Eagleton Quarry

Acoustic Assessment

Prepared for

Eagleton Rock Syndicate Pty Ltd

Global Acoustics

Noise and Vibration Analysis and Solutions

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Eagleton Rock Syndicate Pty Ltd to conduct an assessment of potential noise impacts from a proposed quarry at Lot 2 DP1108702, Killaloe Lane (Off Italia Rd), Eagleton. Figure 1 shows the location of the proposed quarry. The proposed quarry is to extract approximately 6,000,000-8,000,000 m^3 of hard rock quarry resources from the site over a period of 30 years.

This assessment has been prepared in accordance with the relevant guidelines contained in the NSW Industrial Noise Policy (INP), a NSW Environment Protection Authority (EPA) document published in 2000.

Source: Department of Lands, NSW

Figure 1: Site Location

1.2 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.1.

Table 1.1: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels.
L_{A90}	The level exceeded for 90 per cent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Aeq}	The average noise energy during a measurement period
L_{pk}	The unweighted peak noise level at any instant
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
SEL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
ABL	Assessment background level (ABL), the 10th percentile background noise level for a single period (day, evening or night) of a 24 hour monitoring period
RBL	Rating background level (RBL), the background noise level for a period (day, evening or night) determined from ABL data
Day	The period 7:00am to 6:00pm
Evening	The period 6:00pm to 10:00pm
Night	The period 10:00pm to 7:00am
PPV	Peak particle velocity, a measure of vibration, typically in units of millimetres per second. This descriptor is commonly used to quantify blast vibration measured in the ground as it has been found to correlate best to structural damage
Overpressure	Overpressure is a transient pressure wave generated by blasting. It is measured on the decibel scale as an un-weighted peak.

2 CRITERIA

2.1 Receptors

Twenty-three residential receptors and four commercial receptors were included in the construction and operational noise assessment. One of the residential receptors is used by the manager of the neighbouring landscape supply operation. This residence has been assessed as a residential receptor, as it is located on a lot zoned rural landscape, despite being directly involved in a commercial operation. Details of receptors included in the assessment are presented in Appendix A, Table A.1.

There is one residential receptor in proximity to the primary haul route to the Pacific Highway (located on Italia Road). Receptor R01 was included in the road traffic noise assessment.

2.2 Background Noise Monitoring

Local environmental noise level measurements were made in the area surrounding the site from 22 June to 2 July 2012 at Italia Road, Balickera, and from 17 July 2012 to 27 July 2012 at 266 Six Mile Road, Balickera. Data from 30 June to 2 July inclusive were excluded from calculation of RBL, as these days were during school holidays. Of note, RBL remain the same regardless of whether these days are excluded or not.

Data recorded at Italia Road are considered representative of all receptors within 300 metres of the Pacific Highway, including R01, R02, R03 and R04. Data recorded at 266 Six Mile Road is considered representative of all other receptors in this assessment.

Measurements were made using Acoustic Research Laboratory (ARL) EL-215 noise data loggers. Each logger was configured to provide a statistical noise data summary every 15 minutes. Logging locations are shown in Figure 2.

With regard to current applicability of background monitoring undertaken during 2012, road traffic volumes on the Pacific Highway have been reviewed, as road traffic noise is deemed responsible for background noise levels. Road traffic volumes were sourced from the Road and Maritime Services (RMS) online Road Traffic Viewer.

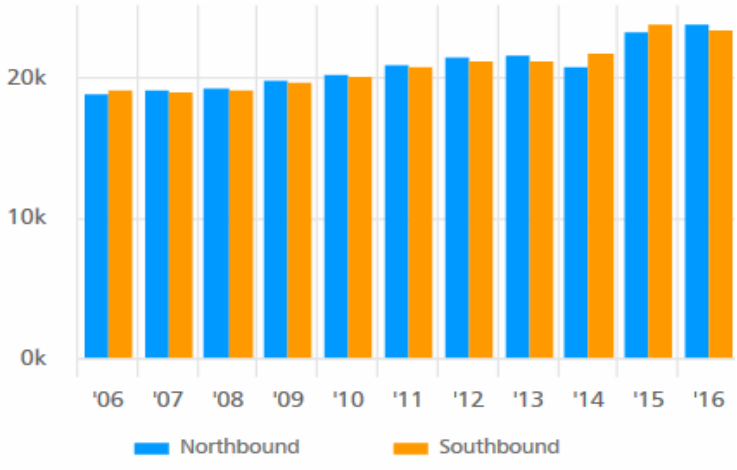
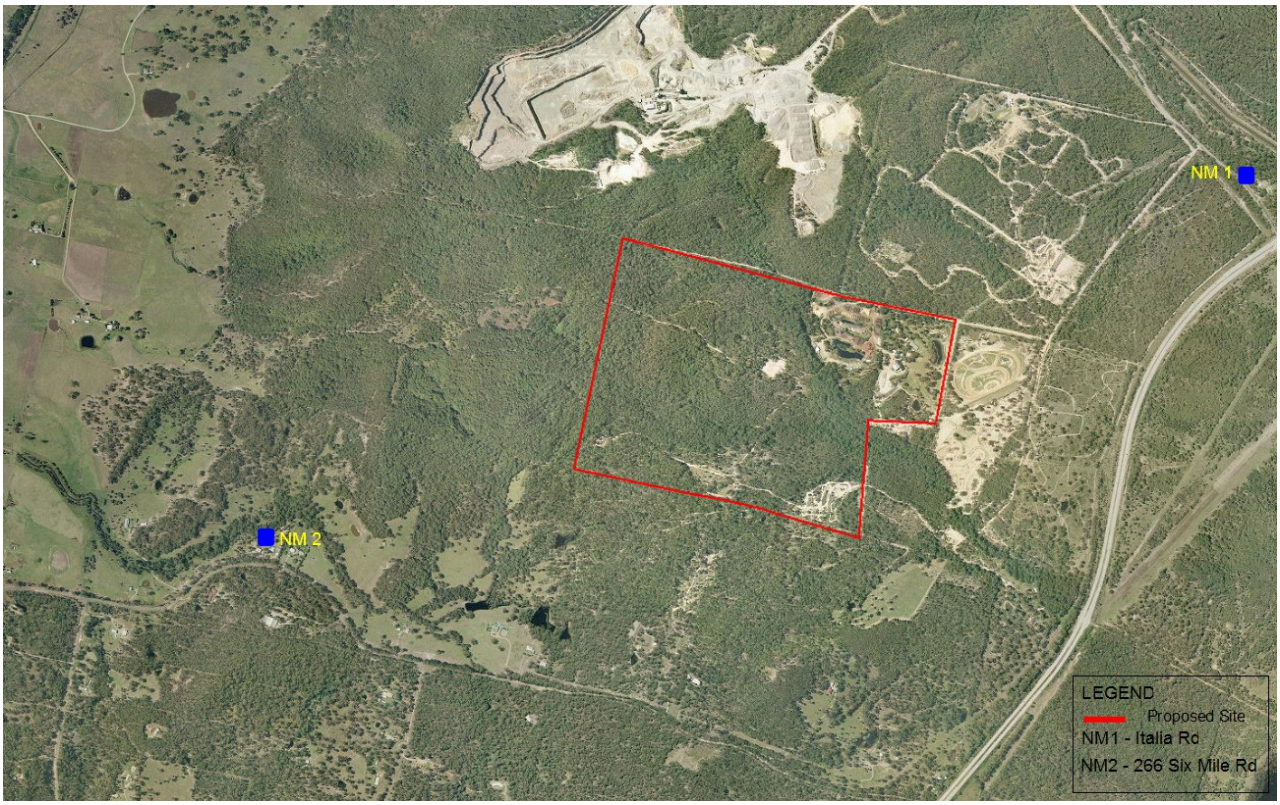


Figure 2: Road Traffic Volumes, Pacific Highway, Tomago

The nearest permanent traffic counter on the Pacific Highway is 380 metres west of Tomago Road, Tomago. Annual traffic flow volumes at this location, shown in Figure 2, are considered indicative of relative change in the vicinity of the subject site.

Road traffic volumes have increased since 2012, which indicates measured background levels would most likely have increased since that time. On this basis, measured background levels are considered conservative.



Source: Department of Lands, NSW

Figure 3: Noise Logger Locations

2.2.1 Unattended Monitoring Equipment

The equipment used to measure and record environmental noise levels are listed in Table 2.1, copies of calibration certificates are provided in Appendix D.

Table 2.1: MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
ARL EL-215 noise data logger	194636	04/11/2012
ARL EL-215 noise data logger	194638	20/05/2013
Rion NC-73 sound level calibration	11248300	27/02/2014

2.2.2 Measured Noise Levels

Table 2.2 and Table 2.3 provide a summary of noise logger data. Graphs are provided as Appendix D. Bureau of Meteorology (BOM) data from the Williamtown AWS was used for processing logger data.

