:30	47.4	40.7	46.4	41.9	52.2	41.7
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	41.9
14:15	51.9	46.0	49.1	41.8	50.3	38.8
14:30	50.5	42.7	46.6	41.3	53.1	42.4
14:45	48.2	40.3	49.8	41.5	48.2	41.8
15:00	50.9	42.7	50.4	43.7	51.8	41.7
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	37.6
15:45	48.2	41.4	50.2	38.7	44.4	37.6
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	33.6
16:30	45.8	34.3	38.2	32.8	57.8	33.5
16:45	45.9	34.0	45.8	33.3	43.4	32.6
17:00	42.9	34.7	42.1	32.4	44.5	32.1
17:15	41.5	33.6	33.5	30.1	36.3	32.7
17:30	33.9	31.1	36.0	33.1	39.6	33.6
17:45	34.0	32.1	41.4	38.9	39.9	34.9
18:00	36.4	33.4	38.6	33.0	40.5	34.5
18:15	34.3	32.2	34.6	32.7	36.4	30.8
18:30	35.4	32.1	33.7	30.0	35.3	30.4
18:45	31.9	29.2	32.2	29.4	37.4	30.5
19:00	30.6	28.1	31.8	28.7	34.0	30.9
19:15	31.5	28.8	31.1	28.1	39.7	31.2
19:30	33.3	26.9	31.9	27.2	32.2	28.4
19:45	38.2	27.8	45.9	27.2	43.2	26.6
20:00	34.0	26.7	30.9	25.6	31.9	26.0
20:15	31.0	25.1	28.1	25.4	28.8	25.6
20:30	28.7	24.9	32.2	25.1	29.5	25.4
20:45	29.0	24.9	29.0	25.8	29.9	26.2
21:00	28.1	25.1	28.5	25.9	29.5	25.6
21:15	28.9	24.1	28.3	25.2	35.1	24.6
21:30	41.0	26.6	31.7	27.1	37.0	28.3
21:45	35.9	27.1	28.2	25.0	27.9	25.0
22:00	28.2	25.3	26.7	24.4	27.3	24.2
22:15	27.4	24.3	28.2	25.5	27.8	24.9
22:30	29.5	24.9	27.8	23.7	28.5	23.8
22:45	28.4	23.1	26.8	23.8	29.7	25.6
23:00	33.3	29.9	28.5	23.8	31.5	27.5
23:15	38.2	30.6	26.8	23.6	28.0	24.5

Rain Affected Data

Rain & Wind Affected Data

Wind Affected Data > 5m/s

Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
8:45	51.3	42.2	49.7	41.1	49.5	40.1
9:00	49.1	40.5	49.0	37.7	43.2	36.9
9:15	51.4	39.4	44.8	35.4	44.1	35.5
9:30	51.1	38.8	48.5	36.2	44.6	34.8
9:45	51.4	38.0	44.1	36.3	43.9	33.9
10:00	49.4	38.9	46.7	37.1	39.2	33.9
10:15	52.0	38.8	48.0	38.8	41.9	34.4
10:30	49.5	38.4	46.4	39.3	44.0	34.0
10:45	53.2	40.7	45.6	37.7	42.1	34.8
11:00	50.1	38.7	45.3	37.2	44.3	35.5
11:15	45.4	36.9	42.4	34.2	49.8	36.3

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
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

Saturday 8th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
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	36.2	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	38.3	32.9
3:15	28.2	22.0	25.2	20.8	23.3	21.3	15:15	50.4	32.6	37.4	31.3	38.8	32.1
3:30	27.5	21.4	31.6	22.0	39.5	33.6	15:30	46.8	33.6	40.2	32.2	39.5	33.4
3:45	34.7	28.6	29.6	26.0	34.4	30.7	15:45	48.5	34.8	37.9	32.1	43.8	33.9
4:00	31.4	26.7	26.7	24.4	31.2	28.1	16:00	40.7	32.8	38.5	30.8	42.6	32.5
4:15	29.9	26.2	26.4	22.9	29.8	25.6	16:15	37.7	31.7	45.9	30.6	36.3	32.4
4:30	28.1	25.6	26.8	22.7	30.0	24.3	16:30	47.3	31.2	40.0	29.7	36.3	31.7
4:45	28.7	24.7	26.6	23.5	27.5	24.4	16:45	40.8	30.6	38.8	30.3	37.9	31.1
5:00	28.4	25.2	28.2	24.8	28.1	25.5	17:00	42.1	30.4	33.3	29.3	34.8	31.3
5:15	28.2	25.2	27.8	25.2	28.0	25.7	17:15	36.6	30.7	32.1	29.1	35.2	31.5
5:30	27.9	25.4	27.2	23.8	28.2	25.1	17:30	34.5	32.1	32.7	29.5	34.1	31.7
5:45	29.7	26.7	28.5	26.2	30.9	26.6	17:45	35.9	33.8	31.2	28.3	41.0	28.9
6:00	31.0	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	27.6	25.5
10:45	54.1	34.1	37.0	29.7	48.4	30.5	22:45	28.9	24.2	28.2	26.4	29.3	27.5
11:00	57.2	33.9	42.5	32.9	41.2	31.7	23:00	31.8	29.3	28.1	25.1	32.7	29.7
11:15	52.3	32.0	36.6	30.1	33.5	30.1	23:15	29.6	26.0	35.8	25.1	41.3	27.4
11:30	51.4	34.6	38.4	30.7	36.2	30.8	23:30	42.2	34.8	34.1	29.7	40.4	36.5
11:45	47.0	32.8	37.4	29.7	41.9	30.5	23:45	38.9	34.8	32.3	29.4	44.1	34.7

Sunday 9th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	38.0	35.7	28.5	25.5	33.1	29.5	12:00	52.4	37.1	41.0	31.8	55.4	32.3
0:15	32.4	28.2	24.9	23.5	28.8	26.4	12:15	50.5	34.0	44.0	31.4	52.6	33.1
0:30	28.0	24.3	25.1	22.0	26.5	24.2	12:30	47.8	32.2	41.4	31.1	56.2	31.9
0:45	24.8	22.7	26.3	22.2	27.3	23.9	12:45	57.7	33.5	50.1	32.0	55.7	31.2
1:00	34.9	24.4	28.9	26.7	34.0	31.3	13:00	49.6	34.2	34.6	31.0	57.1	34.3
1:15	33.7	29.6	25.0	23.3	30.2	26.8	13:15	48.7	33.8	36.4	31.0	55.6	32.9
1:30	28.4	25.9	26.6	23.7	31.8	28.1	13:30	48.1	33.2	48.5	31.1	61.1	39.1
1:45	27.2	23.4	25.9	21.7	27.8	23.7	13:45	51.5	33.5	37.5	31.8	48.4	36.2
2:00	23.9	21.7	23.5	21.5	25.0	22.4	14:00	43.0	33.0	38.4	31.8	55.0	41.5
2:15	25.0	21.6	24.8	20.6	25.0	22.2	14:15	48.0	34.2	38.5	31.7	48.5	37.8
2:30	23.6	21.4	23.6	21.2	24.4	22.0	14:30	39.8	31.9	37.3	31.1	48.9	33.8
2:45	27.6	22.5	35.5	22.4	37.2	22.2	14:45	41.7	31.3	39.5	30.2	47.7	36.3
3:00	41.5	30.8	32.8	26.1	37.3	33.8	15:00	47.9	31.6	48.7	32.1	49.0	34.6
3:15	36.9	33.2	28.4	25.0	33.0	29.2	15:15	43.0	32.0	41.3	32.9	51.1	33.5
3:30	31.2	26.9	25.6	23.5	28.4	25.9	15:30	41.5	32.1	51.8	32.9	45.6	31.7
3:45	27.8	24.7	24.6	22.6	25.4	23.0	15:45	43.7	30.9	47.2	31.5	50.2	31.5
4:00	28.3	24.6	24.6	22.8	26.2	23.2	16:00	53.3	33.3	44.6	30.8	44.1	30.5
4:15	28.7	26.2	26.4	23.4	25.6	23.2	16:15	50.3	34.2	43.0	31.1	44.5	31.2
4:30	29.0	24.9	23.1	21.6	25.2	22.8	16:30	49.7	35.4	37.9	30.8	43.9	31.9
4:45	27.0	24.1	26.1	22.0	26.1	22.9	16:45	43.0	34.8	39.7	30.5	45.3	31.2
5:00	29.2	25.8	24.9	23.1	25.2	23.1	17:00	44.8	36.0	44.4	33.5	47.3	32.4
5:15	28.9	25.9	25.6	23.6	26.3	24.3	17:15	45.1	36.2	45.3	32.8	41.7	33.2
5:30	28.4	25.6	37.1	24.0	28.0	25.0	17:30	39.9	37.9	37.1	33.5	36.3	35.0
5:45	29.6	25.4	28.5	25.4	28.4	25.5	17:45	39.6	38.4	36.9	34.9	35.7	34.0
6:00	34.4	29.7	38.7	26.6	32.5	26.9	18:00	39.0	37.3	35.0	33.4	35.2	33.0
6:15	40.5	31.4	42.8	32.2	45.4	30.1	18:15	37.7	36.2	32.4	29.6	33.2	31.3
6:30	49.6	34.2	40.7	31.5	50.0	31.6	18:30	35.3	33.1	30.1	28.1	31.1	28.0
6:45	43.1	34.4	43.0	34.0	47.8	33.3	18:45	35.2	31.8	29.7	27.1	37.0	27.4
7:00	54.8	36.9	40.2	32.9	42.2	31.4	19:00	33.2	31.0	31.7	27.3	30.6	26.7
7:15	50.3	36.4	43.7	35.1	52.9	34.0	19:15	34.4	30.3	30.2	27.0	36.1	26.3
7:30	53.3	37.4	46.6	37.2	49.1	34.8	19:30	31.5	28.8	30.3	26.4	36.3	26.2
7:45	49.6	34.3	48.3	39.0	52.5	36.0	19:45	33.8	29.6	29.4	25.8	31.5	25.5
8:00	47.2	35.3	44.8	36.7	48.5	34.6	20:00	35.1	30.2	31.2	27.9	31.1	25.6
8:15	47.5	35.0	46.8	39.1	44.8	33.6	20:15	32.6	28.4	30.7	26.8	27.4	24.6
8:30	55.3	33.9	46.2	35.3	49.7	34.8	20:30	32.1	27.1	31.6	28.7	30.9	25.9
8:45	48.3	35.5	46.3	33.9	48.8	33.3	20:45	31.8	26.5	31.3	29.0	30.8	26.8
9:00	45.9	34.2	43.1	33.2	45.0	33.0	21:00	35.2	29.8	33.2	27.6	34.9	24.6
9:15	55.0	35.9	53.8	34.0	50.1	36.0	21:15	36.7	28.7	30.3	26.4	26.8	23.6
9:30	49.9	35.9	42.5	32.2	50.0	34.1	21:30	33.0	28.1	32.6	26.9	28.2	23.8
9:45	47.0	33.4	40.2	32.4	44.1	34.1	21:45	34.7	31.1	31.4	25.7	24.6	22.8
10:00	48.9	33.7	51.2	32.6	47.2	34.1	22:00	35.6	33.4	30.3	26.8	26.7	23.4
10:15	50.0	34.5	38.5	32.0	44.0	31.1	22:15	33.4	31.1	37.4	26.2	27.0	22.4
10:30	59.3	40.0	44.5	32.2	37.3	31.1	22:30	32.8	28.6	27.5	23.1	24.2	21.2
10:45	52.1	33.8	44.8	31.5	40.9	29.6	22:45	43.2	25.8	27.4	22.0	28.1	20.3
11:00	50.3	34.6	50.5	33.3	46.9	32.3	23:00	38.3	23.6	26.9	22.1	22.7	20.0
11:15	48.3	36.3	42.6	33.0	44.2	32.7	23:15	29.3	24.3	27.3	23.7	26.2	21.7
11:30	55.5	35.6	40.5	31.4	48.2	30.3	23:30	30.2	24.2	28.8	22.2	25.8	20.3
11:45	50.4	35.6	42.9	32.0	44.3	34.9	23:45	27.5	23.8	25.0	21.8	21.2	19.2

Monday 10th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	26.0	23.7	24.3	21.8	22.2	19.9	12:00	50.3	37.4	51.6	32.0	41.5	29.7
0:15	26.2	23.4	26.1	22.4	22.9	20.1	12:15	55.7	37.8	47.8	33.8	58.3	32.7
0:30	28.0	23.8	25.1	22.0	24.2	21.5	12:30	49.2	36.7	46.9	32.8	49.3	32.2
0:45	27.0	23.7	24.4	21.9	24.7	21.4	12:45	50.8	36.8	46.6	32.3	46.8	32.8
1:00	32.3	28.7	25.4	22.7	24.9	21.3	13:00	49.9	33.3	39.3	32.3	45.0	32.2
1:15	31.9	28.7	25.1	22.7	24.4	21.4	13:15	46.3	33.6	39.3	32.3	48.4	33.8
1:30	34.7	24.4	24.9	22.8	22.0	19.1	13:30	49.6	34.5	37.1	31.9	45.5	31.8
1:45	37.9	22.9	27.1	22.1	24.3	19.3	13:45	47.3	34.8	37.5	32.1	42.4	30.4
2:00	25.7	22.7	27.5	23.9	24.7	21.5	14:00	51.2	36.6	40.0	33.7	50.7	30.9
2:15	28.4	24.5	28.0	23.4	26.0	20.3	14:15	45.3	33.7	42.5	32.5	48.2	31.4
2:30	29.9	25.2	30.6	22.8	28.5	20.8	14:30	48.1	32.7	37.2	32.6	56.8	31.6
2:45	30.3	25.0	26.1	22.2	24.0	19.9	14:45	38.4	30.4	38.4	32.3	44.3	30.3
3:00	32.8	25.3	31.3	25.4	28.9	21.2	15:00	43.9	31.8	39.1	32.0	36.1	28.2
3:15	33.2	28.0	26.0	22.0	23.0	19.5	15:15	48.6	32.1	51.1	31.8	49.7	28.9
3:30	29.8	26.6	30.2	23.9	28.3	21.8	15:30	46.6	32.7	47.6	34.7	42.9	28.9
3:45	36.0	29.0	32.0	24.6	28.4	21.2	15:45	44.8	35.5	49.1	34.8	42.0	30.6
4:00	30.7	27.3	28.9	24.5	27.1	22.5	16:00	54.1	34.5	51.4	33.7	47.2	30.1
4:15	30.9	25.6	30.5	25.7	29.0	23.2	16:15	45.3	34.9	41.8	31.7	44.4	29.3
4:30	31.0	28.0	32.8	27.8	28.7	23.4	16:30	42.8	34.6	38.4	31.7	38.9	30.8
4:45	32.5	28.9	30.8	27.0	28.9	25.5	16:45	49.9	35.4	40.1	33.3	36.9	30.6
5:00	33.2	28.3	33.3	27.4	30.0	26.4	17:00	47.5	37.0	44.1	34.9	38.1	33.7
5:15	34.0	29.0	33.0	28.6	28.2	25.8	17:15	41.4	38.3	41.5	34.8	38.2	33.8
5:30	33.7	30.2	32.4	28.5	30.4	27.7	17:30	40.7	38.8	45.4	41.4	37.7	34.8
5:45	36.2	32.8	33.1	29.8	31.9	27.7	17:45	40.7	39.1	49.8	47.3	39.1	35.4
6:00	38.9	34.8	41.5	29.9	34.9	27.8	18:00	39.7	37.8	45.3	43.4	38.1	34.4
6:15	47.8	35.8	45.0	36.1	47.6	34.0	18:15	37.1	35.1	42.1	33.8	34.7	31.0
6:30	45.3	37.0	42.5	36.6	38.1	32.6	18:30	37.2	35.3	31.7	29.6	32.3	28.8
6:45	51.9	38.8	43.1	37.3	49.6	34.5	18:45	39.3	35.7	33.5	28.4	36.7	28.8
7:00	46.3	37.7	42.9	36.8	52.2	35.1	19:00	39.1	34.7	29.8	27.2	32.2	28.6
7:15	48.0	39.2	46.8	37.7	52.5	35.6	19:15	40.0	34.0	30.9	28.1	31.6	28.4
7:30	47.3	38.6	45.3	38.0	47.7	35.8	19:30	38.3	32.8	32.6	28.0	30.2	27.2
7:45	46.6	36.3	47.9	37.1	55.3	35.2	19:45	39.3	31.5	30.5	28.3	31.3	27.4
8:00	47.0	38.9	44.3	38.3	48.8	37.2	20:00	43.1	32.6	49.3	30.7	40.6	27.6
8:15	50.3	40.8	44.5	39.9	49.9	36.5	20:15	48.2	33.0	53.9	26.6	45.5	26.9
8:30	50.1	42.7	46.2	40.2	46.9	36.6	20:30	31.4	28.0	33.1	26.5	33.1	27.9
8:45	52.5	46.0	47.0	40.2	47.8	39.9	20:45	32.6	27.9	29.4	26.5	33.4	29.5
9:00	53.8	40.0	45.5	39.3	50.5	39.3	21:00	31.4	27.3	31.2	26.9	32.5	29.2
9:15	50.9	40.8	51.3	37.4	49.5	37.3	21:15	31.8	27.3	28.8	26.5	30.6	26.8
9:30	50.6	37.6	47.8	36.3	45.4	38.5	21:30	32.4	26.7	29.7	26.5	31.1	27.6
9:45	50.8	37.8	41.3	34.2	44.3	35.0	21:45	38.6	26.7	31.8	28.0	31.5	28.2
10:00	53.6	35.0	43.1	33.1	44.0	33.7	22:00	32.2	26.1	28.9	25.0	30.8	27.1
10:15	49.7	36.5	38.3	33.6	43.5	34.2	22:15	32.9	27.3	32.0	26.7	29.6	23.9
10:30	47.4	33.8	41.6	33.5	44.7	37.0	22:30	40.6	25.6	29.7	25.5	27.4	22.7
10:45	51.9	35.4	42.7	33.7	56.6	41.9	22:45	29.6	25.7	28.1	25.0	26.0	23.3
11:00	52.9	38.5	42.3	34.7	61.5	44.7	23:00	28.7	24.8	26.7	23.6	25.4	22.3
11:15	52.1	37.9	49.9	34.9	54.9	42.6	23:15	30.7	25.9	32.3	26.3	29.0	24.6
11:30	55.7	39.0	44.4	33.3	54.1	34.4	23:30	36.6	30.2	33.5	22.3	35.8	21.2
11:45	50.5	38.5	42.9	33.6	47.6	32.1	23:45	32.4	24.5	33.5	24.3	28.7	23.0