Table 2.2: AVERAGE LOGGED NOISE LEVELS – ITALIA ROAD

Site	Period	L_{Aeq} dB	L_{A10} dB	L_{A90} dB	RBL
Italia Road, Balickera	Day	68	67	48	44
	Evening	63	58	46	43
	Night	62	55	38	31

Notes:

1. *L_{Aeq} are logarithmic average.*

Table 2.3: AVERAGE LOGGED NOISE LEVELS – 266 SIX MILE ROAD

Site	Period	L_{Aeq} dB	L_{A10} dB	L_{A90} dB	RBL
266 Six Mile Road, Balickera	Day	55	48	38	36
	Evening	45	43	37	34
	Night	42	40	36	34

Notes:

1. *L_{Aeq} are logarithmic average.*

Table 2.4 provides a summary of noise logger data for traffic noise descriptors. It has been assumed these measured levels were due to road traffic.

Table 2.4: AVERAGE LOGGED NOISE LEVELS - TRAFFIC

Site	Day – $L_{Aeq,15hour}$ dB	Night – $L_{Aeq,9hour}$ dB
Italia Road, Balickera	68	62
266 Six Mile Road, Balickera	54	42

Notes:

1. *Day: 7:00am – 10:00pm ~ Night: 10:00pm to 7:00am.*

2.3 Construction Noise Criteria

The NSW Interim Construction Noise Guidelines (ICNG, July 2009) prepared by the Office of Environment and Climate Change[1] specifically relates to construction, maintenance and renewal activities. The guideline suggests that for short-term construction (not more than three weeks), a qualitative assessment will suffice and for longer-term construction, a quantitative assessment is required, with comparison to relevant criteria.

1 Now the Environment Protection Authority.

Six stages of construction are proposed for quarry establishment. These stages will be undertaken at separate times so that cumulative noise from more than one activity does not result. Figure 3 details the construction activities and indicative equipment required for each task. As the proposed construction period exceeds three weeks, a quantitative assessment is required.

The ICNG recommended noise levels for the nearest residences in relation to work undertaken during standard construction hours are shown in Table 2.5.

Table 2.5: NOISE AT RESIDENCES AND OTHER LAND USES (L_{Aeq} dB)

Time of Day	Management Level $L_{Aeq,15minute}$	Notes
Residential Premises Recommended standard hours: Monday to Friday – 7am to 6pm Saturday – 8am to 1pm No work on Sundays and Public Holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise.
Commercial Premises	70 dB(A)	External noise level at most affected point of the premises.

Notes:

1. *RBL is Rating Background Level.*

Construction noise criteria for residences are indicated in Table 2.6.

Table 2.6: CONSTRUCTION NOISE CRITERIA $L_{Aeq,15minute}$ dB

Location	RBL L_{A90} dB	Noise Affected Criterion	Highly Noise Affected Criterion
R01 to R04	44	54	75
R05 to R23	36	46	75

Notes:

1. *Criteria are applicable during standard construction hours.*

2.4 Operational Noise Criteria

The INP states that objectives for environmental noise are '*to account for intrusive noise and … to protect the amenity of particular land uses*'. To achieve these objectives, limits are specified where the '*intrusiveness criterion essentially means that the equivalent continuous (energy-average) noise level of the source should not be more than 5 decibels (dB) above the measured background level*'. Amenity is protected by '*noise criteria specific to land use and associated activities*'. Amenity criteria '*relate only to industrial-type noise and do not include road, rail or community noise*'.

Applicable intrusiveness and amenity limits are derived independently. These are then compared to determine project specific noise levels (PSNL).

The intrusiveness criterion is expressed as:

$L_{Aeq,15minute}$ = RBL + 5 dB

Where $L_{Aeq,15\ minute}$ is the L_{Aeq} noise level from the source, measured over 15 minutes and RBL is the rating background level. Where the RBL is less than L_{A90} 30 dB, a value of L_{A90} 30 dB can be adopted.

An amenity criterion caps industrial noise levels. Amenity criteria are recommended for various land uses.

According to the INP, a suburban area is an area that has:

- local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:
    - decreasing noise levels in the evening period (1800–2200); and/or
    - evening ambient noise levels defined by the natural environment and infrequent human activity.

  This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.

According to the INP, an urban area has an acoustical environment that:

- is dominated by 'urban hum' or industrial source noise;
- has through traffic with characteristically heavy and continuous traffic flows during peak periods;
- is near commercial districts or industrial districts;
- has any combination of the above, where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources; and

  This area may be located in either a rural, rural-residential or residential zone as defined on an LEP or other planning instrument, and also includes mixed land use zones such as mixed commercial and residential uses.

It is Global Acoustics opinion that the Italia Road receptor, and any other receptors located in close proximity to the Pacific Highway, can be characterised as either "urban" or "suburban" in accordance with definitions in the INP for the following reasons:

1. Proximity to an arterial road with through traffic and characteristically heavy and continuous traffic flows during peak periods; and
2. Background levels generally reduce during the evening and night periods.

Whilst this area could technically be characterised as urban due to proximity to the Pacific Highway, a suburban classification has been adopted due to decreasing levels during the evening and night periods. Data from the Italia Road logging location is considered representative of all receptors within 300 metres of the Pacific Highway, including R01, R02, R03 and R04.

Six Mile Road area is considered rural, although existing industry and road traffic noise from the Pacific Highway contribute to the acoustic environment in this area. The rural classification applies to receptors R05 to R23.

Recommended amenity limits from the INP for residences in rural and suburban areas are shown in Table 2.7 and Table 2.8. Adjustments to these are required where there is high traffic or existing industrial noise.

Table 2.7 RURAL AMENITY CRITERIA, $L_{Aeq,period}$ dB

Period	Acceptable	Maximum
Day	50	55
Evening	45	50
Night	40	45

Table 2.8 SUBURBAN AMENITY CRITERIA, $L_{Aeq,period}$ dB

Period	Acceptable	Maximum
Day	55	60
Evening	45	50
Night	40	45

Table 2.9 summarises amenity criteria that apply at assessed industrial receiver boundaries.

Table 2.9: AMENITY CRITERIA FOR OTHER LAND USES, $L_{Aeq,period}$ dB

Type of Receiver	Period	Acceptable	Maximum
Commercial	When in use	65	70
Industrial	When in use	70	75

The INP does not provide a method to standardise L_{Aeq} assessed over different time periods. The NSW draft Industrial Noise Guideline (dING) provides the following guidance, which has been adopted in this assessment:

> *The L_{Aeq} is determined over a 15-minute period for the intrusiveness noise level and over an assessment period (day, evening and night) for the amenity noise level. To standardise the time periods for the intrusiveness and amenity noise levels, this guideline assumes that the $L_{Aeq,15}$ minute will be taken to be equal to the L_{Aeq}, period + 2 dB.*

2.4.1 R01 to R04 Project Specific Noise Levels

For the purpose of this assessment it has been assumed that logged period L_{Aeq} have been generated by road traffic at the Italia Road location. Amenity criteria were derived in accordance with Section 2.2.3 of the INP and relevant application notes; they are higher than standard due to the influence of road traffic noise. The INP application notes state:

In areas where traffic flow is continuous and noise from industrial sources is inaudible or difficult to measure due to a high level of road traffic noise, and where the $L_{Aeq,\ (period),\ traffic}$ noise level is more than 10 dB above the ANL presented in Table 2.1, the ANL is replaced by $L_{Aeq,\ (period),\ traffic}$ minus 10 dB. This becomes the new ANL for the receiver area.

On this basis, modified acceptable amenity criteria for R01 to R04 are measured $L_{Aeq,period,traffic}$ minus 10 dB.

Table 2.10 summarises intrusiveness and amenity criteria that apply for the morning shoulder, day, evening and night periods at residential receiver R01 to R04. The lower of the two (intrusiveness or amenity) apply and are adopted as project specific noise levels. Intrusiveness criteria are based on measured background levels presented in Section 2.2.2 of this report.

Table 2.10: PROJECT SPECIFIC NOISE LEVELS (dB) – R01 TO R04

Period[1,2]	RBL L_{A90} dB	Intrusiveness Criterion $L_{Aeq,15minute}$	Road Traffic $L_{Aeq,period}$	Modified Amenity Criterion[4] $L_{Aeq,period}$	Modified Amenity Criterion[5] $L_{Aeq,15minute}$	Project Specific Noise Levels $L_{Aeq,15minute}$
Morning Shoulder[2]	38	43	-	55	57	43
Day	44	49	68	58	60	49
Evening	43	48	63	53	55	48
Night	31	36	62	52	54	36

Notes:

1. *Day 7:00 am 6:00 pm ~ Evening: 6:00 pm to 10:00 pm ~ Night: the remaining periods;*
2. *The morning shoulder (5.00am to 7.00am) has been adopted as the midpoint between day and night periods, as per section 3.3 of the INP;*
3. *Road traffic $L_{Aeq,period}$ are average logged L_{Aeq} as presented in Table 2.2;*
4. *The measured ambient noise levels were controlled by traffic noise. An assessment of noise for high traffic areas in accordance with section 2.2.3 of the INP has been undertaken and corrections applied; and*
5. *Plus 2 dB adjustment applied to standardise $L_{Aeq,period}$ and $L_{Aeq,15minute}$.*

2.4.2 R05 to R23 Project Specific Noise Levels

There are two other existing industrial facilities in proximity to the proposed project, the Boral Quarry and Port Stephens Garden Land Centre. A car racing facility has also been approved to operate north of the subject site on Lot 2 DP1158962 and Lot 1 DP245116.

Existing noise levels from these other industrial facilities is unknown. The dING includes a method of

assessing cumulative industrial noise limits that does not require estimation of existing industrial noise contributions. The dING states:

> *The recommended amenity noise levels represent the objective for total industrial noise at a receiver location whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location. To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:*
>
> *Project amenity noise level for industrial developments = recommended amenity noise level minus 5 dB(A).*

Table 2.11 summarises intrusiveness and amenity criteria that apply for the morning shoulder, day, evening and night periods at residential receiver R05 to R23. The lower of the two (intrusiveness or amenity) apply and are adopted as project specific noise levels. Intrusiveness criteria are based on measured background levels presented in Section 2.2.2 of this report.

Table 2.11: PROJECT SPECIFIC NOISE LEVELS (dB) – R05 TO R23

Period[1,2]	RBL L_{A90} dB	Intrusiveness Criterion $L_{Aeq,15minute}$	Recommended Amenity Criterion $L_{Aeq,period}$	Project Amenity Criterion[3] $L_{Aeq,period}$	Project Amenity Criterion[4] $L_{Aeq,15minute}$	Project Specific Noise Levels $L_{Aeq,15minute}$
Morning Shoulder[2]	35	40	-	40	42	39
Day	36	41	50	45	47	41
Evening	34	39	45	40	42	39
Night	34	39	40	35	37	37

Notes:

1. *Day 7:00 am 6:00 pm ~ Evening: 6:00 pm to 10:00 pm ~ Night: the remaining periods;*
2. *The morning shoulder (5.00am to 7.00am) has been adopted as the midpoint between day and night periods, as per section 3.3 of the INP;*
3. *Project amenity criterion is recommended amenity criterion minus 5 dB; and*
4. *Plus 2 dB adjustment applied to standardise $L_{Aeq,period}$ and $L_{Aeq,15minute}$.*

Project specific noise levels for commercial and industrial premises are as detailed in Table 2.9.

2.5 Voluntary Land Acquisition and Mitigation Policy

The NSW government has published the Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government, 2014). This document describes the NSW Government's policy for voluntary mitigation and land acquisition to address noise impacts from State significant mining, petroleum and extractive industry developments.

Mitigation and acquisition criteria

The VLAMP provides the following guidance on the applicability of noise mitigation and acquisition criteria:

A consent authority can grant voluntary mitigation and acquisition rights to reduce:

- *Operational noise impacts of a development on privately-owned land; and*
- *Rail noise impacts of a development on privately-owned land near non-network rail lines (private rail lines) on or exclusively servicing industrial sites (see Appendix 3 of the RING).*

But not:

- *Construction noise impacts, as these impacts are shorter term and can be controlled;*
- *Noise impacts on the public road or rail network; or*
- *Modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.*

Voluntary mitigation rights

The VLAMP states:

A consent authority should only grant voluntary mitigation rights:

- *If the noise generated by the development would be equal to or greater than 3dB(A) above the INP project-specific noise level at any residence on privately owned land; or*
- *If the development would increase the total industrial noise level at any residence on privately-owned land by more than 1dB(A), and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; or*
- *If the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING (see Appendix B) by greater than or equal to 3dB(A) at any residence on privately-owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

Voluntary land acquisition rights

The VLAMP states:

A consent authority should only grant voluntary land acquisition rights where:

- *The noise generated by the development would be more than 5dB(A) above the project specific noise level at any residence on privately-owned land; or*
- *The noise generated by the development would contribute to exceedances of the recommended maximum noise*

levels in Table 2.1 of the INP on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls (voluntary land acquisition rights should not be applied to address noise levels on vacant land other than to vacant land specifically meeting these criteria); or

- *If the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING at any residence on privately owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

Vacant Land Assessment

An assessment of operational noise impact over privately owned lots has been completed. The goal of the assessment is to determine if the recommended maximum noise levels in Table 2.1 of the INP are exceeded on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

Recommended maximum noise levels in Table 2.1 of the INP for rural and suburban areas are $L_{Aeq,period}$ 55/50/45 dB and 60/50/45 dB for the day/evening/night periods respectively. A criterion of $L_{Aeq,period}$ 50 dB, midway between day and night period criteria for rural areas, has been adopted for the morning shoulder period. Results of the assessment are included in Section 4.4.

2.6 Sleep Disturbance Criteria

INP application notes provide guidance on setting sleep disturbance criteria. The application notes state that a review of sleep disturbance research included in the 'NSW Road Noise Policy' (RNP) concludes, "the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance".

The application notes indicate a criterion based on $L_{A1,1minute}$ not exceeding background noise levels by more than 15 dB(A) can be used as a guide to identify the likelihood of sleep disturbance. This means that where this criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required. The detailed analysis should cover the maximum noise level, and, the number of occurrences during the night period.

As an initial assessment of sleep disturbance, a criterion of background (RBL) plus 15 dB has been adopted. Adopted sleep disturbance criteria for the morning shoulder and night periods are indicated in Table 2.12. No operations are proposed for the night period outside of the morning shoulder period.

Table 2.12: SLEEP DISTURBANCE CRITERIA, $L_{A1,1minute}$ dB

Location	Morning Shoulder		Night Period	
	RBL L_{A90} dB	Criterion	RBL L_{A90} dB	Criterion
R01 to R04	38	53	31	46
R05 to R23	35	50	34	49

2.7 Cumulative Noise Criteria

As discussed in Section 2.4, cumulative industrial noise levels are capped by amenity criteria.

Modified amenity criteria for receivers R01 to R04 listed in Table 2.10 are 10 dB below $L_{Aeq,period,traffic}$. To allow an equitable share of total industrial noise levels, it is considered reasonable to limit noise contributions from the project to 5 dB below the modified amenity criterion at these receivers. The resulting limit is 15 dB lower than road traffic L_{Aeq}, which would likely result in the project being inaudible due to masking from road traffic noise.

In the case of receivers R05 to R23, the dING approach provides a project specific amenity noise level that applies to the single industrial development under consideration. In accordance with the dING, this approach is suitable for areas with up to three or four industrial noise sources, as is the case in the project area. Project amenity criteria listed in Table 2.11 have been adopted for these receivers, and apply to predictions for the project in isolation. Contributions from other industry in the area is not required under this approach.

Table 2.13 summarises derived project specific noise criteria for morning shoulder, day, evening and night periods that will provide compliance with recommended amenity criteria.

Table 2.13: CUMULATIVE NOISE CRITERIA, $L_{Aeq,period}$ dB

Period	Residential Receptors – R01 to R04	Residential Receptors – R05 to R23	Commercial Receptors	Industrial Receptors
Morning Shoulder[2]	50	40	55	60
Day	53	45	55	60
Evening	48	40	55	60
Night	47	35	55	60

Notes:

1. *Day 7:00 am 6:00 pm ~ Evening: 6:00 pm to 10:00 pm ~ Night: the remaining periods; and*
2. *The morning shoulder (5.00am to 7.00am) has been adopted as the midpoint between day and night periods, as per section 3.3 of the INP.*

It is noted that noise amenity and cumulative criteria are typically expressed in terms of $L_{Aeq,period}$, which means acoustic energy is averaged over the full duration of the relevant time period (day, evening or night). The approved car racing facility on Lot 2 DP1158962 and Lot 1 DP245116 has potential to generate short duration, high level noise bursts during races, with periods of low noise emission between races. When

averaged over the duration of the operating period (assumed to be day only), resulting $L_{Aeq,11hour}$ emissions are expected to be sufficiently low level as to not cause exceedance of cumulative noise criteria. The environmental assessment for the car racing facility was not available, so it is not possible to comment on predicted short term emission from car racing activities.

2.8 Blast Vibration and Overpressure Criteria

The Australian and New Zealand Environment and Conservation Council (ANZECC) provide recommended criteria for the assessment of noise and vibration from blasting in its publication entitled guidelines to minimise annoyance due to blasting overpressure and ground vibration.

2.8.1 Annoyance & Discomfort

The ANZECC guidelines specify that the peak particle velocity (ppv) from ground vibration should not exceed 5 mm/s for more than 5 % of the total number of blasts over a period of 12 months. However, the maximum level should not exceed 10 mm/s at any time. The ANZECC guidelines also recommend that a level of 2 mm/s be considered as the long-term regulatory goal for the control of ground vibration.