Tuesday 11th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
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	31.3
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	38.8	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	33.4
6:15	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
6:30	49.1	40.1	43.5	39.1	44.7	37.5	18:30	37.8	32.8	30.9	28.4	36.6	31.1
6:45	49.3	42.5	45.9	41.6	46.5	38.6	18:45	35.8	32.5	31.9	29.1	39.5	30.5
7:00	54.4	42.9	49.8	43.0	43.4	38.3	19:00	35.3	32.1	31.8	28.2	34.6	27.2
7:15	56.9	44.2	50.9	47.1	45.2	40.0	19:15	34.7	31.5	33.0	30.4	36.0	28.8
7:30	51.9	44.6	53.4	46.6	45.4	41.0	19:30	35.6	32.7	33.1	29.0	41.4	26.3
7:45	51.9	44.7	51.5	45.7	46.0	41.1	19:45	35.1	31.5	32.7	28.9	31.5	26.3
8:00	55.5	45.8	49.5	44.4	49.4	41.2	20:00	40.3	33.2	45.1	30.7	36.6	25.4
8:15	52.5	44.9	48.6	43.8	46.0	41.4	20:15	38.9	32.5	33.6	29.7	32.4	26.4
8:30	49.3	44.2	47.9	43.6	45.8	39.5	20:30	35.8	32.6	33.2	28.0	32.9	23.0
8:45	48.2	43.3	49.1	43.3	45.5	39.3	20:45	38.0	31.0	34.6	29.0	32.9	24.7
9:00	51.4	42.3	49.3	40.4	47.9	39.3	21:00	37.0	30.5	36.5	32.3	38.3	28.4
9:15	49.2	39.2	42.9	38.7	43.9	37.9	21:15	39.2	31.6	34.9	29.6	27.8	23.4
9:30	51.2	40.3	47.8	38.4	49.7	38.0	21:30	32.0	28.0	33.4	26.5	38.0	22.4
9:45	54.1	38.9	46.4	36.8	43.0	35.7	21:45	33.9	29.2	36.6	28.3	29.6	23.9
10:00	54.2	38.6	41.9	36.1	43.5	34.0	22:00	34.5	29.4	38.2	29.2	27.7	24.1
10:15	49.5	37.3	45.0	38.1	43.0	34.0	22:15	32.9	28.5	42.6	26.6	29.4	23.8
10:30	53.1	39.0	42.8	36.0	44.3	33.0	22:30	33.5	29.6	33.1	24.1	28.2	20.5
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	19.9
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	20.9
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	20.9
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	20.5
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	22.5

Wednesday 12th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
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	31.2
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	33.4
4:00	30.1	27.1	30.8	27.0	28.0	22.2	16:00	43.5	39.6	40.5	35.9	44.7	35.8
4:15	34.3	29.6	35.6	29.8	30.3	25.8	16:15	52.3	38.7	41.5	35.3	46.6	34.1
4:30	35.1	31.5	34.7	30.3	31.4	25.7	16:30	55.6	38.5	41.9	35.4	45.8	34.1
4:45	37.0	33.0	35.4	29.8	32.8	27.5	16:45	43.0	37.9	42.8	35.1	39.8	33.5
5:00	35.4	31.5	34.6	31.3	32.5	28.8	17:00	47.3	38.7	42.8	35.7	38.2	33.5
5:15	39.3	35.0	36.5	33.8	32.4	29.2	17:15	44.3	38.1	37.5	34.7	38.9	35.4
5:30	39.7	36.8	38.6	36.5	33.5	31.1	17:30	46.2	39.1	47.5	35.2	42.7	36.2
5:45	39.2	36.2	38.9	36.4	33.9	31.6	17:45	39.8	37.8	46.1	45.2	38.0	33.6
6:00	40.4	37.0	39.4	36.4	40.4	31.8	18:00	40.3	37.7	43.1	40.3	36.1	32.6
6:15	45.8	39.5	47.0	39.1	40.9	34.8	18:15	38.6	36.4	34.7	33.1	35.6	32.2
6:30	48.5	41.7	45.8	41.1	47.7	38.0	18:30	37.4	35.3	33.8	32.1	35.4	31.6
6:45	51.8	42.7	50.4	41.8	45.7	37.6	18:45	43.4	34.4	35.2	30.9	40.1	27.8
7:00	49.3	41.6	46.7	41.3	43.2	37.7	19:00	36.4	33.5	33.0	30.2	32.9	28.0
7:15	53.9	43.8	44.6	42.0	43.4	38.5	19:15	36.0	32.5	32.1	29.9	32.8	29.0
7:30	50.1	43.2	47.2	42.3	48.2	39.9	19:30	36.7	34.6	44.8	30.3	37.0	28.7
7:45	51.7	45.4	48.7	44.6	46.5	40.7	19:45	39.9	33.4	36.3	29.8	33.8	28.2
8:00	50.7	45.9	46.4	43.3	44.5	40.0	20:00	36.8	33.7	32.1	29.0	32.9	26.9
8:15	51.2	44.8	48.7	43.3	44.0	39.9	20:15	37.9	30.6	41.6	27.2	39.7	25.6
8:30	61.1	44.5	48.7	43.3	44.4	40.5	20:30	35.3	29.7	30.9	27.5	29.4	26.0
8:45	52.6	43.8	46.8	42.4	43.3	40.2	20:45	33.3	28.5	31.4	27.7	28.7	26.4
9:00	52.7	41.5	43.2	38.5	42.0	39.4	21:00	35.5	30.6	31.6	28.9	30.8	25.6
9:15	51.2	40.6	45.6	38.7	43.8	37.9	21:15	42.5	30.1	32.2	28.5	28.7	24.1
9:30	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	26.6	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

Thursday 13th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	34.4	29.5	34.4	28.8	33.4	24.8	12:00	47.5	37.6	44.1	35.9	45.3	34.9
0:15	36.2	28.1	39.5	28.8	30.3	24.3	12:15	54.4	42.1	43.2	37.0	45.0	37.6
0:30	34.8	28.1	35.0	26.8	27.7	21.7	12:30	52.6	38.6	41.2	36.4	45.8	37.9
0:45	31.2	26.2	31.0	25.6	27.8	23.8	12:45	47.5	39.7	40.5	36.1	46.1	37.4
1:00	30.7	27.2	31.7	27.7	29.2	25.8	13:00	51.1	37.7	40.3	35.1	47.3	36.9
1:15	32.7	28.0	31.4	24.5	26.6	22.3	13:15	53.9	37.7	57.1	35.6	47.2	37.1
1:30	33.8	31.8	30.2	25.1	24.9	22.3	13:30	49.3	37.5	55.1	45.4	53.7	39.5
1:45	32.9	30.0	33.4	28.0	28.2	24.8	13:45	50.2	38.8	50.8	44.5	46.6	38.8
2:00	31.9	27.8	32.5	25.2	29.4	24.7	14:00	53.5	39.9	53.7	44.2	53.8	42.0
2:15	31.0	26.6	33.9	25.3	26.2	21.5	14:15	49.0	39.7	48.4	42.3	52.5	43.7
2:30	31.8	28.0	32.1	25.6	27.0	23.5	14:30	55.0	40.1	53.2	43.8	56.1	46.6
2:45	34.8	28.8	34.6	26.9	30.4	24.4	14:45	48.8	39.2	50.8	46.7	57.8	49.3
3:00	32.2	28.5	33.2	26.3	30.9	25.0	15:00	46.1	38.2	64.9	38.6	53.3	46.4
3:15	32.2	27.4	32.7	26.5	32.0	26.1	15:15	47.4	40.5	44.0	38.5	51.1	37.6
3:30	33.5	25.5	30.4	24.7	29.3	22.1	15:30	49.3	41.3	48.9	37.6	46.1	34.1
3:45	31.0	27.1	33.1	28.1	29.0	24.1	15:45	54.1	38.7	45.7	38.3	45.0	33.0
4:00	33.0	29.2	34.0	29.0	31.9	25.0	16:00	56.8	39.8	45.6	37.0	48.6	34.8
4:15	34.7	29.7	34.4	29.9	31.0	27.4	16:15	44.2	37.7	42.1	35.2	42.6	33.7
4:30	36.6	31.6	36.3	32.1	34.1	29.4	16:30	43.4	37.6	42.9	34.6	48.2	34.4
4:45	36.2	31.3	35.1	30.4	31.7	28.3	16:45	49.1	38.2	43.4	35.3	45.0	34.0
5:00	38.0	32.1	36.0	32.4	33.7	30.4	17:00	47.2	37.2	43.4	34.8	45.5	32.8
5:15	39.4	34.0	39.9	34.6	35.2	30.9	17:15	40.6	35.9	38.4	33.8	35.7	32.4
5:30	39.9	37.0	38.6	35.9	38.4	33.1	17:30	39.4	37.7	40.6	34.7	36.5	33.4
5:45	40.2	37.5	39.7	36.6	36.1	33.3	17:45	40.5	37.2	47.8	44.9	38.5	33.5
6:00	41.7	39.2	43.9	39.3	38.5	35.0	18:00	40.0	38.0	46.6	41.9	38.7	33.3
6:15	47.8	41.3	46.3	42.3	47.2	37.8	18:15	38.5	35.1	40.4	35.5	33.8	30.9
6:30	47.2	41.8	45.7	42.0	46.2	38.7	18:30	40.5	35.8	35.7	32.6	34.2	31.0
6:45	51.8	43.6	46.3	42.5	44.0	39.7	18:45	38.2	34.2	34.2	31.3	33.3	30.4
7:00	52.3	43.8	48.9	42.2	47.6	40.0	19:00	35.8	32.5	37.3	31.2	35.6	30.5
7:15	52.1	45.2	49.7	45.6	50.1	42.4	19:15	39.0	34.5	35.2	31.4	36.2	32.0
7:30	52.2	47.8	50.0	46.5	47.1	42.0	19:30	38.8	33.0	44.2	31.6	38.9	32.8
7:45	51.8	47.8	49.8	46.4	48.6	42.5	19:45	38.1	32.6	36.7	31.4	35.3	32.4
8:00	50.0	44.4	47.9	44.0	48.4	41.0	20:00	36.3	32.0	34.1	30.7	34.3	31.3
8:15	50.5	45.8	47.6	45.2	44.6	41.2	20:15	37.1	34.5	34.2	30.8	36.1	31.8
8:30	49.9	44.5	48.3	44.6	45.2	41.6	20:30	37.9	33.7	32.8	29.6	34.5	29.2
8:45	48.9	44.2	49.1	45.0	46.9	42.8	20:45	37.4	32.5	33.5	30.3	40.1	28.8
9:00	49.2	42.9	49.1	45.2	49.5	41.3	21:00	36.2	31.1	33.4	29.6	31.3	28.0
9:15	53.1	42.1	46.3	40.7	43.6	39.0	21:15	52.1	31.9	34.7	29.9	31.4	27.2
9:30	51.3	40.7	44.8	40.9	45.8	39.5	21:30	34.5	30.6	35.4	30.9	32.1	27.4
9:45	51.0	39.2	47.9	40.3	43.5	39.4	21:45	36.8	31.8	34.5	29.4	32.6	28.3
10:00	54.4	40.8	42.6	39.1	44.2	37.5	22:00	36.8	31.4	36.5	30.8	35.3	28.4
10:15	51.8	41.7	42.8	38.8	49.4	37.1	22:15	34.1	29.6	32.4	27.8	30.9	25.7
10:30	54.6	39.6	41.9	38.0	42.4	35.8	22:30	46.8	27.9	32.5	28.1	28.8	24.5
10:45	52.3	41.1	41.7	38.2	48.9	37.6	22:45	33.1	29.5	33.5	30.9	29.9	25.3
11:00	51.7	41.5	41.9	38.1	43.0	33.3	23:00	32.9	28.3	33.1	28.2	26.6	22.4
11:15	56.0	37.5	41.2	37.3	43.2	33.7	23:15	34.2	28.8	35.3	31.4	37.8	26.4
11:30	52.8	38.1	41.6	36.8	44.2	33.3	23:30	35.0	33.5	33.2	28.6	34.7	27.3
11:45	50.6	38.3	62.8	38.6	43.3	35.1	23:45	32.4	28.5	33.7	26.0	35.1	23.9

Friday 14th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	32.5	28.1	31.8	28.0	34.7	24.7	12:00	49.7	40.1	43.6	37.5	51.9	31.5
0:15	32.4	26.6	32.0	29.3	33.2	24.7	12:15	49.0	38.6	45.8	37.0	55.6	34.3
0:30	34.1	29.4	36.3	32.4	30.7	23.7	12:30	47.0	38.0	43.8	37.2	50.6	38.7
0:45	35.8	27.4	36.8	28.9	33.7	24.5	12:45	58.6	40.2	48.7	38.5	52.9	38.9
1:00	30.4	26.6	32.0	28.8	36.1	24.0	13:00	54.1	47.9	55.7	49.6	52.1	39.7
1:15	31.7	26.2	34.0	29.6	32.4	25.0	13:15	54.9	50.0	54.0	49.5	52.9	38.1
1:30	30.1	25.7	33.2	28.4	33.9	23.3	13:30	53.1	49.5	53.4	49.5	47.6	38.0
1:45	32.7	25.7	35.4	29.3	38.4	25.9	13:45	50.4	42.6	46.2	40.9	48.3	39.1
2:00	32.9	26.7	32.8	27.3	32.4	25.3	14:00	49.0	42.0	48.7	41.3	57.0	40.9
2:15	34.0	28.6	33.0	28.1	30.6	24.8	14:15	46.3	39.9	46.5	39.5	55.0	37.1
2:30	34.7	30.4	35.6	26.1	36.0	22.3	14:30	50.5	40.4	47.8	38.7	47.4	37.3
2:45	35.2	29.2	29.7	25.1	25.5	22.2	14:45	47.6	42.4	47.5	41.6	51.8	43.4
3:00	34.7	28.3	35.3	29.0	33.7	26.1	15:00	48.7	43.4	43.8	39.9	51.7	41.7
3:15	35.5	28.5	36.0	28.9	29.8	23.6	15:15	50.3	44.2	46.5	41.1	49.4	37.9
3:30	35.7	28.8	36.8	30.1	31.6	28.4	15:30	47.6	42.2	47.3	40.6	46.2	35.9
3:45	33.4	28.1	34.4	29.5	30.6	24.9	15:45	49.4	41.8	49.6	40.1	48.1	35.6
4:00	35.0	30.1	35.4	28.7	31.0	26.3	16:00	46.2	37.8	47.7	35.0	43.3	34.0
4:15	34.3	30.2	34.9	29.1	34.6	26.0	16:15	47.1	37.5	41.3	34.3	49.3	33.3
4:30	36.7	30.7	34.5	30.7	30.8	27.3	16:30	47.4	37.2	40.8	34.4	42.2	34.2
4:45	37.0	31.1	35.7	29.6	31.9	26.7	16:45	43.8	35.7	39.4	32.8	41.7	32.5
5:00	38.3	33.6	37.1	33.0	33.3	29.7	17:00	43.0	36.2	42.9	32.7	45.3	32.2
5:15	38.4	33.4	37.5	34.4	32.3	30.1	17:15	39.2	36.8	35.5	32.5	38.6	33.5
5:30	39.9	34.6	37.6	34.6	34.1	31.9	17:30	39.2	37.1	46.9	34.3	37.7	33.4
5:45	39.3	36.0	37.9	36.0	33.9	31.8	17:45	38.3	36.3	48.9	47.8	38.6	36.5
6:00	42.6	38.8	41.7	38.2	36.8	33.5	18:00	37.6	35.6	45.5	43.0	33.8	30.7
6:15	48.9	40.7	45.6	40.2	47.4	34.9	18:15	38.3	35.5	37.5	35.5	33.0	29.9
6:30	50.6	41.7	48.7	40.7	44.9	36.4	18:30	38.7	34.9	43.1	35.5	34.8	28.1
6:45	50.4	42.2	44.8	41.0	47.1	36.5	18:45	37.9	34.8	33.9	30.6	32.4	28.0
7:00	49.1	42.0	47.5	41.8	46.4	38.7	19:00	38.1	34.4	35.1	30.4	34.9	28.2
7:15	50.7	44.8	48.1	43.5	43.7	39.9	19:15	35.2	31.7	31.7	28.8	31.6	26.9
7:30	51.9	44.1	48.7	43.1	46.4	39.5	19:30	36.5	32.4	32.6	29.0	35.0	26.6
7:45	52.9	48.7	50.5	45.9	43.1	39.9	19:45	39.2	31.1	45.9	31.2	37.2	26.7
8:00	54.3	47.6	51.2	46.9	44.7	40.6	20:00	40.9	30.8	37.8	32.6	32.3	27.0
8:15	52.9	46.9	49.0	44.4	44.7	38.0	20:15	35.6	31.2	41.2	36.1	30.6	27.0
8:30	52.0	43.6	48.6	42.5	47.9	39.3	20:30	32.7	30.0	32.7	26.6	33.0	26.4
8:45	51.3	42.0	48.6	42.9	48.0	40.8	20:45	33.2	30.1	29.7	27.2	34.6	27.1
9:00	52.0	39.2	48.0	41.7	48.2	36.2	21:00	34.3	28.6	30.2	27.8	28.2	25.2
9:15	51.9	40.8	48.5	39.5	42.1	33.5	21:15	32.3	28.9	30.9	29.0	27.7	25.2
9:30	54.2	40.0	44.7	37.5	44.0	34.2	21:30	35.4	27.6	31.1	27.5	28.9	25.8
9:45	57.3	42.5	57.2	39.5	49.4	33.6	21:45	31.0	27.9	32.6	28.6	32.8	26.9
10:00	55.8	43.2	45.9	40.4	46.5	33.9	22:00	28.6	25.8	27.9	25.9	28.4	25.0
10:15	56.5	46.7	48.0	41.2	56.1	33.8	22:15	29.5	26.2	27.9	26.0	28.6	25.0
10:30	54.2	43.7	46.1	38.5	48.4	32.2	22:30	29.5	24.4	29.1	25.5	29.5	24.4
10:45	53.0	45.2	50.7	38.7	47.4	34.5	22:45	28.3	24.2	27.7	25.0	26.9	23.9
11:00	53.1	43.5	47.7	37.4	48.5	33.0	23:00	26.9	22.4	27.6	24.8	27.5	23.0
11:15	50.2	39.8	47.6	37.5	54.5	35.9	23:15	29.6	23.8	28.5	24.5	26.7	23.5
11:30	51.4	39.0	47.9	36.3	55.7	31.7	23:30	26.9	22.3	27.0	24.3	27.4	22.4
11:45	51.7	41.9	47.9	39.0	57.2	32.4	23:45	24.1	21.6	26.3	24.7	23.4	21.9