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

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

The guidelines recommend that when a temperature inversion is known to exist, blasting should be avoided if practical. These restrictions do not apply where the effects of blasting are not perceived at noise sensitive locations. In addition to the above criteria, general good practice procedures can be used to effectively minimise noise impacts.

Table 2.14 specifies adopted criteria for blast vibration and over pressure.

Table 2.14: BLAST VIBRATION & OVERPRESSURE CRITERIA

	Vibration PPV (mm/sec)		Overpressure – Lpeak (dB)	
	Acceptable	**Maximum**	**Acceptable**	**Maximum**
Residential Receptors	<= 5	10	<= 115	120

The ANZECC guidelines state that blasting should generally be limited to the hours from 9.00 am to 5.00 pm Monday to Saturday and should not take place on Sundays or public holidays.

The guidelines recommend that when a temperature inversion is known to exist, blasting should be avoided if practical.

2.8.2 Structural Damage

The blast overpressure at sufficiently high levels in the range of 133 dB and above may in itself cause structural damage to some building elements such as windows. However, this is well in excess of annoyance criteria.

For assessment of damage due to ground vibration, Australian Standard AS2187.2-1993 Explosives – Storage, Transport and Use contains an appendix specifying recommended levels for peak vibration velocity to protect typical buildings from damage. These are:

- Structures that may be particularly susceptible to ground vibration – 5mm/sec
- Houses and low rise residential buildings; commercial not included below –10mm/sec; and
- Commercial and industrial buildings or structures of reinforced concrete or steel construction – 25mm/sec.

Blast overpressure of 133 dB has been adopted as the project specific criterion for structural damage. For ground vibration, a PPV criterion of 10 mm/sec has been adopted for residential buildings.

A PPV of 25 mm/sec has been adopted as the project specific criterion for infrastructure, commercial and industrial buildings.

2.9 Road Traffic Noise Criteria

The RNP applies different noise limits dependent upon the road category and type of project or land use. Table 2.15 shows the applicable residential noise level criteria.

Table 2.15: ROAD TRAFFIC NOISE CRITERIA FOR RESIDENTIAL LAND USES

Road Category	Type of Project/Land Use	Assessment Criteria (dB)	
		Day (7am - 10pm)	Night (10pm – 7am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hour}$ 60 (external)	$L_{Aeq,9hour}$ 55 (external)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hour}$ 55 (external)	$L_{Aeq,1hour}$ 50 (external)

For residences where the existing traffic exceeds assessment criteria, the policy states that "for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

Proposed access to the quarry would be from Italia Road by a right of way over two property lots to the north. Italia Road has direct access to the Pacific Highway for both north and south bound travel.

Italia Road and the Pacific Highway trigger road traffic noise criteria for sub-arterial roads and freeways as defined in Table 2.15.

Receptors close to the right of way are commercial, which are generally used during weekends for motor sport activities. Traffic from the quarry is mainly during weekdays and, regardless, is not expected to exceed any amenity criterion as per the INP. Methodology

Noise levels were calculated using DataKustik CadnaA noise modelling software. The CONCAWE methodology was used to determine the acoustic impact of operational activities at selected receptor locations. Road traffic noise calculations were performed using the CoRTN methodology.

Model parameters are detailed in Section 3 of this report. Predicted levels are compared against project specific noise levels as detailed in Section 4 of this report.

3 NOISE MODEL PARAMETERS

3.1 Parameters

3.1.1 Topography

The proponent provided topographical data for the proposed quarry site and surrounding area. Topography representing each stage of quarrying (years 1 to 30) was not available. Landform contours for each stage were created using sequenced extraction area locations and proposed reduced levels (RL). Where applicable, a 5 metre high operating face was incorporated on the south side of extraction areas.

3.1.2 Atmospheric Conditions

Williamtown weather station meteorological data was obtained from the BOM for the entire year of 2011. Data analysis showed no prevailing meteorological condition as the majority of wind speeds recorded were in excess of 5 metres per second. Therefore, for the day and evening periods, noise modelling was carried out for neutral atmospheric conditions only.

Analysis of frequency occurrence of temperature inversions was not undertaken. Conservatively, atmospheric stability class F combined with calm wind conditions was modelled for morning shoulder operations, as this period is technically classified as the night period in accordance with the INP. No operations will occur during the night period outside of the morning shoulder period.

3.2 Scenarios

3.2.1 Construction Scenarios

Six construction activities are proposed. Each was modelled as a separate scenario, as these tasks will not be undertaken concurrently. Figure 3 illustrates equipment proposed for each activity. Locations of construction tasks are shown in Figure 5.

Each of the construction activities is described in the following points:

- Activity 1 represents clearing and stripping of the processing area, dam areas and internal haul roads. Equipment was modelled in worst case operating locations with respect to private receptors located south of the site, which is the dam area. The tub grinder was located as shown in Figure 8. Haul trucks were modelled as strings of points along the internal haul road from the dams to the tub grinder;
- Activity 2 represents construction of access roads and intersection upgrades. Two scenarios were assessed. The first considered all equipment operating at the closest point to R01. The second considered all equipment operating at the closest point to private receptors south of the site, which is close the site entrance;
- Activity 3 represents blast hole drilling, which may be required for dam construction. The drill was

modelled in a worst case operating location with respect to private receptors located south of the site, which is the southern corner of the dam area;

- Activity 4 represents construction of haul roads, culvert crossings and dams. Equipment was modelled in worst case operating locations with respect to private receptors located south of the site, which is the dam area;
- Activity 5 represents infrastructure installation. All equipment was modelled in a worst case operating location, on top of the dumping station pad at RL 54.5; and
- Activity 6 represents road sealing. Two scenarios were assessed. The first considered all equipment operating at the closest point to R01. The second considered all equipment operating at the closest point to private receptors south of the site, which is close the site entrance.

3.2.2 Operational Scenarios

Three primary operational scenarios were assessed covering the stages of the project with the greatest potential to cause impact. These are:

1. Year 1 – Commencement of project. Extraction occurs at high elevation in an exposed location on top of the ridge. To represent the worst-case scenario, extraction plant was modelled at natural surface level, with no operating face to provide shielding to the south. Once the initial strip is extracted, a minimum 5 metre high operating face will be provided, which will reduce levels relative to the initial scenario assessed;
2. Year 5 – Extraction is still at relatively high elevation on the ridge. A minimum 5 metre high operating face is provided to the south of the extraction area. The processing area is enlarged and two options for processing material are assessed, as described in Section 3.2.4; and
3. Year 30 – The final stage when extraction occurs at the closest point to receivers located south of the site. A minimum 5 metre high operating face is provided to the south of the extraction area. The topography of the area allows for the face to be retained until the boundary of the extraction area is reached.

Within each of the three primary scenarios, a series of secondary scenarios were assessed, considering the various models of operation proposed. Each mode of operation consists of various activities, some of which will operate concurrently depending on the mode of operation. Figure 5 illustrates equipment proposed for each activity, and lists activities included in each mode of operation.

Of the six modes shown in Figure 5, Mode 1, Mode 2 and Mode 6 were assessed. Modes 3, 4 and 5 were not assessed for the following reasons:

- Mode 3 consists of sales and maintenance; impact from this mode will be less than for Modes 1 and 2, which include significantly greater plant quantities.
- Mode 4 consists of sales, clearing and stripping; impact from this mode will be less than for Mode 1,

which includes both these activities as well as blast hole drilling.

- Mode 5 consists of site rehabilitation at completion of the project. Plant quantities for this mode are considered insignificant, and noise emission would be significantly less than extraction activities in the same areas.

Mode 1 consists of Activities 1, 2 and 5 (clearing/stripping, drilling and sales). A tub grinder will be used to mulch cleared vegetation for stockpiling and subsequent site rehabilitation. The proposed tub grinder location is shown in Figure 8. This mode is restricted to the day period.

Mode 2 consists of extraction, processing and sales. This mode of operation will be the most common. This mode is restricted to the day period.

Mode 6 consists of Activity 5 (sales), and is the only activity proposed for the evening and morning shoulder periods. Four sales trucks are proposed to operate within any 15 minute period. One truck was modelled in an exposed location in the processing area. Three trucks were distributed along the length of the site access road from the intersection with Italia Road to the site entrance. Mode 6 will be used for both the evening and morning shoulder periods.

For each stage (primary scenario), Activities 1, 2 and 3 were modelled in up to three different operating locations to ensure the worst-case location was considered. The highest prediction for each receptor resulting from the various operating locations was adopted. In all cases, articulated haul trucks were modelled as strings of points distributed along the length of the operating route.

Figures illustrating modelled equipment locations are provided in Appendix C.

3.2.3 Sleep Disturbance

Potential sleep disturbance impact is typically assessed for the INP defined night period, which is 10pm to 7am. Therefore, the morning shoulder period was assessed. Mode 6 (sales) is the only mode of operation proposed for this period. Maximum noise emission events would most likely be due to impacts caused by loader buckets impacting truck bodies, or product material impacting empty truck bodies.

Sleep disturbance impact was assessed using the operational noise model for Mode 6, with the addition of an L_{Amax} sound power representing an impact. The impact source was located at the loading point within the processing area. Each stage was assessed to include the modified landform and plant configuration over the life of the project.

3.2.4 Processing Plant

Processing of quarried material, including crushing, screening and stockpiling will occur in a designated processing area on the eastern side of the site, as shown in Figure 8.

Initially, the processing area will have limited space available for equipment. The initial quarry set up will utilise mobile diesel powered processing equipment, with a move towards permanent electric powered modular equipment at around Year 5 of the project. For the Year 5 scenario, both the initial mobile

equipment and ultimate electric equipment alternatives were assessed. Year 1 considers only mobile diesel equipment; Year 30 considers only electric powered equipment.

Figure 10 shows the configuration of the ultimate electric powered processing plant. Conservatively, sound power for diesel power equipment was used, although lower noise emission is expected to result from electric powered plant. Feed from the dumping station to the primary jaw crusher would be automated via a dump hopper bin and feeder.

Figure 12 shows the configuration of the initial diesel powered processing plant. Feed from the dumping station to the primary jaw crusher would be via an excavator manually transferring material.

3.2.5 Quarry Progression

Quarrying will advance generally in a north to south direction in 5 metre bench heights to ensure an operating face is maintained between the extraction area and receptors to the south.

Figure 8 illustrates the direction of face development. Figure 7 illustrates typical sections and how acoustic shielding will be maintained to the south.

Construction Activities

Activity 1

Clearing and Stripping
- Excavator (claw) in clearing area
- Articulated Trucks (2 of)
- Excavator (claw) at tub grinder
- Tub grinder

Activity 2 (Access and intersections roads)

Road Construction
- Dozer (D8 or similar) or 30T Excavator (as required)
- Grader
- Roller
- Water cart
- Material delivery trucks (gravel)

Activity 3 (Preparation for civil construction if required)

Drill and Blast
- Drill rig
- Blasting

Activity 4 (Haul roads, culvert crossing and dams)

Civil Construction
- Dozer (D8 or similar) or 30T Excavator (as required)
- Grader
- Roller
- Water cart (intermittent)
- Material delivery trucks x 2

Activity 5 (infrastructure construction)

Infrastructure Installation
- Excavator
- Mobile crane
- Concrete truck

Activity 6 (road sealing)

Road sealing
- Bitumen spray truck
- Roller
- Aggregate delivery truck
- Mobile crane
- Concrete truck

Phase	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
Activity 1	Yes					
Activity 2		Yes				
Activity 3			Yes			
Activity 4				Yes		
Activity 5					Yes	
Activity 6						Yes

Figure 4: Proposed Construction Activities

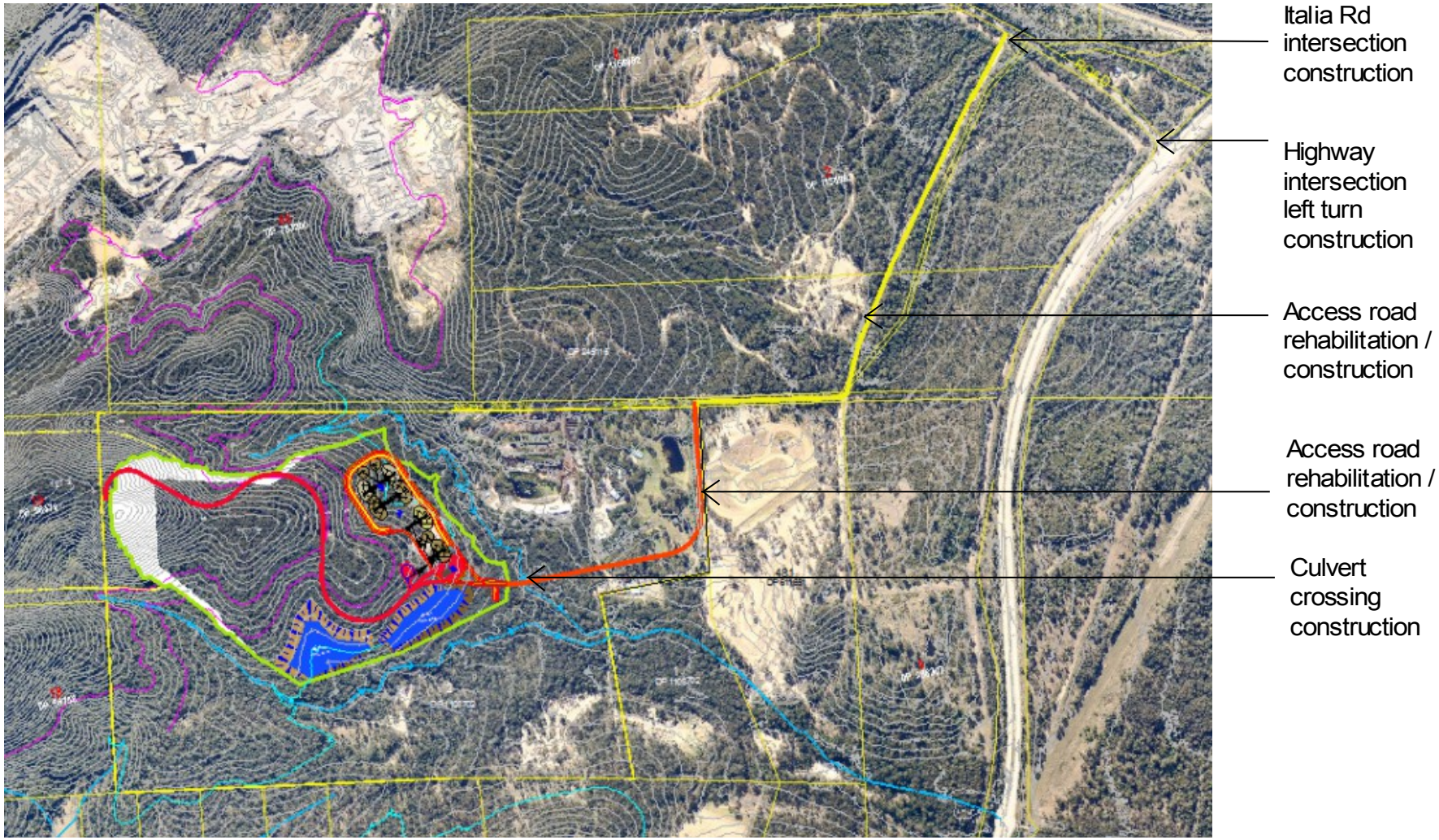


Figure 5: Proposed Access Route and Location of Construction Activities

Quarrying Activities

Activity 1 (progressive)

Clearing and Stripping
- Excavator (claw) in clearing area
- Articulated Trucks (2 of)
- Excavator (claw) at tub grinder
- Tub grinder

Activity 2 (progressive)

Drill and Blast
- Drill rig x 1
- Blasting

Activity 3 (Campaign to continuous)

Extraction
- 30T excavator at face loading dump trucks
- Articulated dump trucks x 2 haul from face to processing area
- Water cart to substitute with dump truck for short periods

Activity 4 (Campaign or continuous)

Processing
- 30t excavator feed
- Primary jaw crusher
- Screen
- Secondary Cone crusher
- Screen
- Secondary Cone crusher
- Tertiary VSI crusher
- Screen
- Screen
- Conveyors

Activity 5 (continuous)

Sales
- Cat 980 Sales loaders x 2
- Sales trucks x 4

Activity 6 (intermittent)

Maintenance / road building
- Water cart
- Grader
- Roller

Activity 7 (once off at quarry closure)

Rehabilitation (closure circa 2035 – 2040)
- Excavator (at mulch stockpile)
- Articulated Truck x 2
- Positrack or similar

Phase	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
Activity 1	Yes			Yes		
Activity 2	Yes					
Activity 3		Yes				
Activity 4		Yes				
Activity 5	Yes	Yes	Yes	Yes		Yes
Activity 6			Yes			
Activity 7					Yes	

Mode 5 will occur once at completion of project
Mode 6 is morning shoulder (5am to 7am) and evening (6pm to 10pm) operations