Saturday 15th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	33.0	21.9	29.7	25.0	24.0	22.5	12:00	58.5	38.7	41.8	34.2	47.6	41.7
0:15	25.9	23.0	27.3	24.8	26.4	23.1	12:15	55.7	35.9	43.2	35.9	51.7	33.0
0:30	28.4	21.2	24.7	22.7	24.3	22.9	12:30	60.5	43.4	44.3	34.5	46.1	34.3
0:45	39.5	23.7	33.9	22.5	37.8	22.5	12:45	58.0	40.2	41.9	35.3	52.3	34.4
1:00	34.7	30.7	27.8	24.8	35.1	28.8	13:00	47.6	36.7	42.5	36.7	46.7	31.3
1:15	41.3	29.7	32.1	24.6	35.0	26.0	13:15	48.5	34.0	44.5	36.2	45.3	34.9
1:30	35.5	26.9	28.2	24.0	33.5	26.7	13:30	44.0	31.4	42.3	34.7	50.4	41.9
1:45	36.0	23.1	25.5	23.1	28.3	22.2	13:45	54.7	35.2	42.9	34.2	52.5	46.0
2:00	24.2	21.2	24.6	22.2	23.9	20.5	14:00	47.5	31.9	44.1	35.3	49.9	32.3
2:15	23.5	21.2	23.5	22.1	21.7	19.9	14:15	39.3	30.0	42.9	34.3	42.8	30.8
2:30	23.5	21.3	24.0	22.3	22.2	20.2	14:30	52.7	30.7	49.6	32.9	46.2	27.6
2:45	24.4	20.9	38.8	22.9	23.3	19.9	14:45	52.3	32.7	47.7	31.6	48.1	27.8
3:00	27.4	22.3	26.8	24.7	25.1	21.9	15:00	55.6	31.7	42.1	35.0	41.6	28.8
3:15	27.0	21.6	27.1	23.9	24.4	21.1	15:15	43.5	34.5	42.5	34.4	35.5	27.6
3:30	23.1	21.0	25.1	22.3	22.5	21.2	15:30	42.8	33.2	44.1	35.3	43.0	29.0
3:45	26.5	22.1	25.2	21.8	24.1	21.7	15:45	41.8	34.4	45.7	32.5	48.4	30.3
4:00	25.8	21.7	24.3	20.8	24.5	21.8	16:00	40.5	32.9	42.4	31.0	54.1	28.0
4:15	25.8	21.9	23.8	20.6	23.1	20.9	16:15	43.0	33.9	40.2	31.5	43.5	28.6
4:30	26.6	23.2	23.9	20.6	23.7	21.2	16:30	45.2	33.2	40.4	31.3	35.4	28.6
4:45	28.7	22.2	22.9	20.9	24.1	21.7	16:45	51.6	33.7	41.5	30.2	45.2	30.3
5:00	27.2	23.9	24.6	21.8	24.7	22.1	17:00	47.3	37.9	42.0	32.1	46.5	32.1
5:15	27.2	23.8	26.1	22.7	25.1	22.5	17:15	41.9	37.6	37.5	30.0	35.2	31.5
5:30	28.5	25.5	28.6	25.4	26.5	24.0	17:30	42.1	40.0	34.5	32.6	35.6	33.8
5:45	30.5	27.4	29.7	25.3	29.5	25.4	17:45	41.4	40.2	38.7	33.9	34.8	33.2
6:00	41.1	28.3	43.4	24.8	30.6	25.7	18:00	39.9	38.1	39.3	32.2	33.6	30.4
6:15	46.5	32.5	43.3	31.3	39.8	31.3	18:15	38.7	37.2	34.5	31.9	32.6	29.0
6:30	49.1	35.9	45.4	33.4	52.5	32.5	18:30	37.4	36.1	34.0	31.7	31.0	27.0
6:45	50.5	38.3	48.9	34.3	49.2	32.7	18:45	36.6	35.1	32.7	29.4	30.6	26.7
7:00	53.1	37.1	41.2	33.2	39.5	31.1	19:00	36.4	34.8	33.7	31.5	31.5	25.8
7:15	47.7	39.4	41.3	35.2	42.5	33.6	19:15	36.5	35.4	32.2	28.8	30.4	25.8
7:30	52.7	41.8	41.4	36.9	51.6	35.1	19:30	37.3	34.8	32.6	28.7	32.1	26.0
7:45	56.7	44.6	49.2	39.3	46.4	40.1	19:45	36.6	34.6	30.4	27.7	32.2	27.0
8:00	58.3	43.9	44.6	39.6	41.9	37.5	20:00	49.5	36.3	48.3	27.5	45.0	27.0
8:15	52.6	41.6	47.2	41.6	44.9	36.0	20:15	47.1	30.8	48.4	29.7	59.3	38.3
8:30	49.7	40.9	47.6	39.7	41.1	33.2	20:30	56.3	27.6	32.4	28.6	35.2	28.3
8:45	67.1	38.3	58.6	35.4	50.3	31.7	20:45	30.9	25.2	27.8	26.1	28.1	25.1
9:00	47.3	33.0	43.5	37.0	41.1	31.5	21:00	42.9	25.3	40.6	27.4	47.1	27.7
9:15	52.3	33.4	44.2	37.1	46.1	33.1	21:15	59.5	49.1	56.9	43.5	57.2	45.7
9:30	41.9	30.2	48.3	38.9	45.7	32.0	21:30	64.0	50.1	56.9	46.1	59.6	49.9
9:45	45.4	32.2	43.4	37.2	43.0	31.4	21:45	53.2	35.8	48.1	32.8	53.9	38.8
10:00	45.9	34.1	47.1	37.1	44.2	30.7	22:00	34.1	29.7	33.7	29.7	35.1	30.9
10:15	47.9	35.0	47.1	34.0	42.4	29.8	22:15	32.1	27.9	30.9	29.1	32.7	28.0
10:30	48.8	34.4	46.5	32.0	39.2	29.1	22:30	34.8	33.9	28.3	26.4	28.4	25.6
10:45	51.3	35.5	41.6	33.6	42.2	30.8	22:45	34.4	33.7	27.7	25.2	28.0	24.1
11:00	49.5	39.0	53.0	38.9	43.2	33.7	23:00	37.7	35.0	26.3	24.1	29.8	24.2
11:15	51.5	43.8	44.3	37.8	45.7	36.0	23:15	38.9	37.2	26.8	24.5	25.7	24.2
11:30	52.3	38.8	46.5	38.7	50.2	32.8	23:30	43.6	35.3	35.4	25.0	25.4	23.4
11:45	55.4	35.5	45.1	37.9	46.9	34.0	23:45	37.4	36.6	27.2	25.1	25.7	24.1

Sunday 16th June 2019													
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$	Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	37.6	36.8	27.2	24.7	24.8	22.5	12:00	51.0	35.3	46.5	33.9	35.9	29.3
0:15	37.8	36.4	26.8	23.6	23.9	22.3	12:15	49.9	33.7	42.4	32.9	44.1	30.6
0:30	37.1	36.4	25.3	23.7	24.2	21.9	12:30	51.7	34.4	42.5	33.5	45.7	30.4
0:45	36.6	35.2	25.0	22.7	23.4	21.9	12:45	53.9	40.0	41.4	32.5	42.8	29.5
1:00	35.7	34.5	25.6	23.8	26.9	21.4	13:00	49.0	37.4	44.1	32.3	59.5	32.5
1:15	35.0	34.3	24.0	22.2	23.4	21.1	13:15	55.6	38.1	40.1	32.0	59.2	35.4
1:30	34.3	31.6	24.9	22.7	25.0	21.1	13:30	52.4	35.6	42.5	31.6	51.1	30.6
1:45	32.9	32.2	24.5	22.3	23.9	20.8	13:45	45.5	32.7	41.2	32.2	52.1	30.1
2:00	32.2	26.5	24.1	22.4	21.7	20.5	14:00	40.1	30.3	39.9	30.1	41.4	28.0
2:15	34.5	32.2	25.0	22.7	22.7	21.3	14:15	44.9	29.6	39.6	30.9	39.6	29.1
2:30	27.9	25.7	25.5	22.8	23.4	21.9	14:30	45.8	31.6	42.8	31.8	46.5	29.4
2:45	26.6	22.4	25.5	22.8	23.5	21.6	14:45	45.8	36.5	47.4	33.7	45.8	31.9
3:00	29.8	22.8	26.7	22.3	23.6	21.2	15:00	47.9	36.1	44.2	32.6	49.5	29.5
3:15	30.4	22.4	26.2	23.0	24.1	21.8	15:15	47.4	35.8	43.5	33.7	54.4	31.6
3:30	27.2	21.6	24.6	22.0	22.3	20.1	15:30	47.9	38.2	47.9	33.9	42.2	29.9
3:45	32.5	25.0	26.9	23.0	24.3	21.1	15:45	44.7	35.3	41.8	33.4	37.6	29.5
4:00	26.0	22.6	25.9	22.1	24.0	20.9	16:00	46.1	35.0	47.5	32.8	45.0	29.7
4:15	25.8	22.0	24.2	21.7	22.9	21.1	16:15	50.4	38.9	46.4	34.3	40.6	30.3
4:30	29.1	23.3	24.7	22.2	23.4	21.2	16:30	48.9	33.1	39.4	28.9	35.5	29.1
4:45	44.8	24.3	38.8	23.0	37.9	22.0	16:45	45.8	34.4	39.2	29.8	38.6	29.3
5:00	42.6	35.8	38.8	33.3	45.1	37.4	17:00	48.0	39.6	41.7	31.7	37.8	30.5
5:15	32.1	28.6	28.4	26.1	33.8	28.2	17:15	43.4	41.6	33.7	29.8	36.2	33.4
5:30	32.7	28.8	27.5	24.9	28.8	25.4	17:30	44.4	43.5	35.3	33.8	38.8	37.1
5:45	30.5	28.2	27.2	24.9	27.4	25.5	17:45	43.7	42.5	44.8	34.0	37.8	36.7
6:00	32.9	27.0	40.5	24.7	29.5	25.9	18:00	43.5	42.4	45.1	40.6	37.7	35.8
6:15	47.4	30.3	43.3	28.7	48.2	27.8	18:15	43.2	42.1	34.3	32.5	36.3	32.9
6:30	47.2	34.6	43.4	31.9	49.7	30.5	18:30	41.8	40.1	34.8	32.2	35.6	33.3
6:45	50.0	34.8	41.7	32.4	42.5	30.0	18:45	41.0	39.0	35.5	31.4	36.3	29.8
7:00	46.8	33.9	41.5	33.2	43.3	30.8	19:00	40.9	38.1	37.2	32.2	36.6	29.5
7:15	52.0	37.4	42.8	35.7	41.3	31.8	19:15	54.1	40.7	52.3	34.7	51.4	35.3
7:30	52.6	38.3	44.6	36.3	52.2	32.2	19:30	68.6	50.1	63.7	44.1	60.5	47.9
7:45	50.1	34.9	42.4	35.3	42.9	31.2	19:45	69.9	64.9	64.7	60.6	68.1	63.7
8:00	51.4	33.4	42.5	35.4	41.6	31.2	20:00	49.0	35.4	50.9	36.7	62.2	41.4
8:15	48.0	30.9	46.1	35.6	41.9	31.7	20:15	37.0	33.5	39.6	32.6	41.1	35.3
8:30	52.0	33.9	42.9	34.1	48.0	33.0	20:30	38.8	36.6	32.6	30.6	36.7	31.1
8:45	47.6	32.0	44.7	35.0	40.8	31.9	20:45	37.9	36.6	31.8	28.6	32.2	25.0
9:00	48.5	31.0	46.5	34.4	41.3	30.9	21:00	42.8	36.9	40.2	29.3	38.6	26.1
9:15	51.0	33.1	43.3	33.2	42.2	30.3	21:15	42.7	37.6	35.3	29.0	35.6	25.3
9:30	50.8	33.1	41.2	33.6	43.8	31.2	21:30	43.0	37.0	38.1	28.4	42.4	28.1
9:45	53.3	33.6	44.5	35.3	46.4	30.7	21:45	36.8	36.0	29.8	26.5	26.2	23.6
10:00	49.7	34.0	44.7	34.9	38.3	30.3	22:00	39.4	37.3	34.4	29.6	34.3	25.8
10:15	49.7	33.9	47.3	34.5	42.1	29.4	22:15	44.3	37.9	37.3	29.2	40.1	32.0
10:30	46.7	32.5	43.5	34.4	45.3	29.9	22:30	43.2	36.7	37.9	29.0	43.5	31.8
10:45	55.4	35.2	54.0	37.6	44.6	29.5	22:45	38.6	36.0	31.2	27.0	29.2	26.4
11:00	49.6	34.4	50.0	37.1	42.7	30.7	23:00	37.3	36.1	28.6	25.9	27.9	25.2
11:15	54.0	34.6	53.6	37.8	51.2	31.2	23:15	38.3	35.8	31.0	25.6	30.9	23.5
11:30	49.9	33.6	44.9	35.6	38.6	30.9	23:30	39.1	35.6	28.6	24.7	27.5	23.0
11:45	58.7	39.4	46.2	36.6	42.6	29.8	23:45	48.0	34.9	28.5	24.6	31.3	23.2

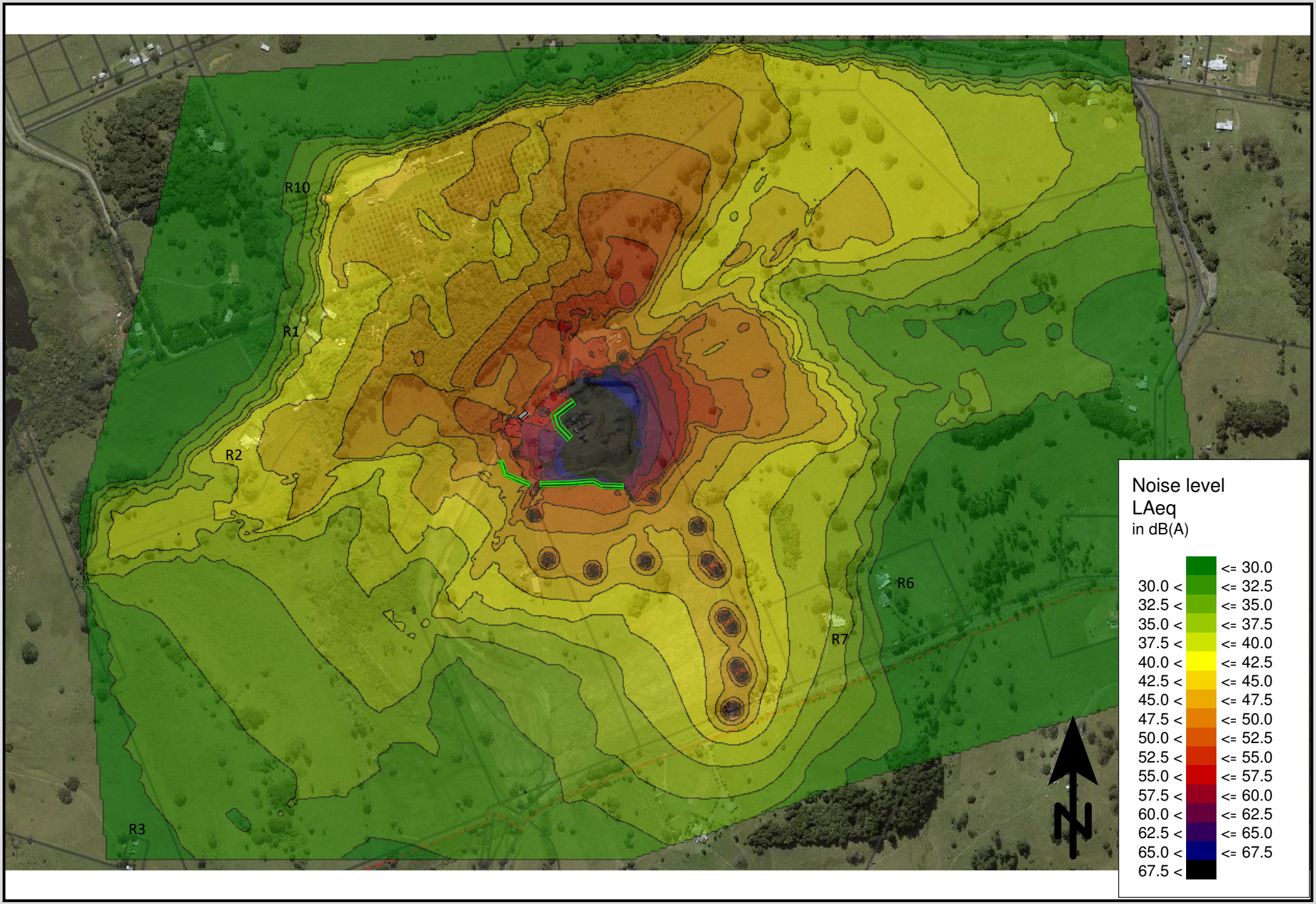
Monday 17th June 2019						
Start Time	R1 L_{Aeq}	R1 $L_{AF90.0}$	R2 L_{Aeq}	R2 $L_{AF90.0}$	R5 L_{Aeq}	R5 $L_{AF90.0}$
0:00	35.0	28.8	26.6	24.5	24.4	22.9
0:15	36.3	34.8	29.7	25.5	25.9	23.6
0:30	36.5	29.6	26.1	24.6	26.4	23.5
0:45	30.2	23.5	28.4	24.0	25.6	22.3
1:00	31.7	23.2	26.5	23.1	23.5	21.2
1:15	24.8	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
6:45	50.1	40.9	47.3	38.3	47.7	36.7