Figure 6: Proposed Quarrying Activities and Modes of Operation

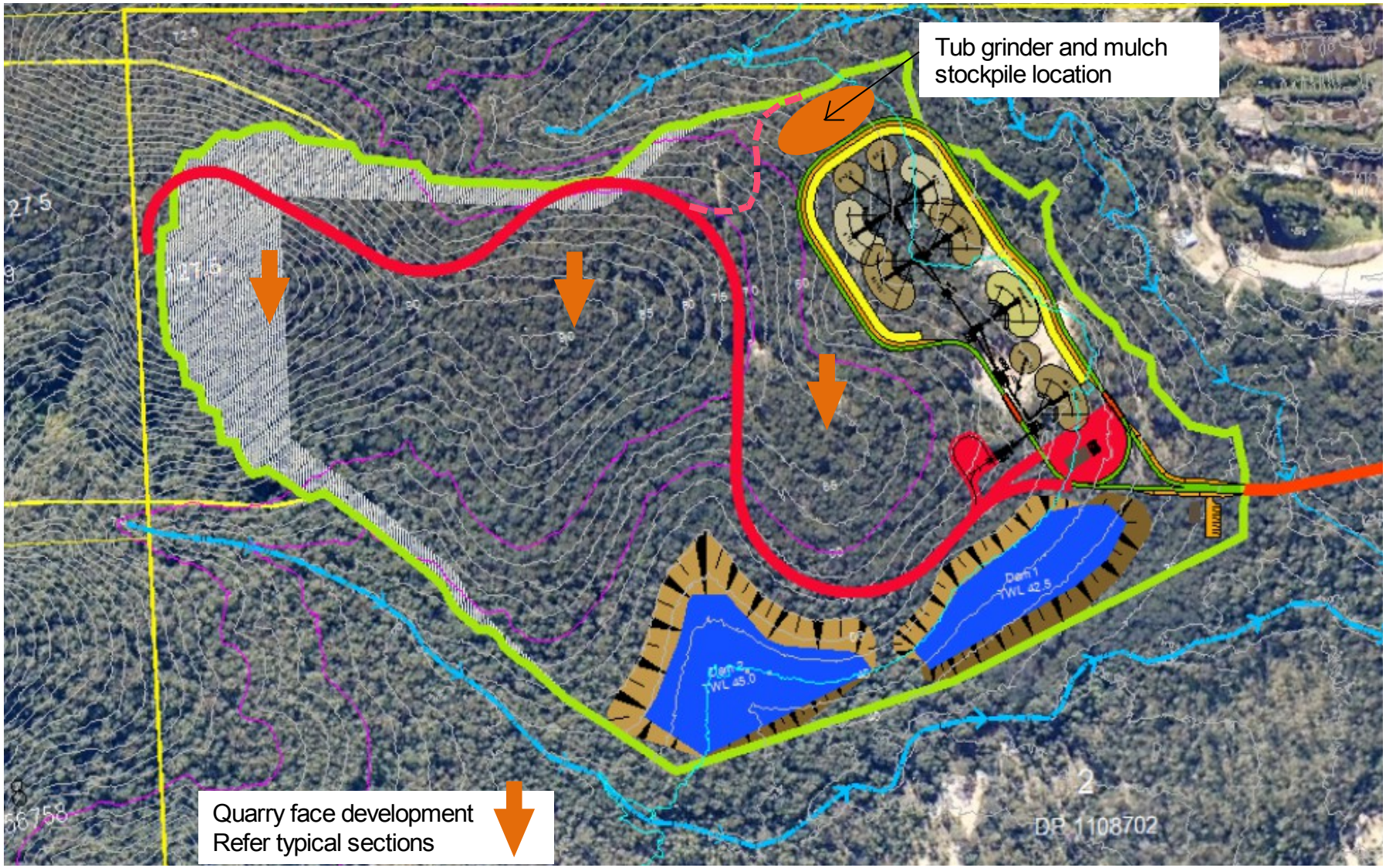
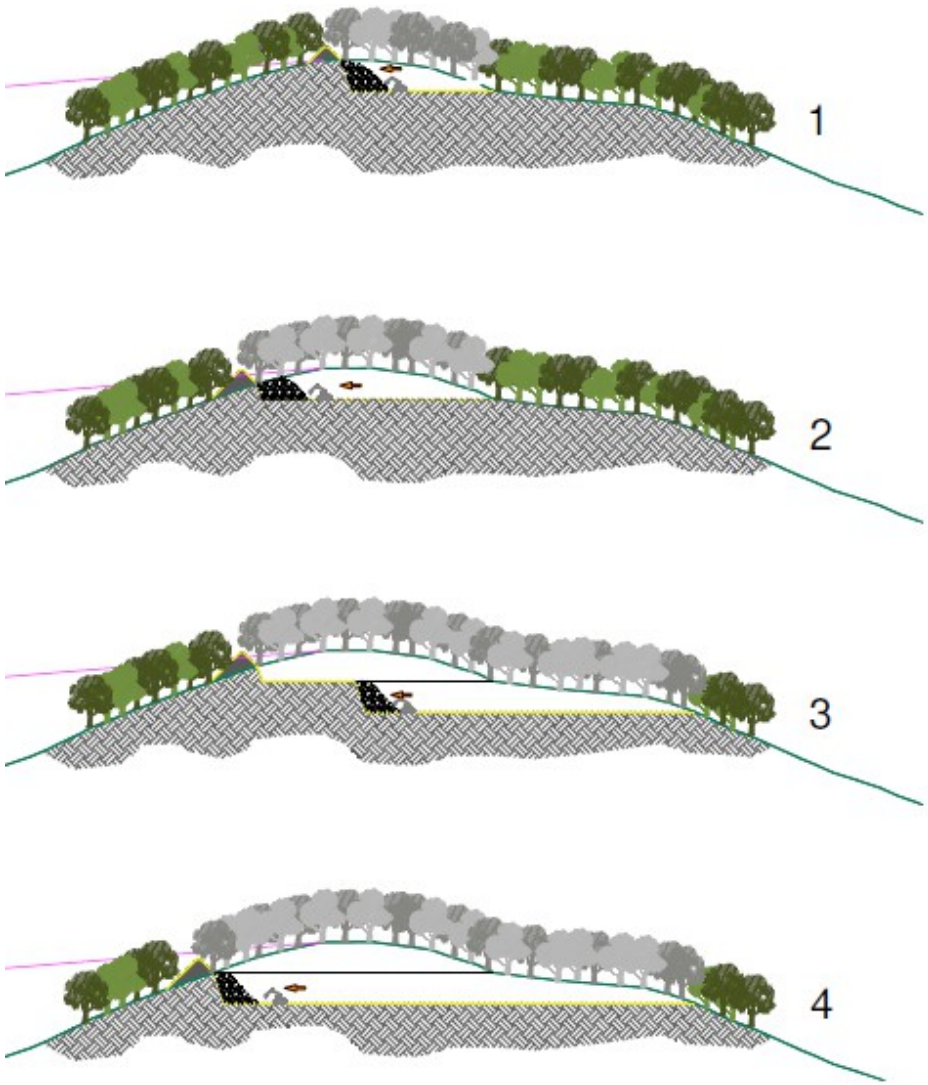
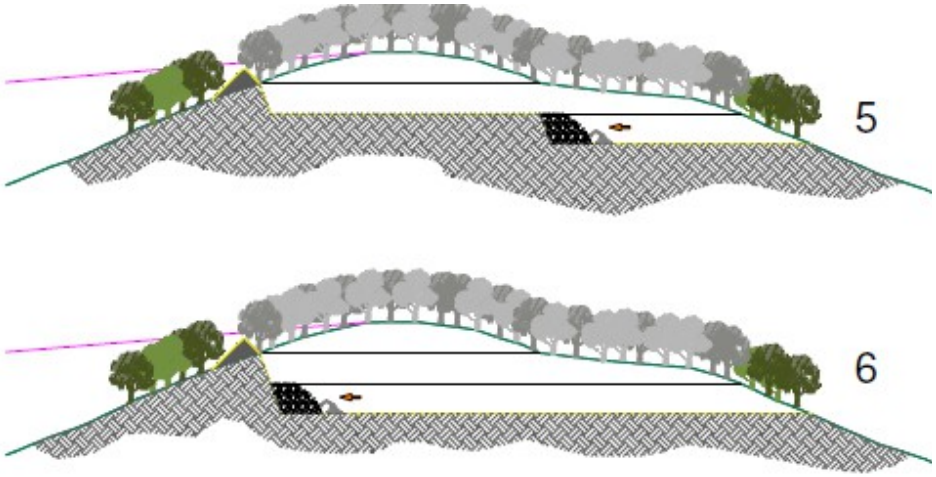


Figure 7: Site Layout and Face Development





Quarrying sequence from north to south direction in 5m bench heights, always maintaining face between receptors and extraction area.

Figure 8: Typical Sections

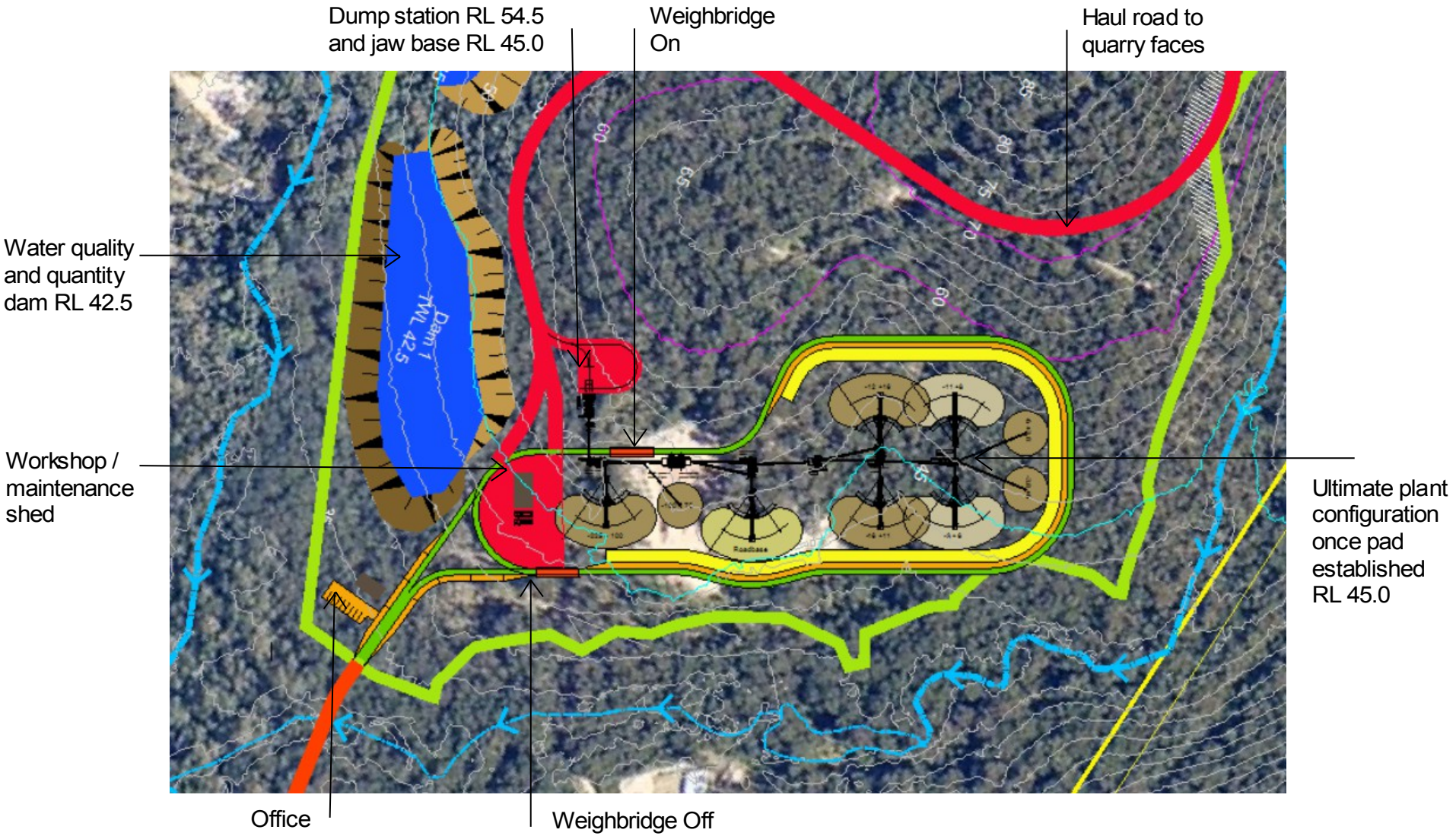


Figure 9: Processing Area, Dams, Roads and Dump Station

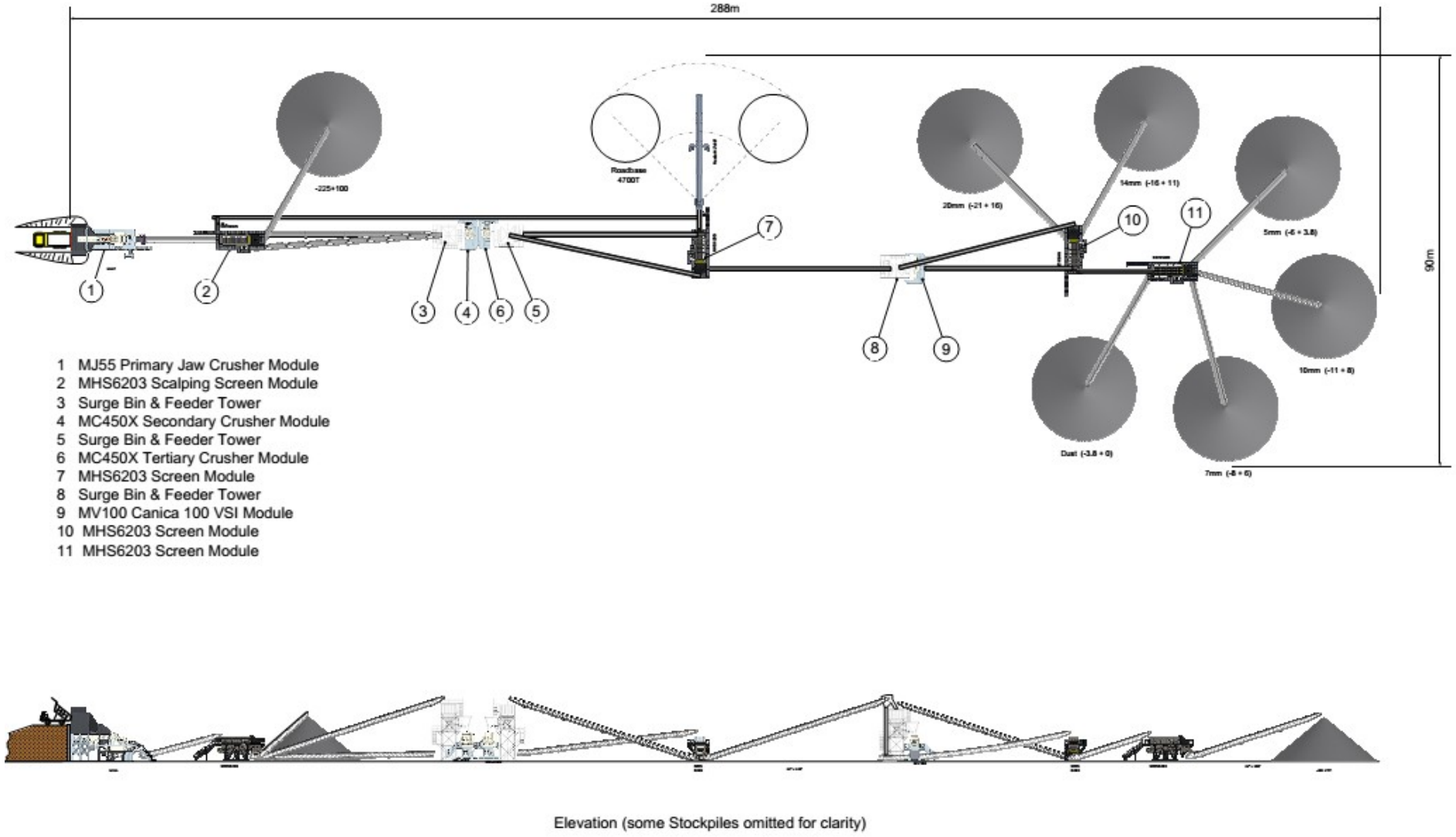


Figure 10: Processing Area, Ultimate Electric Configuration

Initial quarry setup with mobile diesel powered plant with move to progress and replace with same plant but electric powered modular as additional space becomes available at pad.