APPENDIX B – EQUIPMENT MEASUREMENT SPECTRUM DATA

Santin Quarry Equipment Measurements Spectrum Data 12032020								
	M1	M2	M3	ML4	ML5	ML6	ML7	ML8
Frequency	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]	Post A LZeq [dB]
12.5 Hz	5.7	7.6	9.7	15.0	9.9	-3.2	-1.7	13.8
16 Hz	14.6	15.5	19.0	24.0	19.2	6.3	8.0	20.1
20 Hz	21.9	17.9	25.6	24.4	24.4	18.0	18.7	28.7
25 Hz	36.8	34.0	33.3	27.9	28.8	28.9	29.0	38.1
31.5 Hz	30.2	27.5	30.2	31.5	32.2	27.1	28.4	35.0
40 Hz	42.3	45.2	50.9	51.8	54.9	41.5	49.6	48.9
50 Hz	47.4	47.9	44.9	44.3	42.3	51.5	50.6	51.9
63 Hz	59.9	54.0	53.0	49.6	59.2	53.4	53.8	60.7
80 Hz	79.8	73.7	71.1	59.5	65.5	64.1	65.8	80.6
100 Hz	61.9	57.9	56.5	54.9	53.7	52.6	56.2	63.6
125 Hz	60.7	58.8	56.0	55.4	55.9	56.7	58.8	63.8
160 Hz	65.1	62.5	59.5	55.8	57.0	59.9	60.8	69.9
200 Hz	65.1	60.9	59.9	56.5	57.5	59.0	61.2	70.9
250 Hz	65.6	63.6	60.5	58.6	57.6	59.5	61.9	76.3
315 Hz	67.8	64.1	62.2	63.5	61.8	60.1	62.0	71.4
400 Hz	71.1	67.6	67.4	66.0	67.7	63.1	64.5	78.6
500 Hz	70.1	71.1	67.9	66.8	64.7	63.6	64.3	78.2
630 Hz	72.7	73.2	69.3	68.2	66.1	64.7	65.6	79.1
800 Hz	74.0	73.5	69.7	67.8	66.7	65.3	67.2	80.1
1 kHz	74.7	71.4	72.0	69.9	67.4	66.4	69.1	81.3
1.25 kHz	75.4	71.3	70.9	68.4	66.4	66.4	67.8	80.2
1.6 kHz	74.2	70.9	70.4	66.6	65.7	66.2	68.2	79.6
2 kHz	74.4	70.0	69.7	65.6	65.5	64.7	67.2	79.7
2.5 kHz	74.0	70.3	70.0	65.6	64.8	64.1	67.8	79.5
3.15 kHz	72.4	70.1	68.1	64.1	63.9	62.0	66.2	78.2
4 kHz	70.9	66.5	66.5	62.2	63.1	60.1	64.5	76.5
5 kHz	68.1	63.1	64.1	60.2	61.7	57.4	61.6	74.2
6.3 kHz	65.5	60.2	61.7	58.7	59.0	54.5	58.4	71.7
8 kHz	62.2	56.9	59.2	57.6	58.3	51.7	54.6	68.2
10 kHz	59.3	54.2	57.7	56.3	56.7	48.0	51.9	66.2
12.5 kHz	54.0	48.7	54.0	51.8	50.1	43.1	47.3	61.6
16 kHz	45.1	40.5	45.6	44.2	41.3	33.8	36.9	52.7
20 kHz	38.4	35.1	39.6	37.9	34.2	25.4	30.1	46.8
A	85.5	82.4	80.8	78.0	77.3	76.0	78.2	90.7
C	101.9	96.2	94.0	88.1	91.9	88.6	90.5	103.2

Santin Quarry 12/03/2020 - Receiver Locations - A Weighted Spectrum Measurements Summary						
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	**Top of Quarry East M1**	**Top of Quarry East M2**	**Top of Quarry East M3**	**Top of Quarry East M4**	**Top of Quarry West**	**R2 41 Chilcott Street**
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
63	42.9	42.6	43.6	42.0	36.0	19.8
80	51.1	49.1	52.1	51.7	52.0	31.9
100	40.1	42.3	37.6	38.9	37.4	27.8
125	36.9	37.4	36.4	36.7	37.9	24.6
160	36.3	34.9	36.4	37.6	41.5	26.7
200	41.4	41.4	41.3	41.4	38.9	25.8
250	43.7	41.8	44.6	44.2	39.8	22.7
315	44.4	43.1	45.2	44.8	44.6	23.9
400	54.7	53.1	56.1	54.3	52.4	28.8
500	51.0	49.5	52.0	51.3	51.0	26.5
630	49.2	47.3	50.1	50.0	52.2	26.0
800	51.7	49.9	52.5	52.3	50.9	28.4
1k	51.1	49.7	51.9	51.6	53.2	29.5
1.25k	51.4	50.2	52.2	51.7	53.2	29.5
1.6k	50.2	49.1	50.9	50.5	52.1	29.3
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


R10
R1
R2
R3
R6
R7
Noise level
LAeq
in dB(A)
<= 30.0
30.0 < <= 32.5
32.5 < <= 35.0
35.0 < <= 37.5
37.5 < <= 40.0
40.0 < <= 42.5
42.5 < <= 45.0
45.0 < <= 47.5
47.5 < <= 50.0
50.0 < <= 52.5
52.5 < <= 55.0
55.0 < <= 57.5
57.5 < <= 60.0
60.0 < <= 62.5
62.5 < <= 65.0
65.0 < <= 67.5
67.5 <
N

Riverbank Quarry
Traffic Impact Assessment

29 June 2020
Revision 0

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DOCUMENT CONTROL

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Document number: J1065_TIA_0

Author: Michiel Kamphorst, *MSc BSc RPEng RPEQ NER*

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Client's representative: Malcolm Scott

Approved for use by:

Name: Michiel Kamphorst **Signature:** **Date:** 30/6/20

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1. INTRODUCTION

Ingen Consulting P/L has been engaged by Santin Quarry Products to prepare a Traffic Impact Assessment (TIA) to accompany a Section 4.55(2) modification application for an existing quarry at 72 Riverbank Road in Monaltrie, NSW.

1.1. Scope

The purpose of this report is to quantify the traffic impact of the quarry on the surrounding road network for the proposed quarry life from 2020 until 12 May 2036. In particular, this report seeks to:

- Demonstrate compliance with the requirements of the 2012 Lismore City Council Development Control Plans
- Address relevant items recommended for a Traffic Impact Study in the 2002 RTA Guide to Traffic Generating Developments (GTTGD)
- Analyse the impact on the through traffic on Riverbank Road and Wyrallah Road

In October 2002, the NSW Roads and Traffic Authority issued version 2.2 of the Guide to Traffic Generating Developments. Chapter 2.2 of this guide provides a typical scope of items to be addressed in traffic impact studies. This is a typical scope, as not every scope item is relevant to each development. Consulting Engineers are required to provide practical and economical outcomes to their clients. This includes preparing technical documentation that is fit-to-purpose, that does not include unnecessary scope items at unnecessary fees.

In this context, reference is made to the review report issued by Geolink on the 9th of April 2020, regarding the Traffic Impact Assessment that was issued by our office in relation to the proposed modification to DA1993/523. The main body of items raised by Geolink in their report relates to GTTGD scope items not addressed in the original TIA due to reasons outlined above.

We provide further detailed clarification and warrants regarding scope items included and not included in Table 1 below.

Table 1 | GTTGD scope item warrant list

GTTGD scope item	Section reference in TIA if included	Warrant
Existing proposals for improvements to the adjacent road network and hierarchy	-	Not relevant due to low traffic generation being insignificant

		to existing Wyrallah Road traffic volume
Impact on road safety	Chapter 4	
Impact on traffic noise	-	Refer to Noise Impact Assessment issued with DA.
AADT – Annual Average Daily Traffic	-	Accurate AADT values are not available for impacted roads, only short-term 'ADT' type values, which are addressed in chapters 2 and 3.
Examine volumes and historical trends on key adjacent roads	Section 2.5	
Peak period traffic volumes and congestion levels at key adjacent intersections	-	Not relevant due to low traffic generation being insignificant to existing Wyrallah Road traffic volume and no existing or expected congestion issues.
Existing parking supply and demand in the vicinity of the proposed development	-	Not relevant for development location in rural environment on quiet minor rural road.
Parking provisions appropriate to the development (in relation to demand and statutory requirements)	Section 3.2	
Traffic generation / attraction and trip distribution of the proposed development	Section 3.1	Trip distribution not relevant, due to low traffic generation being insignificant to existing Wyrallah Road traffic volume. All trucks travel to and from Wyrallah Road – direction of travel from there does not impact on Wyrallah Road safety or efficiency

Safety and efficiency of internal road layout, including service and parking areas	Section 3.2	
Impact of generated traffic on key adjacent intersections, streets in the neighbourhood of the development, the environment and other major traffic generating development sites in close proximity	Chapter 4	Relevant items addressed in chapter 4. Due to low trip generation level of service assessments are not warranted.
Safety and efficiency of access between the site and the adjacent road network	Chapter 4	

1.2. Standards, policies and guidelines

This TIA has been prepared in accordance with the following standards, guidelines and policies:

- Lismore City Council Development Control Plan
- Guide to Traffic Generating Developments (RTA, 2002)
- Austroads Guide to Traffic Management
- Austroads Guide to Road Design
- Australian/New Zealand Standard 2890 series

1.3. Site description

Riverbank Quarry is located at Lot 4 DP 701527, 72 Riverbank Road in Monaltrie, NSW. Riverbank Road intersects with Wyrallah Road approximately 800 metres to the east of the existing quarry entrance road intersection. The quarry pit is located in the northern portion of the site.

1.4. Proposed development

Under DA93/523 and subsequent modifications, an approval exists to extract up to 15,000m^3 (equivalent to 40,500 tonnes crushed) in situ material per annum. This approval also allows for an average trip generation of 15 truckloads per day, with a maximum of 20 truckloads per day. The Section 4.55(2) modification application seeks to extend the life of the quarry to 12 May 2036, but it does not seek to alter the annual extraction rate during this time.

From a traffic engineering perspective it is proposed to maintain the approved average trip generation of 15 truck loads per day, but to increase the peak trip generation to 46 truck loads per day. Section

3.2 of this report explains how application of peak loads results in a reduction of traffic for the remainder of the year in order to ensure the average number of loaded trucks is not exceeded.

All haulage is proposed to from the quarry entrance to the East only, and therefore all haulage trucks would travel via Wyrallah Road. No quarry trucks would be permitted to enter from or exit to the West. At Wyrallah Road, trucks can travel to the North and the South, depending on the location of the customer.

1.5. Abbreviations and definitions

Commonly used abbreviations throughout this report are:

AADT – Average Annual Daily Traffic, average daily traffic based on 365 days' worth of data

ADT – Average Daily Traffic, average daily traffic based on 7 days' worth of data

LOS – Level of Service, refer to table below

Table 2 | Level of Service

Level of Service	Uninterrupted flow facility definition (HCM 2010)	Interrupted flow facility definition (AGTTM3)
A	A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.	Describes primarily free-flow operation. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at the boundary intersections is minimal. The travel speed exceeds 85% of the base free-flow speed.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A.	Describes reasonably unimpeded operation. The ability to manoeuvre within the traffic stream is only slightly restricted and control delay at the boundary intersections is not significant. The travel speed is between 67% and 85% of the base free-flow speed.

C	Also, in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	Describes stable operation. The ability to manoeuvre and change lanes at mid segment locations may be more restricted than at LOS B. Longer queues at the boundary intersections may contribute to lower travel speeds. The travel speed is between 50% and 67% of the base free-flow speed.
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.	Indicates a less stable condition in which small increases in flow may cause substantial increases in delay and decreases in travel speed. This operation may be due to adverse signal progression, high volume, or inappropriate signal timing at the boundary intersections. The travel speed is between 40% and 50% of the base free-flow speed.
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.	Characterised by unstable operation and significant delay. Such operations may be due to some combination of adverse progression, high volume, and inappropriate signal timing at the boundary intersections. The travel speed is between 30% and 40% of the base free-flow speed.
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	Characterised by a flow at extremely low speed. Congestion is likely occurring at the boundary intersections, as indicated by high delay and extensive queueing. The travel speed is 30% or less of the base free-flow speed. LOS F is assigned to the subject direction of travel if the through movement at one or more boundary intersections has a volume-to-capacity ratio greater than 1.0.

2. EXISTING CONDITIONS

2.1. Lismore Council traffic survey data

Figure 1 provides an overview of the most current traffic survey data provided by Lismore City Council for the road network in the vicinity of the subject site.

This image shows that during the 2010 surveys, the traffic volume on Riverbank Road to the west of the quarry entrance was 218 vehicles per day, with 6.05% heavy vehicles and an 85%-ile speed of 91.4 km/h at the location of the survey. Wyrallah Road to the north of the site counted 3307 vehicles per day in June 2012 and 2644 in April 2011 to the south of the site. No heavy vehicles or speed statistics were recorded as part of these surveys.

Given this survey information is relatively sparse and old, our office has carried out additional traffic survey work, the results of which are provided in the next section.

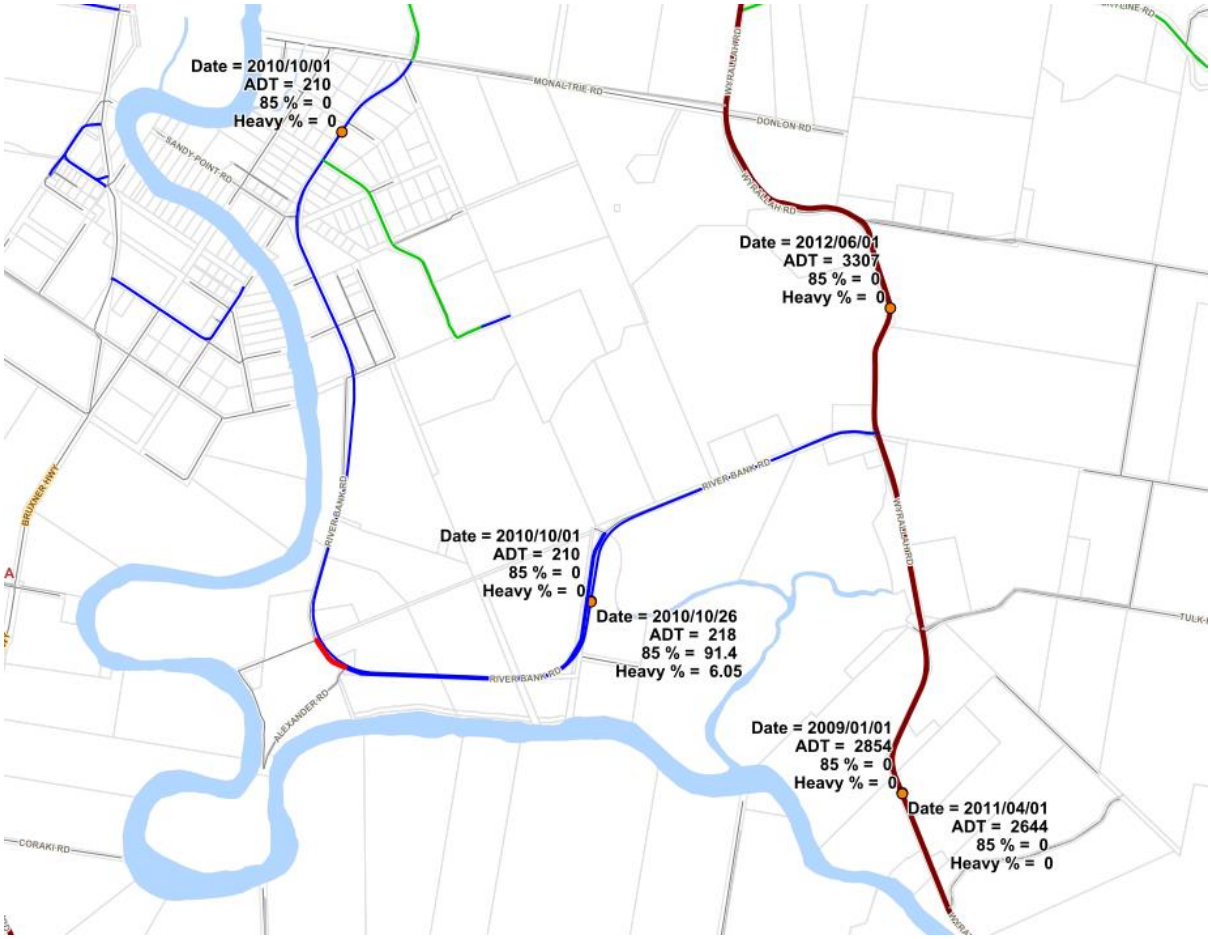


Figure 1 | Traffic Survey Data Lismore City Council

2.2. Recent traffic survey

Our office has carried out traffic surveys on Riverbank Road to the west of the quarry entrance and on Wyrallah Road to the north of the Riverbank Road intersection, from Wednesday 3 July 2019 to Thursday 11 July 2019. These two locations are shown in Figure 2. Survey summaries for the complete days in the survey are provided in Table 3.

The location for TS1 has been chosen to the west of the quarry, where there is no current quarry traffic, to enable understanding the background traffic characteristics on Riverbank Road, and superpose quarry traffic and expected traffic generated by properties to the east for analysis purposes. The TS2 location was selected as the nearest location to safely install the traffic counter tubes.

Figure 2 | 2019 traffic survey locations, *Source of aerial image: Lismore Intramaps 2019*

Table 3 | 2019 traffic survey data summary

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
TS1 – Riverbank Road west of quarry							
Traffic volume	43	50	73	44	55	42	27
Peak hour volume	8	10	12	10	9	8	6
% heavy vehicles		12%					
85%-ile speed		81.3 km/h					
5-day average		53					
7-day average		48					
TS2 – Wyrallah Road, 60m north of Monaltrie Road							
Traffic volume	3419	3610	3663	3665	3818	2716	2162
Peak hour volume AM / PM	282 / 335	288 / 348	321 / 337	356 / 360	329 / 340	285 / 258	251 / 203
% heavy vehicles		9%					
85%-ile speed		83.7 km/h					
5-day average		3635					
7-day average		3293					

2.3. Riverbank Road

Riverbank Road is a minor rural road with a 4.9m – 5m wide seal (based on detail survey near site frontage) and grass verges and a posted speed limit of 80 km/h. The southeastern end finishes at the T-junction with Wyrallah Road and to the west it leads into East Lismore after changing names several times, including Cedar Street, Johnson Street and Gundurimba Road.

This road would not typically be used for through traffic between Wyrallah Road and East Lismore, since Wyrallah Road itself connects to East Lismore, albeit to the eastern side of Girards Hill, where Gundurimba Road is on the western side of Girards Hill. As such, Riverbank Road at the location of the subject site would function as a no-through road, rather than as a through-road.

A traffic survey carried out by Lismore City Council in October 2010 resulted in a daily traffic volume of 210 and 218 vehicles per day at a location some 600 metres to the west of the driveway into the quarry site. The survey carried out in 2019 by our office resulted in daily traffic volumes varying between 27 and 73 vehicles per day with a 6-day (Monday – Saturday) average of 48 vehicles per day, 130 metres

west of the driveway into the quarry site. The 2019 volumes are significantly less than the 2010 volumes. Given insufficient information is available regarding the circumstances of the 2010 survey (it may represent a one-off event creating exceptionally high traffic volumes), and the 2019 survey results are more in line with what has been observed on site during several inspections of the area, the survey results from our 2019 are selected as applicable. The 2010 survey results are not further considered as part of this study.

Based on the 2012 Lismore Development Control Plans and our experience with similar roads in the region, the capacity of Riverbank Road is estimated at approximately 150 AADT. Between the survey site and Wyrallah Road, it is estimated that an additional 50 vehicles per day are generated by the rural residential properties, bringing the background traffic to some 98 vehicles per day.

At the time of inspection, the pavement of Riverbank Road contained evidence of regular pothole repair. Rural road pavement are constructed to withstand structural loads exerted by quarry trucks, however it is recognised that quarry traffic would reduce the life of the pavement. A contribution towards road pavement repair is covered under contributions levied under Section 94 of the Environmental Planning and Assessment Act and the Lismore City Council S94 contributions plan, which thus addresses the issue of pavement damage attributable to traffic generated by the quarry.

2.4. Wyrallah Road

Wyrallah Road is an unclassified Regional road (MR7742) road under the control of Lismore City Council and connecting Lismore with Woodburn and Broadwater. It has an approximate 7.5 metre pavement seal and would classify as a ‘Major road over 1000 AADT’ under table T1.27 of the NRLG Development Design Specification D1 for local LGA’s other than Lismore. The posted speed limit at the Riverbank Road intersection is 80 km/h.

Roadway capacity for Wyrallah Road is not assumed to be an issue that warrants further investigation as part of this report.

2.5. Background traffic growth

Given the low-traffic rural nature of Riverbank Road, it is assumed that Riverbank Road is not subject to an annual compound traffic growth. Factors that result in annual compound traffic growth on through roads such as Wyrallah Road, including new residential developments and economic growth often have no effect on small rural roads such as Riverbank Road and therefore traffic growth on such roads is limited to those resulting from approved developments on those particular roads. Applying annual compound traffic growth is not appropriate in these cases.

The annual compound traffic growth on Wyrallah Road can be calculated using the traffic survey carried out by Lismore City Council on the first of June 2012, which was a Friday, and the Friday traffic volume surveyed by our office in July 2019:

- 2012: 3307
- 2019: 3818

The annual compound traffic growth is calculated as follows.

$$Q_{2019} = Q_{2012} \times n^{2019 - 2012}$$

In this equation
Q_{2019} is the 2019 traffic volume of 3818
Q_{2012} is the 2012 traffic volume of 3307
n is the annual compound traffic growth factor

$$n = (Q_{2019} / Q_{2012})^{1/(2019-2012)} = 1.0207.$$

Thus, the adopted annual compound traffic growth for Wyrallah Road is 2%. This figure is typical for through roads in the Northern Rivers area (generally 2%-3% depending on the road) and is therefore adopted.

3. TRAFFIC AND PARKING GENERATION

3.1. Existing sample survey

The quarry operator has provided our office with quarry dockets for the period of the 1st of May 2020 to the 20th of May 2020. The following data can be extracted from this sample:

- 94 loaded truck movements in this 20-day sample period
- 15 haulage days in this sample period
- Average 6.3 loaded trucks per haulage day
- Peak 13 loaded trucks on the 8th of May 2020
- Average 15.5T per truck load
- Smallest load 2T
- Largest load 37T
- 17% of loads 0-10T range
- 63% of loads in 10-20T range
- 3% of loads in 20-30T range
- 17% of loads in >30T range

3.2. Average trip generation

The proposed extraction rate for the quarry is 40,500 tonnes per annum. The quarry operations would be permitted all days of the year except for Sundays and public holidays. As a result, the number of days of operation per year equals 365 – 52 – 9 = 304 days. Therefore the average daily haulage rate is 133 tonnes per day. Adopting the average of 15.5T per load based on the May 2020 docket sample, this would result in an average of 8.6 truck loads per day.

For staff, it is assumed that an allowance of 10 vehicle movements per day is sufficient.

The estimated average daily trip generation therefore is 27 (2 x 8.6 truck movements + 10 staff vehicle movements) per day. Adding this to the calculated 7-day average traffic volume on Riverbank Road, a total volume of 98 + 19 = 125 trips per day is estimated, which is less than the estimated capacity of 150 AADT, and is therefore acceptable.

With respect to average truck movements, condition 35 of DA1993/523 specifies the following:
"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 day."

Since the current approval of an average of 15 loaded truck movements per day exceeds the current average of 8.6 loaded truck movements per day, no change is proposed to the average of loaded trucks component of this condition.

3.3. Peak trip generation

The current approved peak trip generation (DA1993/523, condition 35) is 20 truck loads per day. As part of this modification request, this value is sought to be increased to a maximum of 46 truckloads per day.

Given confusion expressed in recent submissions by others regarding the previous modification request, it is highlighted that this refers to ***peak*** loads only. This does not alter the annual average traffic or the approved annual extraction rate. In other words, if peak traffic is generated during a short period of the year, then for the rest of the year the average volume would need to be below the approved average volume in order to ensure that over the whole year, the average truck load generation does not exceed the approved value of 15 truckloads per day.

Justification for the increase in peak loads is as follows:

- The changes in the industry since 1993, and Pacific Highway upgrades and increased funding to regional roads resulting in increased demand for larger peak supply.
- Increased peak volumes results in a reduction of the number of days during which the peak volume is applied, thus reducing the traffic impact for the rest of the year.

Peak loads would be associated with supply to large projects, typically using trucks combinations capable of transporting in excess of 30T per load. Therefore the peak calculations are based on 30T truck loads.

The number of days with peak volumes would naturally be limited to 29 days per year, as that would result in transporting the maximum of 40,500 tonnes per annum, at 30T per truck load. During the remaining 336 days of that year there would be no truck loads generated. This demonstrates that this peak volume would only be reached incidentally and would not an on-going scenario.

The approved (condition 11 of DA1993/523) general quarrying hours are 7:30am to 4:30pm Monday to Saturday. This encompasses a time period of 9 hours. Therefore, on a day that the quarry generates 46 truck loads (92 truck movements), the average hourly truck movement generation is 10 movements per hour, of which five are empty trucks and five are loaded trucks. With an existing peak hour volume to the East of the site on Riverbank Road of approximately 15 vehicles per hour, this would result in a

peak hourly volume of 25 vehicles per hour on Riverbank Road. It is important to note that on such a peak day, the quarry staff will already be present before trucks start arriving, therefore their commuting traffic is not counted in the peak hour traffic.

It is recommended that a letterbox drop is carried out for the residences on Riverbank Road to the East of the quarry entrance road one week prior to the anticipated peak haulage period, to advise residents of the expected increased quarry traffic. This provides the following benefit:

- Residents will be aware of a beginning and an end to the peak haulage period, which may satisfy some of their concerns.
- Residents are made aware of the increased haulage volume so that they would likely be more alert when using the road.

3.4. Parking and internal manoeuvring

Sufficient parking should be available for a minimum of 5 staff vehicles and one visitor vehicle. Adequate space for parking is available at the location shown in Figure 3. Figure 4 depicts the internal haulage loop-road. There are no safety or efficiency concerns for this loop road as sight distances at the internal intersection are uninterrupted and adequate and the loop road pavement is in good condition.

Figure 3 | Aerial photo of quarry (undated), *Source: Lismore IntraMaps 2019*

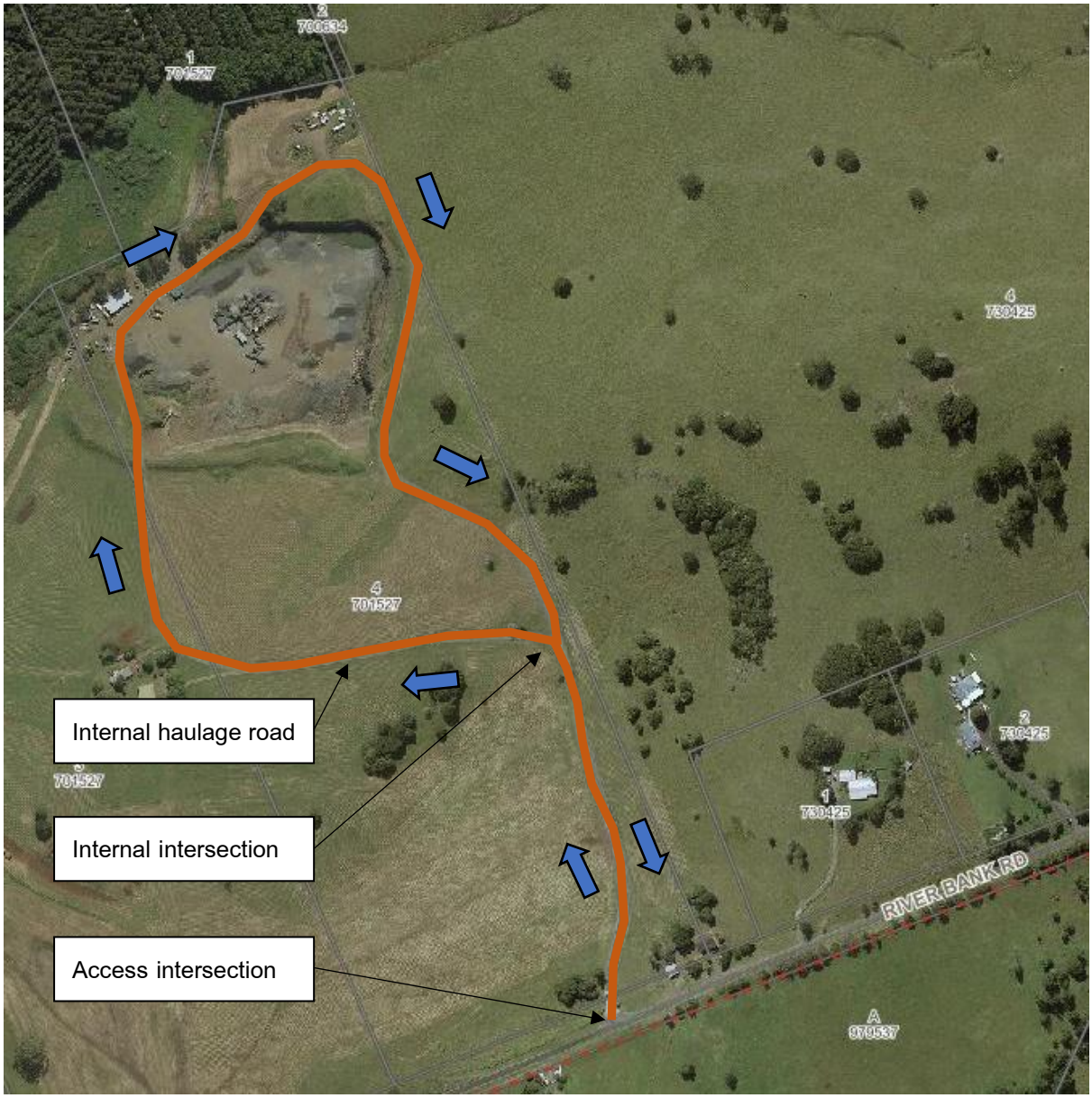


Figure 4 | Internal manoevering, ***Source of aerial image: Lismore IntraMaps 2020***

4. ROAD SAFETY

4.1. Crash history

The Centre for Road Safety website by Transport for New South Wales provide crash history data since 2014. A snapshot for Riverbank Road and Wyrallah Road near the subject stie is provided in Figure 5. This provides the following information:

- No registered crashes on Riverbank Road since 2014.
- No registered crashes at the intersection of Riverbank Road and Wyrallah Road since 2014.
- The nearest crash (to the north of the intersection) was associated with the curve in the road, not the intersection.

Figure 5 | NSW Crash history, *Source: Centre for Road Safety June 2020*

4.2. Entrance intersection

Under the current development approval for the site, the proponent is required to upgrade the existing intersection to a 'Type A' intersection, as detailed on the intersection layout plans by Newton Denny Chapelle for DA 92/523 (undated drawings). The existing intersection is depicted in Figure 6 and the proposed upgraded intersection in Figure 7. These figures are excerpts of the engineering drawings for the intersection upgrade that have been approved for construction by Lismore City Council (S138 Roads Act approval 73.2019.72.1, dated 27th November 2019)

This intersection upgrade should be undertaken within 2 years from approval of the section 4.55 application. Therefore, as part of this TIA, it is assumed that a suitable entrance intersection will be available.

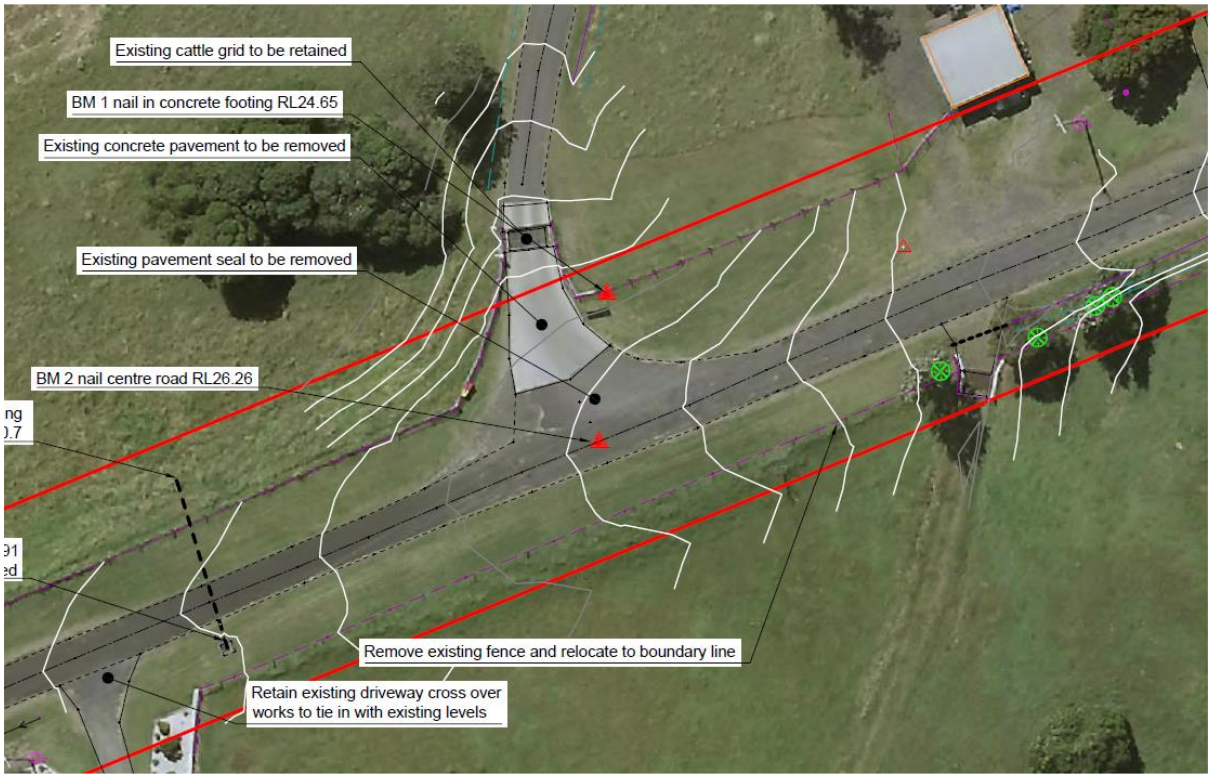


Figure 6 | Existing intersection layout

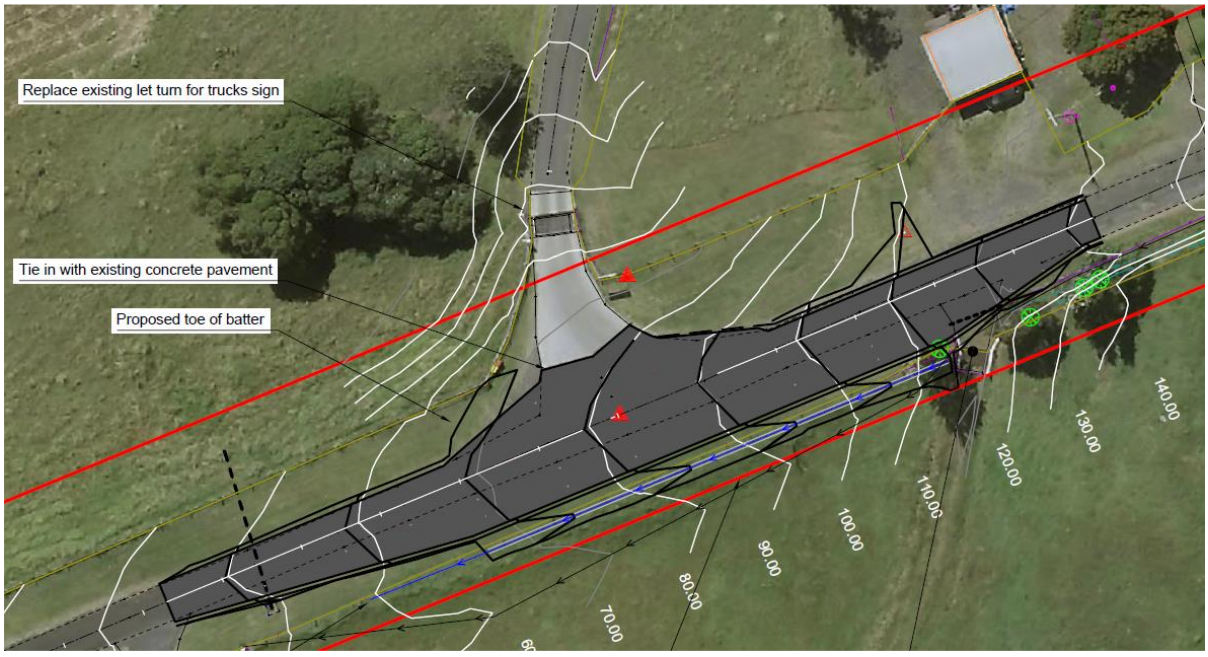


Figure 7 | Proposed intersection layout

4.3. Entrance driveway sight distances

The applicable standard for entrance driveway sight distances is AS 2890.2:2002 as outlined in clause 1.1 of that standard. The entrance driveway provides access into a private, commercial site for loading and unloading of commercial vehicles.

Entrance driveway sight distances should comply with the requirements for AS 2890.2:2002 for a posted speed limit of 80 km/h. The minimum required sight distance for a 5 second gap and a frontage road speed of 80 km/h is 111 metres.

The sight line to the left (Figure 8) is limited by the presence of a crest. During a site inspection, the sight distance to the left was measured to be approximately 120 metres, which complies with the requirements of AS 2890.2:2002. This sight distance is expected to be improved as part of the entrance intersection upgrade works as the road will be in approximately 0.4m fill at this location, thus improving sight lines over the crest. It is noted however that the sight distance to the left is irrelevant, as there would be no trucks turning right out of the quarry entrance and the upgraded intersection would be such that trucks turning left are not swinging over the centreline of Riverbank Road.

Sight lines to the right (Figure 9) are unimpeded and estimated in the order of 300 metres.

Figure 8 | Entrance road sight line to the left

Figure 9 | Entrance road sight line to the right

4.4. Wyrallah Road intersection

The intersection of Riverbank Road with Wyrallah Road is an existing T-junction without specific intersection treatments other than wide flares on the minor legs. Safe Intersection Sight Distances should be achieved as outlined in the Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections. The required sight distance is based both on the approach speed and the approach road gradient. Based on available LiDAR data, the approach grade from the right is estimated to be approximately 9%. The approach from the left is partially across a saddle with relatively flat grades. The first section is at -7%, and flat for the latter 130 metres. Approach grade is therefore not assumed to be of relevance for the approach from the left.

For a reaction time of 2.0 seconds, the required sight distance to the left is 181 metres and to the right it is 181 – 13 = 168 metres. Based on site inspections using a range finder device, the available intersection sight distance to the left (Figure 10) is estimated to be 350 metres. The sight distance to the right Figure 11) was estimated at 220 metres. Therefore the sight distances comply.

Figure 10 | Wyrallah Road sight line to the left

Figure 11 | Wyrallah Road sight line to the right

The capacity of this intersection has been analysed using SIDRA Intersections v8.0 for the following scenario's:

1. Existing 2020 traffic including approved average quarry traffic AM and PM peak

2. Proposed 2020 traffic including proposed peak quarry traffic AM and PM peak
3. Proposed 2030 design year no quarry traffic AM and PM peak
4. Proposed 2030 design year average quarry traffic AM and PM peak
5. Proposed 2030 design year peak quarry traffic AM and PM peak

Based on the traffic survey, the peak hours are defined as follows AM (Friday 8:00 – 9:00) and PM (Friday 16:00 – 17:00).

For the purposes of the model, turning traffic volumes are estimated based on the ratio of northbound and southbound traffic on Wyrallah Road during the AM peak and the PM peak.

The SIDRA modelling results for a number of parameters are provided in Table 4 to Table 8.

Table 4 | Level of Service

Level of Service			1		2		3		4		5	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Wyrallah Road	NB	left	A	A	A	A	A	A	A	A	A	A
		straight	A	A	A	A	A	A	A	A	A	A
	SB	straight	A	A	A	A	A	A	A	A	A	A
		right	A	A	A	A	A	A	A	A	A	A
Riverbank road	EB	Left	A	A	A	A	A	A	A	A	B	A
		Right	A	A	A	A	A	A	A	A	B	A

Table 5 | 95%-ile queue length

95 %-ile queue length, m			1		2		3		4		5	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Wyrallah Road	NB	left	0	0	0	0	0	0	0	0	0	0
		straight	0	0	0	0	0	0	0	0	0	0
	SB	straight	0	0	0	0	0	0	0	0	0	1

		right	0	0	0	0	0	0	0	0	0	1
Riverbank road	EB	Left	0	1	0	1	0	0	0	0	0	1
		Right	0	1	0	1	0	0	0	0	0	1

Table 6 | Control delay, s

Control delay, s			1		2		3		4		5	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Wyrallah Road	NB	left	7	7	7	7	7	7	7	7	7	7
		straight	0	0	0	0	0	0	0	0	0	0
	SB	straight	0	0	0.1	0	0	0	0	0	0.1	0
		right	7.5	8.3	9.6	8.3	7.8	7.2	7.8	7.7	10.2	8.3
Riverbank road	EB	Left	8.6	7.8	8.6	8.4	7.9	7.4	8.9	7.8	9.5	8.4
		Right	9.8	9.4	10.3	9.9	8.3	9.1	10.5	9.7	11.6	10.2

Table 7 | Degree of saturation

Degree of saturation			1		2		3		4		5	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Wyrallah Road	NB	left	0.14	0.07	0.15	0.07	0.17	0.08	0.17	0.08	0.18	0.08
		straight	0.14	0.07	0.15	0.07	0.17	0.08	0.17	0.08	0.18	0.08
	SB	straight	0.05	0.12	0.06	0.12	0.06	0.15	0.06	0.15	0.07	0.15
		right	0.05	0.12	0.06	0.12	0.06	0.15	0.06	0.15	0.07	0.15
Riverbank road	EB	Left	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0.01	0.02
		Right	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0.01	0.02

Table 8 | Travel speed

Travel speed, km/h			1		2		3		4		5	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Wyrallah Road	NB	left	62	74.4	54.7	57.2	74.5	74.5	62	74.5	54.7	57.2
		straight	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8
	SB	straight	79.8	79.7	79.5	79.7	79.8	79.7	79.8	79.7	79.6	79.6

		right	73.7	51.6	51.9	51.6	73.8	73.7	73.8	65.5	51.9	58
Riverbank road	EB	Left	54.4	56.7	54.1	50.8	63.8	64	54	57.8	49.9	52.1
		Right	60.8	61.6	60	61	63.3	62.5	60.4	61.6	58.6	61.1

The SIDRA modelling shows that for all scenarios, the intersection performs well. The control delay increases for scenarios with increased quarry traffic, but the delay and resulting Level of Service are still acceptable.

As part of this proposal, no upgrade works are proposed for the intersection of Wyrallah Road and Riverbank Road for the following reasons:

- Intersection sight distances are adequate
- Intersection capacity is acceptable
- No increase to approved average truck movements
- Proposed increase in peak truck movements for limited number of days only and does not result in excessive decline of intersection capacity and flow behaviour.

If in the future increased extraction rates are proposed as part of a separate DA, then this intersection may require to be upgraded.

4.5. School bus routes

We understand that Riverbank Road is on a school bus route. The proposal does not create unacceptable risks to school buses for the following reasons:

- School bus drivers and haulage truck drivers are professionally trained
- (to our knowledge) there is no local history of incidents involving school buses and haulage trucks on Riverbank Road
- The quarry is existing and has operated for years – school bus drivers are aware of the quarry and the haulage trucks are not new to this road.

4.6. Pedestrians and cyclists

Riverbank Road is typical of many other such roads in the Northern Rivers region. Cyclists and pedestrians choosing to use narrow rural roads with elevation and high posted speed limits (80 km/h) should always take significant care.

Quarry trucks do not pose an unacceptable risk to pedestrians and cyclists on this road for the following reasons:

- The quarry trucks are characteristic to rural roads.
- Quarry truck drivers have a greater eye-height than car drivers and will therefore spot cyclists and pedestrians well before a car driver would.
- Quarry trucks have been using this route for at least 25 years.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided, our site inspection and review of relevant standards and policies, we conclude that the application for continuation of the quarry should be approved from a traffic engineering point of view with the following recommended haulage rate for inclusion in the development consent:

- Average haulage rate of 15 truckloads per day
- Peak haulage rate of 46 truckloads per day

We recommend that a letterbox drop is carried out for the residents to the East of the quarry entrance road on Riverbank Road to advice locals of busier quarry traffic one week in advance of the anticipated peak haulage period.

This proposal does not include a proposal to widen Riverbank Road as it is a mere continuation of the past 25 years of operations for another 16 years. However, any future applications to alter the annual extraction rate or the approved quarry extent would likely result in a requirement to carry out road network upgrade works. Subject to future analysis, such work may include:

- Posted speed limit reduction on Riverbank Road between Wyrallah Road and the quarry access road to 60 km/h
- Pavement upgrade and widening of Riverbank Road between Wyrallah Road and the quarry access road
- Upgrade of the intersection of Riverbank Road with Wyrallah Road.

REFERENCES

New South Wales Development Design Specification D1 – Geometric Road Design (Urban and Rural), Northern Rivers Local Government AUS-SPEC, August 2013

Guide to Traffic Generating Developments, Roads and Traffic Authority, Version 2.2, October 2002

Guide to Traffic Generating Developments – Updated Traffic Surveys TDT 2013/04a, Roads and Maritime Services, August 2013

Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, Austroads Inc., Sydney, November 2017

Australian/New Zealand Standard Parking Facilities, AS/NZS 2890 series, Standards Australia

DRAFT
QUARRY PLAN OF MANAGEMENT

SANTIN QUARRY PRODUCTS

RIVERBANK RD QUARRY

Version 4 – 1 July 2020

Table of contents **Page**

Attachments

1. Copy of Modified Consent DA No. 5.1992.523.4
2. Site Plans showing the Existing Quarry

1 Introduction

1-1 Overview

This document is a quarry plan of management (PoM) for the Riverbank Quarry owned and operated by Santin Quarry Products.

The PoM has been prepared by Malcolm Scott Consultant Town Planner and Michael (Mick) Santin.

The PoM includes the following information relating to the operation of the quarry:

Attachment 1 - Copy of the modified consent DA No. 5.1992.523.4.

Attachment 2 - Site survey plans showing the existing quarry in July 2019.

Map No. 1 shows the approved quarry and general operation of it

1-2 Site description

The quarry is located on Lots 4 DP 701527, 72 Riverbank Rd Lismore. Lot 4 has an area of 16.3ha.

The following image shows the location of the quarry.

2 General description of quarry operation

Attachment No. 1 is copy of plans showing the existing quarry. The following generally describes the quarry operation.

2-1 Extent of approved quarry area

The site plan showing the existing quarry shows the land approved for quarrying as shown the staging plans for DA No. 1993/523. The floor of the quarry is to be maintained generally at the levels near the weighbridge. The access road for the quarry is partially within the adjoining land known as Lot 3 DP 701527, 95 Riverbank Rd and is to be relocated as shown on ***Plan No. 1***.

The quarry including; the floor and faces, maintenance and open storage areas has an area of approx. 3.5ha. The quarry floor and faces have an area of approx. 2.6ha and land area approved for quarrying, approx. 3.4ha.

2-2 Quarrying activities

Land stripping

Pasture grass, topsoil and subsoil overburden above the quarry face to be worked is removed with a 25T 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 and augment bunds to the west and northeast of the quarry.

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 Grande Drill & Blast, Coraki.

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

The blast pattern is 3m x 3m. Noise and blast overpressure is monitored at the closed dwelling at the chicken farm to the north.

Extraction / raw feed winning

Following blasting the following occurs:

- the blown rock is screened using a 25T excavator to separate larger rock from rock suitable for crushing and
- the 25T excavator will pile suitably sized rock ready for loading by a $4m^3$ rubber tyred front end loader or excavator into the crusher.

Crushing and screening

Crushing and screening is undertaken by essentially the same fixed jaw crusher and screener that existed in the quarry in 1993. The plant has an operating capacity of approx. 500T per day. Occasionally a mobile crusher is used at the quarry.

Rock with a maximum size of 0.5m 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.

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

Loading

Loading of trucks is undertaken using a $4m^3$ rubber tyred front end loader. The loaded truck then is driven onto the weighbridge to weigh the load prior to the truck leaving the quarry.

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

- the date
- amount of product loaded
- the registration number of the truck
- the time of loading and

- type of product loaded.

Rate of extraction
The approved rate of extraction in DA No. 1992/523 is 15,000m^3 (40,500T) per annum. The EPL threshold of 30,000T (11,111m^3) limits the rate of extraction to that amount unless an Environment Protection Licence (EPL) is obtained from the NSW EPA.

Mr Santin, unless an EPL is obtained, proposes to 'cap' the rate of extraction at 11,100m^3 (29,970T).

The estimate of the resource remaining in-situ and not yet extracted within the 1ha not quarried within the approved extraction area is approx. 180,000m^3 (486,000T). At an annual rate of extraction of 11,100m^3 (29,970T) the quarry life is estimated to be approx. 16 years.

2-3 Soil and water management
Stormwater diversion drains and bunds are provided to direct overland flow outside the quarry area away from the active floor area.

The levels of the quarry floor and active areas are shaped to direct stormwater to the 2 sediment collection ponds via a drain created at the bottom of the working face.

The large sediment pond drains to the smaller pond near the weighbridge. This pond then drains via a rubble spillway to the watercourse to the north.

ENV Solutions have prepared a soil and water management plan for the quarry operation. The management protocols recommended by ENV Solutions have been included in the PoM.

2-4 Noise management
A noise impact assessment has been undertaken by INGEN Consulting for the continuing operation and a number of recommendations made to reduce noise. The management protocols recommended by INGEN Consulting have been included in the PoM.

Crushing, stockpiling and loading operation are to occur within the existing floor. The existing bund to the west and northwest of the quarry is to be augmented, temporarily fenced and planted with native shrubs and trees.

Other than the crusher quarrying plant and equipment is to be maintained to contemporary noise emission standards.

2-5 Dust management
A 4,000L water truck is to be kept at the quarry and used to control dust generated by use of the quarry floor and internal haulage access road when required.

Only the nominated and stabilised internal access road is used for haulage.

The crushing and screening plant is fitted water sprayers / misters to assist with dust suppression.

The loads of haulage trucks leaving the quarry and using the public road system are to be covered.

2-6 Traffic & access
A traffic impact assessment has been undertaken by INGEN Consulting for the continuing operation of the quarry.

Internal access and intersection with Riverbank Rd
An s. 138 *Roads Act 1993* application for the up-grade of the intersection of the internal haulage road and Riverbank Rd has been approved by Council. The intersection is to be constructed with 2 years of the approval of DA No. 5.1992.523.4.

The internal quarry haulage and access road is part bitumen sealed and gravel. The road is a 1-way loop into and out of the quarry. The main bitumen section of the road is approx. 5m wide and extends approx. 250m into the quarry land from the intersection with Riverbank Rd. The road is then a mix of gravel and bitumen to the quarry floor. Gravel sections are approx. 4.2 - 6m wide.

Number of trucks
That loaded truck movements generated as a consequence of the operation of the quarry are not to exceed an average of 15/day and be subject to a maximum (peak) of 46 loaded truck movements per day for a maximum of 29 days per annum.

2-7 Months / days of operation
Quarrying activities occur all year round. The existing quarry approved working days and hours are:
- General quarrying operations - 7.30am to 4.30pm, Monday to Saturday
- Drilling and crushing operations - 8.00am to 4.30pm, Monday to Saturday and
- Blasting operations - 8.00am to 4.30pm, Monday to Friday and where practicable, blasting is concluded before mid-day.

3 Quarry Management

3-1 Quarry management objectives
The quarry management objectives are:
1. Continue to provide quality quarry products within the Northern Rivers region for the infrastructure and building construction industries.

2. Protect for potential future use a known rare hard rock resource.

3. Comply with Local and State planning and environmental legislation.

4. Develop a plan of management for the on-going quarry that assists to further mitigate the potential off-site impacts of the quarry operation.

The objectives of the plan of management are:
1. Guide the quarry operation to ensure consistency with its development consent.

2. Continue to adapt the quarry operation so its potential, noise, water and dust impacts are minimised by adoption of industry best practice.

3. Provide for the on-going monitoring of the quarry.

3-2 Quarry staff roles and responsibilities
All quarry operations, responsibilities for employees, contractors and visitors, site safety and staff training are under the control of the Quarry Owner and Manager, Mr Santin.

A copy of the PoM is to be provided to all employees.

3-3 Staging of quarry

As the particular resource is not readily available in the Northern Rivers, continues to the east and southeast and the required quarry infrastructure is largely in place Mr Santin intends make an application in due course to laterally expand the quarry beyond its current approved limits.

The plan of management (refer to ***Plan No. 1***) shows the on-going operation of the quarry.

3-4 Quarry operations

The existing quarry will continue to be operated in the manner described in Section 2.

The approved rate of extraction is 30,000m^3 (40,500T) per annum. Unless an EPL is obtained, the annual rate of extraction is not to exceed 11,100m^3 (29,970T). Quarterly returns detailing amount of material extracted are to be provided to Council.

3-5 Product haulage

Advisory signage be erected at the gate saying 'trucks please turn left and do not exceed 40km/hr'.

Customers and truck drivers are to be provided with up-dated notification advising of the quarry days and hours of operation and requesting that truck turn left onto Riverbank Rd to minimise and avoid travelling west along it.

3-6 Clearing, habitat protection and landscaping

No land clearing is required inside the approved quarry footprint. Perimeter bunds are sacrificial temporary in nature and are to be progressively moved away from the quarry face as it expands laterally.

Topsoil and overburden within the extraction area is to be used to create permanent landscape and acoustic bunds and sacrificial temporary stockpiles and stabilised.

Koala food trees (minimum 100) are to be planted where feasible and conditions allow along the western boundary of Lot 3 DP 701527.

3-7 Stormwater controls and soil erosion control

Stormwater drainage and 2 sediment collection ponds are to be regularly inspected and maintained. The quarry floor is to drains to the main sediment collection pond which is to be maintained with a volume of approx. 3,80m^3.

The management protocols recommended by ENV Solutions in the soil and water management plan follow.

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: 1. Install temporary erosion and sediment controls 2. Construct Sediment Basin A 3. Construct earth bunds around the upslope portion of the site to divert clean water away 4. Maintain ground profile within the quarry floor to ensure surface water is directed to surface water channel and onwards to Sediment Basin A 5. Maintain the integrity of the surface water swale to ensure flow occurs to the Sediment Basin A
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.

Material won from clearing the 2 sediment ponds is to be used in the production of road base or spread on the land in locations not subject to run-off.

Clearing of the sediment ponds is to occur as required to maintain an appropriate freeboard.

3-8 Water quality

Water quality monitoring of the 2 sediment collection ponds shall be undertaken every 5 years and results provided to LCC.

The management protocols recommended by ENV Solutions in the soil and water management plan follow.

6.2 Surface Water Quality

Person responsible	Site Operations Manager, Consulting Engineer
Issue	Surface water quality
Operational policy	To establish background water quality conditions and maintain these conditions wherever practicably possible during operation of the quarry.
Performance criteria	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
pH	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	Turbidity, Total Suspended Solids, pH, Oils & Grease.
Auditing	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	Degradation of surface water quality at the sediment basin outside of the ranges of the discharge criteria prescribed in Table 8.
Corrective action	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.

3-9 Dust control

The production of dust may result from; extraction, processing, loading and transport, stockpiles and the general work area including access roads. If necessary operations are to cease if winds are strong and production of dust is too high.

The following measures are to be implemented to contain the dust:

- use of a water cart
- turning on the misting on the crushing and screening plant
- covering of loads and
- minimising the time between extraction of the material, processing, stockpiling and haulage.

If necessary operations are to be stopped when the wind from the south and southwest, exceeds 35km/hr and production of dust is high.

The management protocols recommended by ENV Solutions in the soil and water management plan follow.

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: 1. 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:

3-10 Noise control

A noise impact assessment has been undertaken by INGEN Consulting for the continuing operation and makes a number of recommendations made to reduce noise.

The quarry operation will occur within the existing floor, the existing bunds to the west and northeast of the quarry are proposed to be increased in height, temporarily fenced and planted with native shrubs and trees.

The noise impact assessment recommends following management protocols be implemented:

- 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 12th of March 2020.
- Ensure adequate maintenance and repair of plant and equipment.

If compliance with the 2017 Noise Policy for Industry is not achieved the following is to occur:

- 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.

Other than the crusher and screener all quarrying plant and equipment is to be maintained to contemporary noise emission standards.

A greater potential for noise impact is created when all plant (excavator, loader, crusher and screener) are operating simultaneously. The quarry is to be managed to minimise this occurring.

3-11 Weed control

Undisturbed areas and landscape areas are to be inspected annually and weeds controlled.

3-12 Storage of fuel

Permanent storage of fuel at the quarry is not to occur unless provided in suitably located contained and bunded area.

3-13 Rehabilitation

As the particular resource is not available in the Northern Rivers, continues to the south and the required quarry infrastructure is largely in place Mr Santin intends make an application in due course to laterally expand the quarry beyond its current approved limits.

The following for the key quarry 'zones' describes quarry rehabilitation consistent with the draft plan of quarry rehabilitation previously provided to Council.

Zone	Works
1 – western face	Existing bund above western face to be relocated further to west and progressively increased in height, shaped and sown with pasture seed.
2 – southwestern face	Existing bund above southwestern face to be moved back from face to create a bench to enable blasting to enable benching (approx. 6m) of face. Benches to be topped with topsoil and overburden and planted with native shrubs and trees. Bund to be shaped and sown with pasture seed.
3 – southern face	Existing bund above southern face to be moved back from face to create a bench to enable blasting to enable benching (approx. 6m) of face. Benches to be topped with topsoil and overburden and planted with native shrubs and trees. Bund to be shaped and sown with pasture seed.
4 – southeastern face	Existing bund above southeastern face to be increased in height, shaped and sown with pasture seed.
5 – eastern face	Existing bund above eastern face to be increased in height, shaped and sown with pasture seed.

6 – northeastern face	Existing bund above northeastern face to be shaped and sown with pasture seed. Blown rock to be removed from primary sediment pond for processing. Primary sediment pond operational.
7 – quarry floor	All stockpiles removed. Crushing plant removed.
	Quarry floor to be shaped to drain to primary sediment pond.
	Weighbridge removed.
	Quarry floor to be ripped and spread with overburden and topsoil. Floor to be graded to primary sediment pond and sown with pasture seed.
8 – maintenance area	Unused plant and equipment removed.
	Plant and equipment removed.
	Sheds removed.
	Area to be ripped and spread with overburden and topsoil. Area to be sown with pasture seed.

The quarry land will be managed as part of the grazing farm.

The following photographs show the rehabilitation of the former quarry owned and operated by Council now used as a depot by the State Emergency Services. It is anticipated the faces of the existing quarry which will no longer be worked now or in the future will be treated in a similar manner.

Photograph 1

Photograph 2

Photograph 3

3-14 Buffers

The quarry has an approved extraction rate of 15,000m^3 (40,500T) per annum and its existence pre-dates Council's contemporary requirements to provide buffers within the land, which it obviously cannot.

The approved rate of extraction provides a primary buffer of 500m and secondary buffer of 800m around the quarry. The buffer areas extend onto adjoining land owned by Santin Quarry Products and others.

There are six (6) dwellings within the primary buffer area to the quarry and an additional five (5) dwellings in the secondary buffer area to the quarry. One (1) dwelling has partial line of sight into the quarry.

The earth bund along the northwestern edge of the quarry is to be retained, increased in height to assist mitigate noise and suitably vegetated. ***Plan No. 1*** shows approx. location of sacrificial bunds.

3-15 Bushfire management

The land is used for cattle grazing or slashed every 6 months to provide an asset protection area in the event of bushfire.

3-16 Approvals and licences

The quarry is to be operated in accordance with this plan of management and conditions of consent for DA No. 5.1992.523.4.

The quarry is to be operated in accordance with relevant sections of the following:

- *Local Government Act 1993*
- *Mines Inspections Act 1901*
- *Occupational Health and Safety Act 2000*
- *Protection of the Environment Operations Act 1997* and
- *Waste Avoidance and Resource Recovery Act 2001.*

3-17 Consultation adjoining landowners

One (1) week prior to drilling and blasting quarry operations the quarry owner or manager shall contact (by phone or in person) the occupants of the dwellings on the following rural landholdings to advise contact details and proposed dates of drilling and blasting:

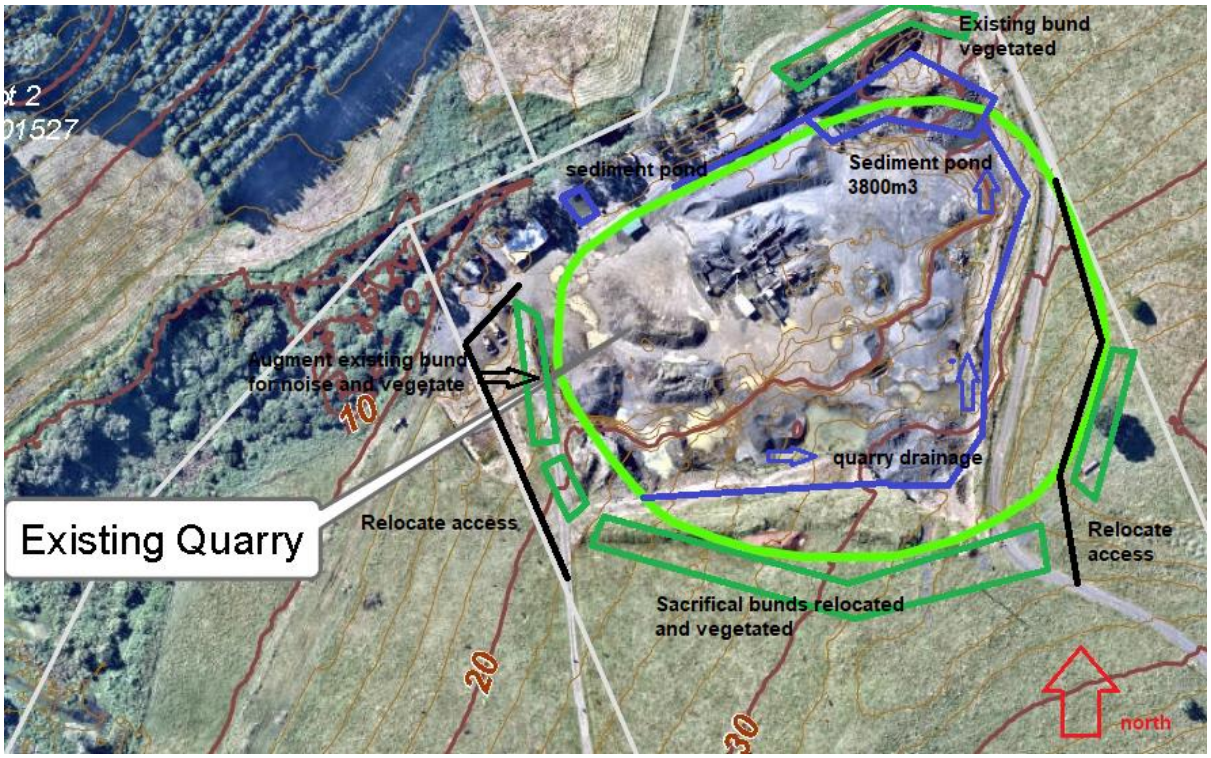
- 55 Chillcott St
- 50 Riverbank Rd
- 124 Riverbank Rd

Written notice are to be provided to residents of dwellings on properties adjoining the quarry and in the immediate vicinity seeking contact details to determine the best means of communication.

3-18 Reporting and auditing

The quarry owner will on a 3 yearly basis provide to LCC a Statement of Compliance indicating whether or not the quarry operation is meeting the terms and conditions of DA No. 5.1992.523.4.

MAP No. 1 OPERATIONAL PLAN OF MANAGEMENT



Attachment One
Copy of Modified Consent DA No. 5.1992.523.4

Insert following approval

Attachment Two

Copy of the survey site plans showing the quarry in July 2019

MGA

Weigh Bridge

BM3

Pond

Pond

Crusher

Quarry

Existing Quarry Access

Existing Quarry Extent (Top of Quarry Face)
(3/5/2019 Abt. 2.6 ha)

Approved Quarry Footprint (Abt. 3.4 ha)
(Origin BJ Mackney Fig 10 LCC DA 1993)

Tree

BM4

Power Pole

Power Pole

3/701527
M. Santin (Owner)

4/701527
M. Santin (Owner)

4/730425
M. Santin (Owner)

2/730425

1/730425

Access Road
to Quarry

RIVER BANK ROAD

LEGEND

Survey Stn	Bdy Line
Bench Mark	Road Centre Line
Tree	Road Edge of Bitumen
Telstra Pit/Marker	Road Drain
Power Pole	Top of Bank
SW Stay Wire	Bottom of Bank
	Fence
	Overhead Power

NOTE

Location of Services both above and below ground is by visual field inspection. Further verification should be carried out on the site prior to the commencement of any excavation work.

Location of Boundaries is approximate only and should be verified before any works commence close to them.

0m 30m 60m 90m 120m 150m

Scale 1:3000

Contour Interval 0.5m

103

No	DATE	AMENDMENTS
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE 1:3000 @ A3

DATUM AHD

Survey:- 8/5/19,6/6/19 & 2/7/19

Computer File :- SANTIN2308.dwg

JOB TITLE

MICK SANTIN
72 RIVER BANK ROAD - MONALTRIE
LOT 4 DP701527

DRAWING TITLE

OVERALL SITE PLAN

No OF SHEETS 3

SHEET No 1

PLAN NUMBER 19/1601

WADE Engineering Surveying

Phone (02) 6621 4334
Mobile 0427 214 334
www.wade.com.au

MGA

BM3 DH & W Crn Weigh Bridge
RL12.01

Inlet 300Ø pipe

Pond

Pond

Weigh Bridge

Drain

400Ø Pipe

Drain

Boundary Fence

Crusher Area

Access Road
to Quarry

3/701527
M. Santin (Owner)

Existing Quarry Extent (Top of Quarry Face)
(3/5/2019 Abt. 2.6 ha)

Approved Quarry Footprint (Abt. 3.4 ha)
(Origin BJ Mackney Fig 10 LCC DA 1993)

4/730425
M. Santin (Owner)

Tree
39.12

BM4 GIN Top of Post
RL41.08

4/701527
M. Santin (Owner)

Power Pole
34.8

No	DATE	AMENDMENTS
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE 1:1000 @ A3

DATUM AHD

Survey:- 8/5/19,6/6/19 & 2/7/19

Computer File :- SANTIN2308.dwg

JOB TITLE
MICK SANTIN
72 RIVER BANK ROAD - MONALTRIE
LOT 4 DP701527

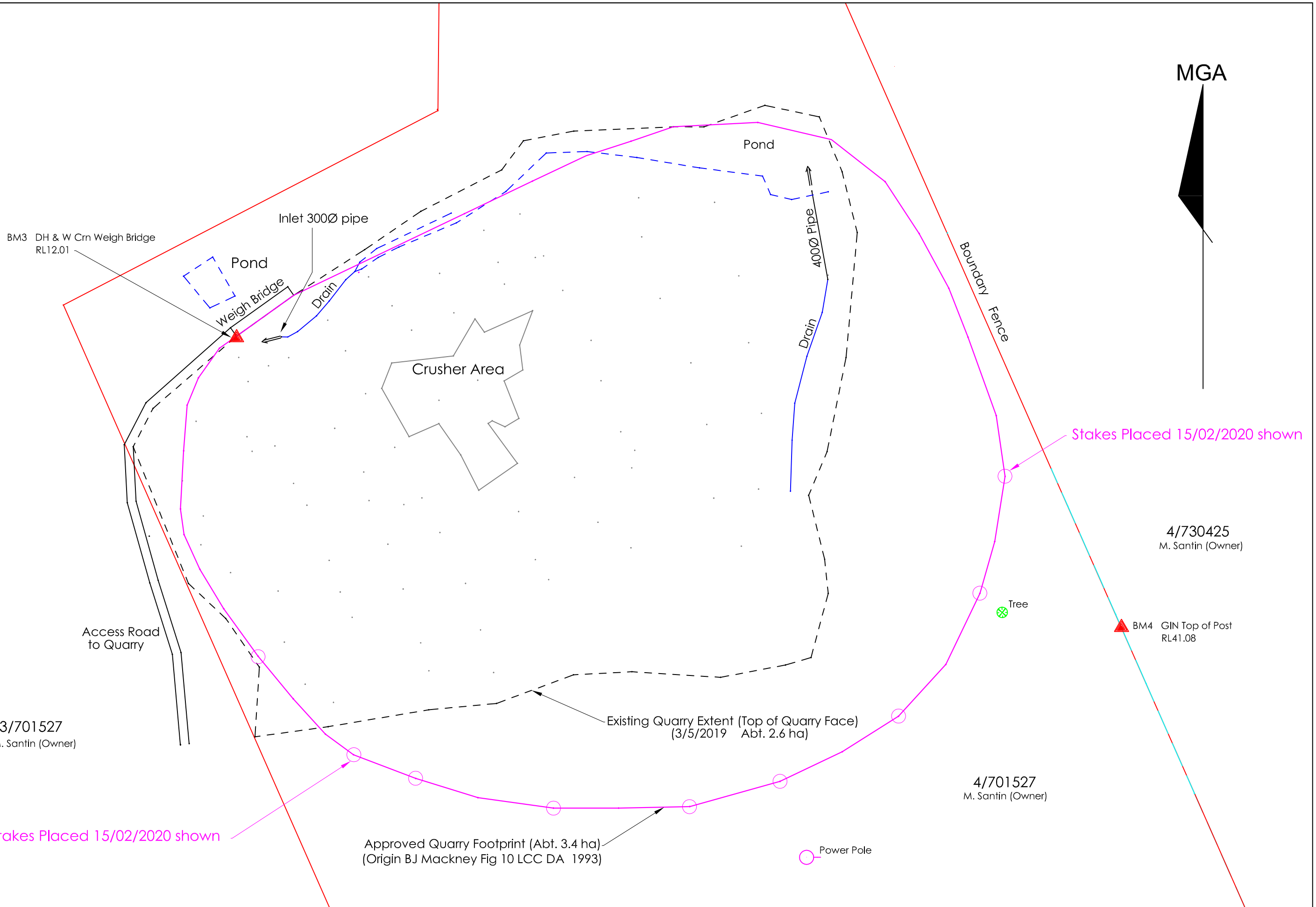
DRAWING TITLE
QUARRY PIT AREA

No OF SHEETS 3 37.17

SHEET No 3

PLAN NUMBER 19/1601

WADE Engineering Surveying
Phone (02) 6621 4334
Mobile 0427 214 334
www.wade.com.au



105

No	DATE	AMENDMENTS
C	15.2.20	STAKES SHOWING QUARRY FOOTPRINT
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE 1:1000 @ A3

DATUM AHD

Survey:- 8/5/19,6/6/19 & 2/7/19 15/02/20 (Stakes)

Computer File :- SANTIN2308.dwg

JOB TITLE

MICK SANTIN

72 RIVER BANK ROAD - MONALTRIE

LOT 4 DP701527

DRAWING TITLE

STAKED LIMIT OF QUARRY FOOTPRINT

No OF SHEETS 3

SHEET No 3

PLAN NUMBER 19/1601

WADE Engineering Surveying

Phone (02) 6621 4334

Mobile 0427 214 334

www.wade.com.au

DRAFT
PLAN OF QUARRY REHABILITATION

SANTIN QUARRY PRODUCTS

RIVERBANK RD QUARRY

Version 5 – 12 June 2020

Table of contents **Page**

1 Introduction

1-1 Overview

This document is a plan of management (PoM) for the rehabilitation of Riverbank Quarry owned and operated by Santin Quarry Products.

The PoM will be incorporated into the PoM for the quarry should the Application for extension to the period of consent or expansion of the quarry be approved.

The PoM proposes the progressive rehabilitation of the quarry within a 9 month time frame commencing 12 May 2020, though that rehabilitation will occur in a manner not to sterilise future access to the resource.

As the particular resource is not available in the Northern Rivers, continues to the southeast and the required quarry infrastructure is largely in place Mr Santin intends to make another application to extend the period of approval and a new development application in due course to laterally expand the quarry beyond its current approved limits.

The PoM includes the following documents relating to the progressive rehabilitation of the quarry:

Attachment 1

Copy of the survey site plans showing the quarry in July 2019.

Attachment 2

Copy of a plan showing conceptually the rehabilitation of the quarry.

1-2 Site description

The quarry is located on Lot 4 and partially on Lot 3 DP 701527, 72 Riverbank Rd Lismore.

The following image shows the location of the quarry.

1-3 Approval history

DA No. 1993/523 was for the expansion of an existing quarry with a production rate of 15,000m^3 per annum (or 40,500T crushed) and approved by LCC 12 May 1993.

The period of consent lapsed on 12 May 2020. The consent will lapse, unless extended or replaced by another approval on 12 Jan. 2021.

2 Description of the land and quarry

2-1 Description of quarry land

2-1-1 Landform & height

The quarry is located within the northern side slope of an east-west ridgeline / hill that has a max. height of approx. 31m(AHD). The land has a general slope of 10 - 20%.

The quarry in general terms comprises;

- the quarry floor area that has a height of approx. 11m(AHD) and
- the working faces southeast to southwest of the quarry floor that have a variable land height to approx. 31m(AHD).

2-1-2 Geology

The rock extracted and processed is solid columnar (Lismore) basalt.

2-1-3 Vegetation

The quarry land is largely devoid of native vegetation. The land into which the quarry is approved to extract rock is grazed by cattle and maintains grass cover only.

2-1-4 Watercourses

A Strahler Class / Order 2 & 3 watercourse is located near the northern boundary and partially within the land. In general the land drains north, west and south to the watercourse. The quarry drains to the watercourse via 2 sediment collection ponds. The primary sediment collection pond is currently under construction.

2-1-5 Planning controls

The land is zoned RU1-Primary Production under the Lismore Local Environmental Plan 2012.

2-1-6 Existing building

There is one (1) dwelling located on the land, approx. 580m from the quarry.

2-1-7 Wastewater management

On-site waste water management comprise a portable / temporary building within toilet and washing facilities.

2-1-8 Waste disposal – garbage

Waste is separated into compostable materials, recyclable materials (steel, rubber, glass, paper & cardboard) and general waste which is either taken to the East Lismore landfill or collected by a metal recycling contractor.

2-1-9 Provision of electricity and other utility services

Electricity is not connected to the quarry. Electricity is generated.

Reasonable telecommunication for mobile phones is available at the quarry.

2-1-10 Provision for emergency services

The land has convenient and adequate vehicular access to and from Riverbank Rd.

2-2 Description of historic quarry operations

Schedule One provides a general description of how the quarry has historically operated.

Attachment No. 2 is copy of a site plan showing the quarry.

The site plan shows the existing quarry and the approved extraction area. In general terms the quarry has laterally expanded in a southeast-south-southwest direction. The floor of the quarry has been maintained generally at the levels near the weighbridge. The access road for the quarry is partially within adjoining land known as Lot 3 DP 701527, 95 Riverbank Rd.

The quarry including; the floor and faces, maintenance and open storage areas has an area of approx. 3.5ha. The quarry floor and faces have an area of approx. 2.6ha and land area approved for quarrying, approx. 3.4ha. The area not yet worked is approx. 1ha.

3 Quarry Rehabilitation

3-1 Quarry rehabilitation objectives

The quarry rehabilitation objectives are:

1. Develop a plan for the progressive rehabilitation of the quarry within 9 months of 12 May 2020 and/or a provided for by Condition No. 3 of DA No. 1992/523.
2. Establish the principles and schedule of works to undertaken for the progressive rehabilitation of the quarry.
3. Ensure the rehabilitation works do not sterilise future access to the remaining resource.
4. Comply with Local and State planning and environmental legislation.

3-2 Quarry staff roles and responsibilities

All quarry operations, responsibilities for employees, contractors and visitors, site safety and staff training are under the control of the Quarry Owner and Manager, Mr Santin.

3-3 Staging of quarry

The final or end shape of the land following cessation of quarrying was shown as a concept on the approved plans for DA No. 1993/523. Photographs 1, 2 and 3 indicatively show how the rehabilitated quarry will look.

3-4 Quarry operations

The existing quarry is to be progressively rehabilitated. Schedule One provides a general description of historic operations which will occur during rehabilitation.

3-5 Clearing, habitat protection and landscaping

No land clearing is required inside the approved quarry footprint. Existing perimeter bunds are sacrificial and temporary in nature and will be progressively moved away from the quarry face as required.

3-6 Stormwater controls and soil erosion control

One (1) of two (2) sediment collection ponds is in place. The quarry disturbed area will drain to a primary sediment collection pond with a volume of approx. 3,800m^3. Works have commenced to create the pond.

Clearing of the sediment ponds will occur as required to maintain an appropriate freeboard. Material won from clearing the 2 sediment collection ponds is to be spread on the land in locations not subject to run-off.

3-7 Water quality

Water quality monitoring of the existing final sediment collection pond and watercourse has been undertaken. Monitoring results for total suspended solids, pH and turbidity are well

within relevant thresholds and no detrimental impact observed on the watercourse. Further water testing of the sediment collection ponds is to be undertaken at the completion of rehabilitation.

3-8 Dust control

If the production of dust is high during rehabilitation the following measures are to be implemented to contain the dust:

- use of a water cart
- turning on the misting on the crushing and screening plant
- covering loads, which is lawfully required in any case and
- minimising the time between extraction of the material, processing, stockpiling and haulage.

If necessary rehabilitation operations are to cease if winds are strong and production of dust is too high.

3-9 Noise control

The quarry rehabilitation will continue within the approved extraction area as shown on *Attachment No.1*.

Drilling and blasting maybe required in order to create suitable benches if required on existing rock faces.

The quarry is to be managed to ensure that all plant (excavator, loader, crusher and screener) are not operating simultaneously.

3-10 Weed control

Rehabilitated areas are to be inspected and weeds controlled.

3-11 Storage of fuel

Permanent storage of fuel at the quarry does not occur.

3-12 Rehabilitation

The following sets out key quarry 'zones' shown on the attached rehabilitation plan and proposed works within a monthly time frame.

Zone	Works	Time frame
1 – western face	Existing bund above western face to be relocated further to west and progressively increased in height, shaped and sown with pasture seed.	0 – 4 months
2 – southwestern face	Existing bund above southwestern face to be moved back from face to create a bench to enable blasting to enable benching (approx. 6m) of face. Benches to be topped with topsoil and overburden and planted with native shrubs and trees. Bund to be shaped and sown with pasture seed.	2 – 6 months

3 – southern face	Existing bund above southern face to be moved back from face to create a bench to enable blasting to enable benching (approx. 6m) of face. Benches to be topped with topsoil and overburden and planted with native shrubs and trees. Bund to be shaped and sown with pasture seed.	5 – 9 months
4 – southeastern face	Existing bund above southeastern face to be increased in height, shaped and sown with pasture seed.	7 – 9 months
5 – eastern face	Existing bund above eastern face to be increased in height, shaped and sown with pasture seed.	7 – 9 months
6 – northeastern face	Existing bund above northeastern face to be shaped and sown with pasture seed. Blown rock to be removed from primary sediment pond for processing. Primary sediment pond operational.	0 – 6 months
7 – quarry floor	All stockpiles removed. Crushing plant removed.	8 – 9 months
	Quarry floor to be shaped to drain to primary sediment pond.	8 – 9 months
	Weighbridge removed.	9 months
	Quarry floor to be ripped and spread with overburden and topsoil. Floor to be graded to primary sediment pond and sown with pasture seed.	9 months
8 – maintenance area	Unused plant and equipment removed.	8 – 9 months
	Plant and equipment removed.	8 – 9 months
	Sheds removed.	9 months
	Area to be ripped and spread with overburden and topsoil. Area to be sown with pasture seed.	9 months

The former quarry land will be managed as part of the grazing farm.

The following photographs show the rehabilitation of the former quarry owned and operated by Council now used as a depot by the State Emergency Services. It is anticipated the

faces of the existing quarry which will no longer be worked now or in the future will be treated in a similar manner.

Photograph 1

Photograph 2

Photograph 3

3-13 Buffers

The quarry has an approved extraction rate of 15,000m^3 (40,500T) per annum and its existence pre-dates LCC's contemporary requirements to provide buffers within the land.

The approved rate of extraction requires a primary buffer of 500m and secondary buffer of 800m be provided around the quarry. The buffer areas extend onto adjoining land.

There are two (2) dwellings within the primary buffer area to the quarry and five (5) additional dwellings in the secondary buffer area to the quarry. Seven (7) dwellings are within 800m of the quarry. One (1) dwelling has partial line of sight into the quarry.

The bund along the western edge of the quarry is to be retained, increased in height to assist mitigate noise and landscaped / grassed.

3-14 Bushfire management

The land is used for cattle grazing or slashed every 6 months to provide an asset protection area in the event of bushfire.

3-15 Approvals and licences

The quarry is to be operated in accordance with this plan of management for rehabilitation and conditions of consent for DA No. 1993/523 (12 May 1993) as amended.

The quarry is to be operated in accordance with relevant sections of the following:

- *Guide Health and Safety at Quarries.* NSW Resources Regulator. Nov. 2018
- *Local Government Act 1993*
- *Mines Inspections Act 1901*
- *Occupational Health and Safety Act 2000*
- *Protection of the Environment Operations Act 1997* and
- *Waste Avoidance and Resource Recovery Act 2001.*

3-16 Consultation adjoining landowners

One (1) week prior to drilling and blasting quarry operations for the purposes of the rehabilitation of the quarry, Mr Santin shall contact (by phone / email / in person) the occupants of the dwellings on the following rural landholdings:

- 55 Chillcott St Lot 2 DP 701527.
- 50 Riverbank Rd Lot 1 DP 730425.
- 39 Riverbank Rd Lot A DP 979537.
- 495 Wyrallah Rd Lot 1 DP 530135.

Schedule One

General description of historic quarry operations

Land stripping

Pasture grass, topsoil and subsoil overburden above the quarry face to be worked is removed with a 25T 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 and augment bunds to the west and northeast of the quarry.

Blasting

Blasting involves drilling core holes in which to place explosives and detonation 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 Grande Drill & Blast, Coraki.

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

The blast pattern is 3m x 3m and blast occurs in a minute timeframe.

Noise and blast overpressure is monitored at the closed dwelling at the chicken farm to the north.

Extraction / raw feed winning
Following blasting of the basalt the following occurs:

- the blown rock is graded
- a 25T excavator will pile suitably sized rock ready for loading by a $4m^3$ rubber tyred front end loader to the crusher and
- a $4m^3$ rubber tyred front end loader will take the rock to the crusher hopper for processing and screening.

Crushing and screening
Crushing and screening is undertaken by the same fixed jaw crusher and screener that existed in the quarry in 1993. The plant has an operating capacity of approx. 300-400T per day, depending on weather and material moisture levels.

Rock with a maximum size of 0.5m 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.

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

Loading
Loading of trucks is undertaken using a $4m^3$ rubber tyred front end loader. The loaded truck then drives onto the weighbridge to ensure the correct weight of load prior to leaving the quarry.

Rate of extraction
The approved rate of extraction in DA No. 1993/523 is $15,000m^3$ per annum (40,500T).

Approx. 430,263T of crushed rock has been transported from the quarry between 1993 and 2019.

Therefore, based on the resource estimates for DA No. 1992/523 approx. 569,737T ($203,478m^3$) of resource remains in-situ within the approved extraction area.

Soil and water management
Stormwater diversion drains and bunds are in place to direct overland flow outside the quarry area away from the active floor area.

Stormwater in the quarry floor and active areas is directed to 2 sediment collection ponds. The primary sediment pond is currently been constructed.

The sediment ponds overflow drain to the pond near the weighbridge. This pond then drains via a pipe and rubble spillway to the watercourse to the north.

Noise management
The quarry operation will continue to occur within the existing floor. A number of retrospective alterations have been undertaken to the crushing and screening plant to reduce / dampen noise.

Other than the crusher quarrying plant and equipment is modern and built and maintained to contemporary noise emission standards.

Dust management
A 4,000L water truck is kept at the quarry and used to control dust generated by use of the quarry floor and internal haulage access road when required.

Only the nominated and stabilised internal access road is used for haulage.

The crushing and screening plant is fitted with dust suppression systems including water misters. If necessary operations are modified when the wind is strong and production of dust is likely to be high.

The loads of haulage trucks are weighed and logged prior to leaving the quarry and loads covered.

Traffic & access
Internal access and intersection with Riverbank Rd
An s. 138 *Roads Act 1993* application to LCC for the intersection up-grade has been approved.

The internal quarry haulage and access road is part bitumen sealed and gravel. The road is a 1-way loop into and out of the quarry. The main bitumen section of the road is approx. 5m wide and extends approx. 250m into the quarry land from the intersection with Riverbank Rd. The road is then a mix of gravel and bitumen to the quarry floor. Gravel sections are approx. 4.2 - 6m wide.

Number of trucks
The average number of trucks generated by the quarry daily is very difficult to determine as that will be influenced by weather, size of the order and destination location.

Now approx. 25% of the haulage vehicles are rigid bodied trucks with trailer that have a payload of 12T. The majority of haulage trucks have a payload of 28T. However, on occasions a 2T truck may haul material from the quarry 3 - 4 times a day (6 - 8 trips per day).

The number of loaded trucks, with an average weight of 28T, likely to be generated onto Riverbank Rd by the quarry at the approved rate of extraction of 40,500T per annum is 1,446.

At an average annual rate of extraction of 29,970T and assuming that the quarry operates 180 days per annum, the average maximum of material hauled out per working day will be in the order of 278T. This is equivalent to an average of 10 trucks with a payload of 28T per working day onto Riverbank Rd.

Months / days of operation
Quarrying activities occur all year round. The quarry approved working days and hours are:
- General quarrying operations - 7.30am to 4.30pm, Monday to Saturday
- Drilling and crushing operations - 8.00am to 4.30pm, Monday to Saturday and

- Blasting operations - 8.00am to 4.30pm, Monday to Friday and where practicable, blasting is concluded before mid-day.

END
12 June 2020

Attachment One

Copy of the survey site plans showing the quarry in July 2019

MGA

Weigh Bridge

BM3

Pond

Pond

Crusher

Quarry

Existing Quarry Access

Existing Quarry Extent (Top of Quarry Face)
(3/5/2019 Abt. 2.6 ha)

Approved Quarry Footprint (Abt. 3.4 ha)
(Origin BJ Mackney Fig 10 LCC DA 1993)

Tree

BM4

Power Pole

Power Pole

3/701527
M. Santin (Owner)

4/701527
M. Santin (Owner)

4/730425
M. Santin (Owner)

2/730425

1/730425

Access Road
to Quarry

RIVER BANK ROAD

LEGEND

Survey Stn	Bdy Line
Bench Mark	Road Centre Line
Tree	Road Edge of Bitumen
Telstra Pit/Marker	Road Drain
Power Pole	Top of Bank
SW Stay Wire	Bottom of Bank
	Fence
	Overhead Power

NOTE

Location of Services both above and below ground is by visual field inspection. Further verification should be carried out on the site prior to the commencement of any excavation work.

Location of Boundaries is approximate only and should be verified before any works commence close to them.

0m 30m 60m 90m 120m 150m

Scale 1:3000

Contour Interval 0.5m

119

No	DATE	AMENDMENTS
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE 1:3000 @ A3

DATUM AHD

Survey:- 8/5/19,6/6/19 & 2/7/19

Computer File :- SANTIN2308.dwg

JOB TITLE

MICK SANTIN
72 RIVER BANK ROAD - MONALTRIE
LOT 4 DP701527

DRAWING TITLE

OVERALL SITE PLAN

No OF SHEETS 3

SHEET No 1

PLAN NUMBER 19/1601

WADE Engineering Surveying

Phone (02) 6621 4334
Mobile 0427 214 334
www.wade.com.au

MGA

BM3 DH & W Crn Weigh Bridge
RL12.01

Inlet 300Ø pipe

Pond

Pond

Weigh Bridge

Drain

400Ø Pipe

Drain

Boundary Fence

Crusher Area

Access Road
to Quarry

3/701527
M. Santin (Owner)

4/730425
M. Santin (Owner)

4/701527
M. Santin (Owner)

Tree
39.12

BM4 GIN Top of Post
RL41.08

Existing Quarry Extent (Top of Quarry Face)
(3/5/2019 Abt. 2.6 ha)

Approved Quarry Footprint (Abt. 3.4 ha)
(Origin BJ Mackney Fig 10 LCC DA 1993)

Power Pole
34.8

No	DATE	AMENDMENTS
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE 1:1000 @ A3

DATUM AHD

Survey:- 8/5/19,6/6/19 & 2/7/19

Computer File :- SANTIN2308.dwg

JOB TITLE
MICK SANTIN
72 RIVER BANK ROAD - MONALTRIE
LOT 4 DP701527

DRAWING TITLE
QUARRY PIT AREA

No OF SHEETS 3 37.17

SHEET No 3

PLAN NUMBER 19/1601

WADE Engineering Surveying
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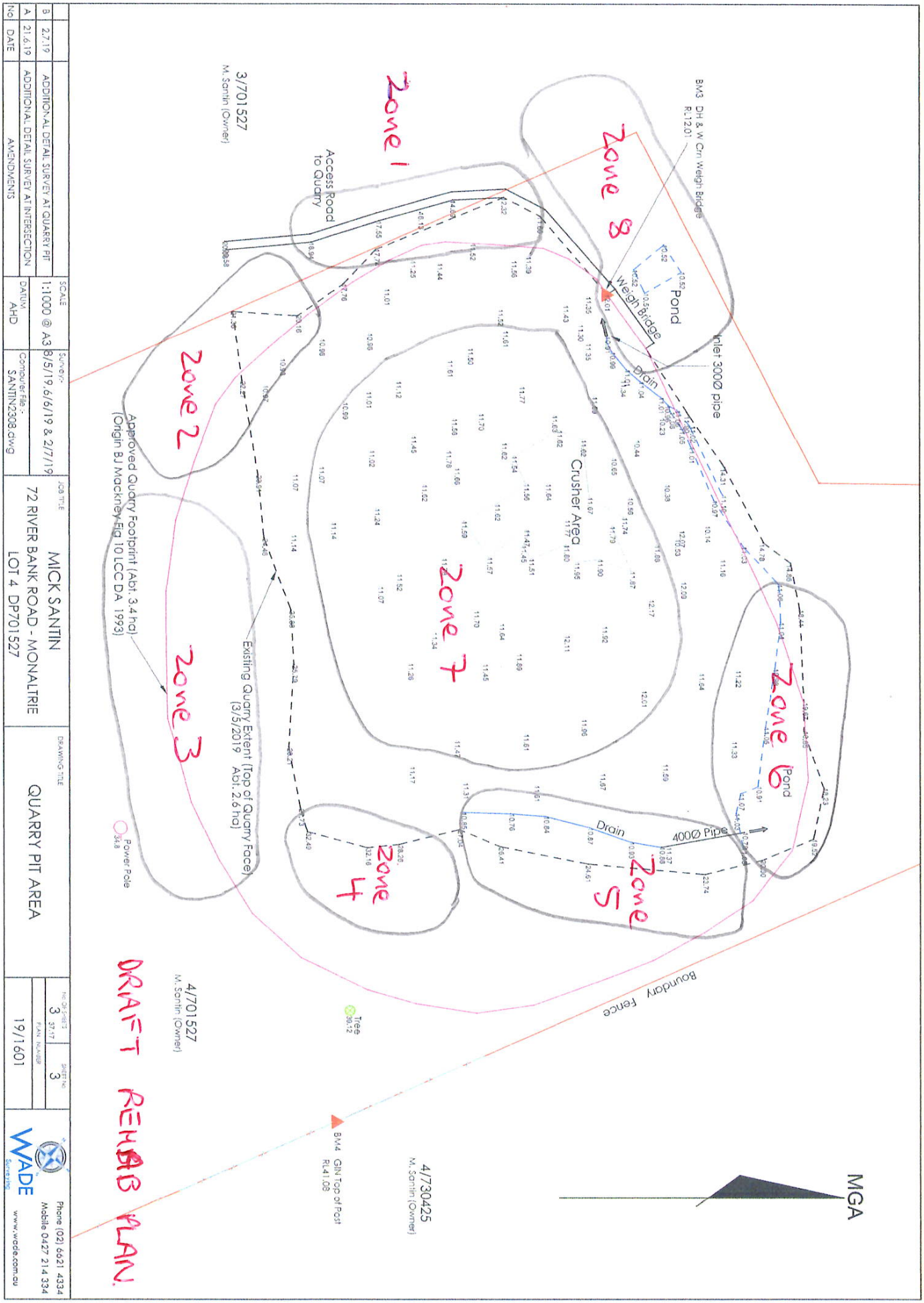
Mobile 0427 214 334
www.wade.com.au

Attachment Two

Copy of a plan showing conceptually the rehabilitation of the quarry



No	DATE	AMENDMENTS
B	2.7.19	ADDITIONAL DETAIL SURVEY AT QUARRY PIT
A	21.6.19	ADDITIONAL DETAIL SURVEY AT INTERSECTION

SCALE: 1:1000 @ A3
Survey: 8/5/19, 6/6/19 & 2/7/19
DATUM: AHD
Computer File: SANTIN2308.dwg

JOB TITLE: MICK SANTIN
72 RIVER BANK ROAD - MONALTRIE
LOT 4 DP701527

DRAWING TITLE: QUARRY PIT AREA

SHEETS: 3
PLAN NUMBER: 19/1601

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