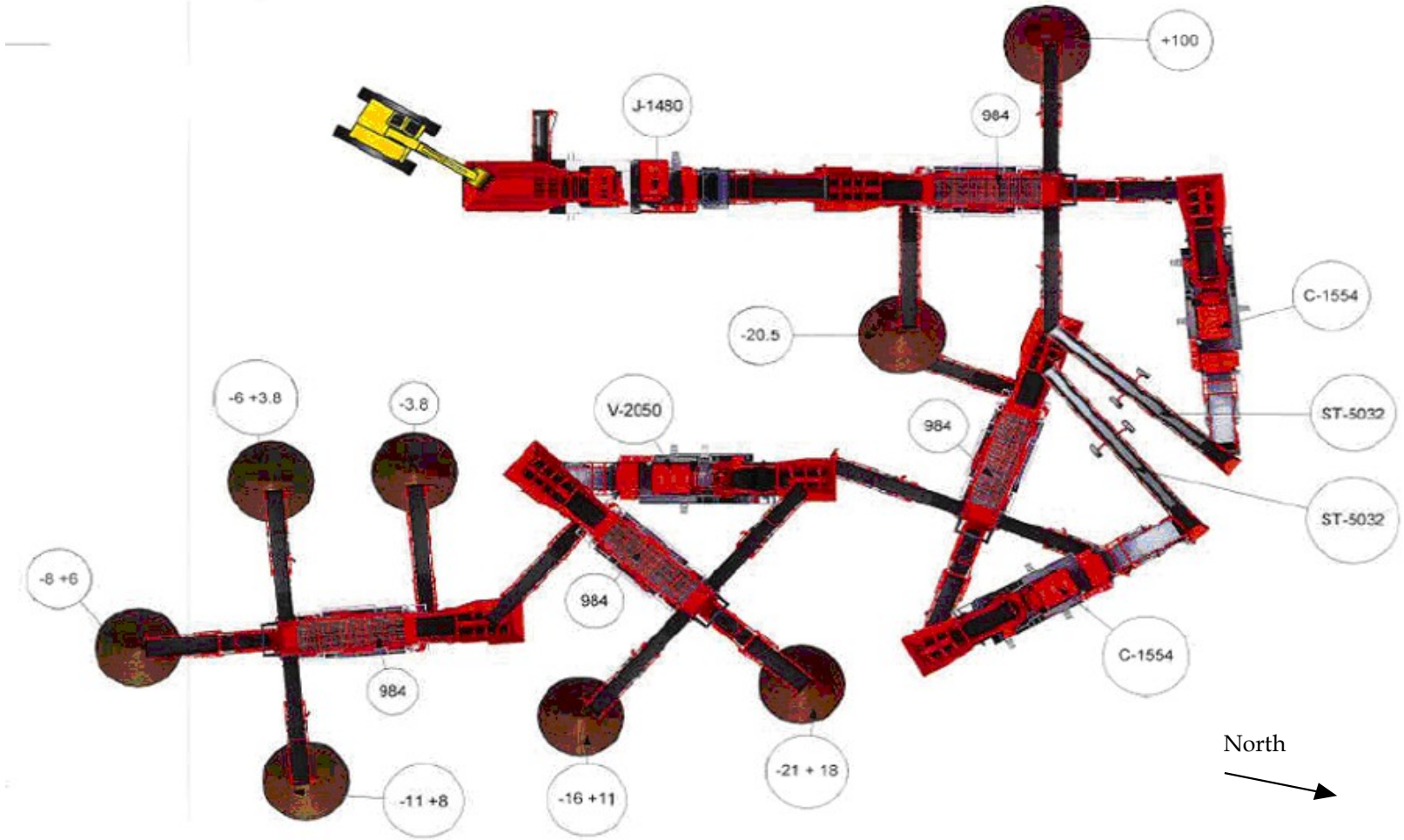


Figure 11: Processing Area, Initial Diesel Configuration

3.3 Equipment Sound Power

Typical sound power levels of proposed equipment were sourced from measurement of representative equipment performed by Global Acoustics on other projects. Sound power spectra and totals used in the noise models are shown in Table 3.1.

Articulated trucks as strings of points to distribute the acoustic energy over the length of the operating route.

Table 3.1: SOURCE 15 MINUTE SOUND POWER

	Octave Band Sound Power Spectrum, L_{eq} dB									
Item Description	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Total dB (Lin)**	**Total dB (A)**
Water Truck	107	101	99	103	100	95	87	78	**110**	**104**
Drill Rig	98	109	103	98	105	106	110	109	**116**	**115**
Articulated Truck	119	118	111	111	109	107	98	89	**123**	**114**
Tub Grinder	130	128	117	116	115	112	106	100	**133**	**120**
Excavator (30tonne)	105	115	107	102	103	99	91	85	**117**	**107**
Process Stockpile Loader	113	117	110	107	107	103	96	86	**120**	**111**
Jaw Crusher	112	119	115	115	115	113	107	98	**123**	**119**
Cone Crusher	110	117	113	113	113	111	105	96	**121**	**117**
Impactor VSI	110	117	113	113	113	111	105	96	**121**	**117**
Screens	113	106	108	108	107	107	107	101	**117**	**114**
Conveyor drive	105	106	106	104	103	98	91	82	**112**	**107**
Sales Loader	113	117	110	107	107	103	96	86	**120**	**111**
Scalper	113	106	108	109	107	107	107	101	**117**	**114**
Stacker	105	106	102	102	98	97	90	84	**111**	**104**
Surge Bin	110	107	98	97	97	98	91	79	**112**	**103**
Conveyor (per metre)	88	83	81	79	77	73	66	55	**90**	**82**
Road Trucks	102	99	96	94	95	94	88	86	**106**	**100**
Sales Loader	113	117	110	107	107	103	96	86	**120**	**111**
Dozer	109	118	119	113	109	105	99	90	**123**	**116**
Grader	101	112	105	105	102	100	96	87	**114**	**108**
Roller	105	109	108	106	107	100	93	91	**114**	**110**
Mobile Crane	112	108	100	98	93	91	92	82	**114**	**101**
Bitumen Truck	111	109	102	101	105	99	96	92	**115**	**108**
Concrete Truck	107	101	99	103	100	95	87	78	**110**	**104**
Impact L_{Amax}	128	123	121	120	120	119	116	110	**131**	**125**

3.4 Noise Control

The following noise controls were developed and incorporated into the modelling assessment:

1. For all stages other than initial establishment in Year 1, a minimum 5 metre high face will be maintained between extraction areas and private receptors located south of the site. Extraction equipment will operate as close to the face as practically possible;

2. Acoustic barriers will be constructed adjacent nominated processing plant items. Barriers are to be of minimum height 4.8 metres, be of impervious construction (except for minimal openings required for conveyor pass though), and have minimum density of 20 kg/m2. Barriers will be constructed within 2 metres of plant items.

3. For the initial diesel powered plant configuration (refer Figure 12), the following barriers are required:

    a. The west side of the Jaw Crusher (J-1480), minimum length 12 metres. Barrier to extent as far south as practical without impeding the excavator;

    b. The south side of the Northern Cone Crusher (C-1554), minimum length 18 metres;

    c. The south-west side of the North-eastern Cone Crusher (C-1554), minimum length 12 metres; and

    d. The west and south sides of the VSI Crusher (V-2050), an 'L' shaped barrier, 18 x 6 metres with long leg oriented north/south.

4. For the ultimate electric powered plant configuration (refer Figure 10), the following barriers are required:

    a. The south side of the Jaw Crusher, minimum length 12 metres; and

    b. The western side of the Secondary and Tertiary Crushers (entire length of feed tower structures, with 5 metre extension to south).

Figure 12 and Figure 14 show the approximate locations of the barriers for the initial and ultimate plant configurations respectively.

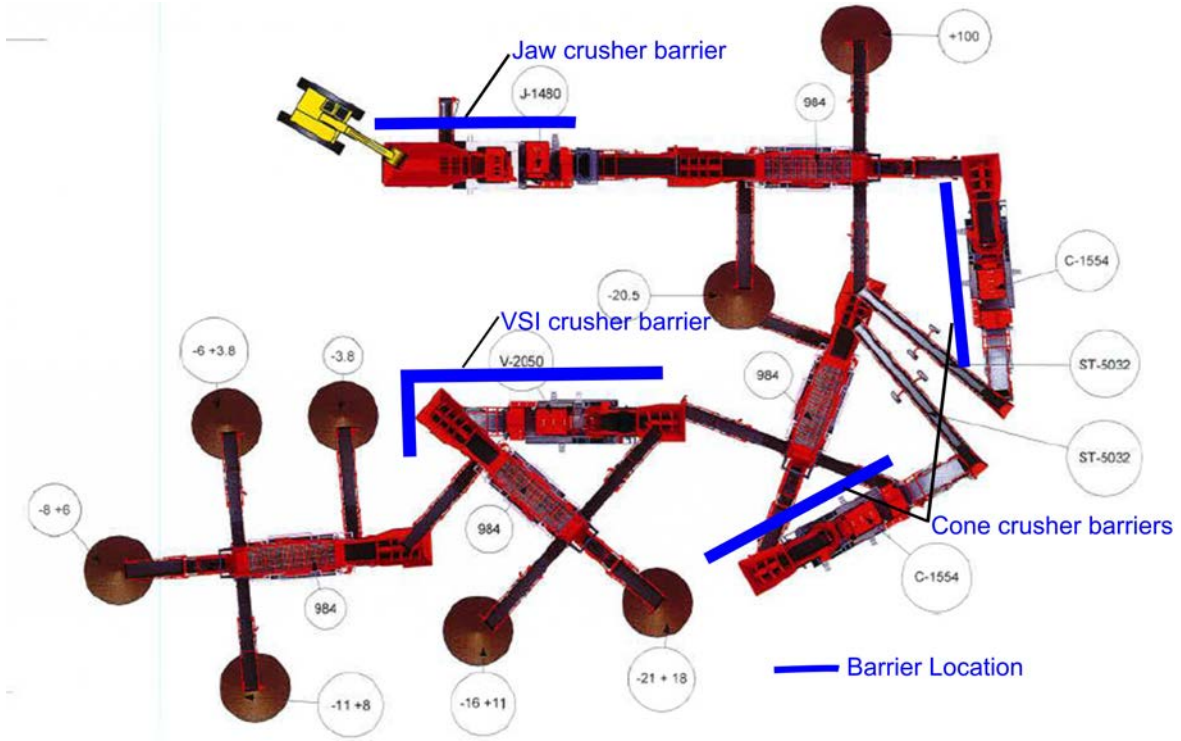


Figure 12: Proposed noise barrier locations, initial configuration

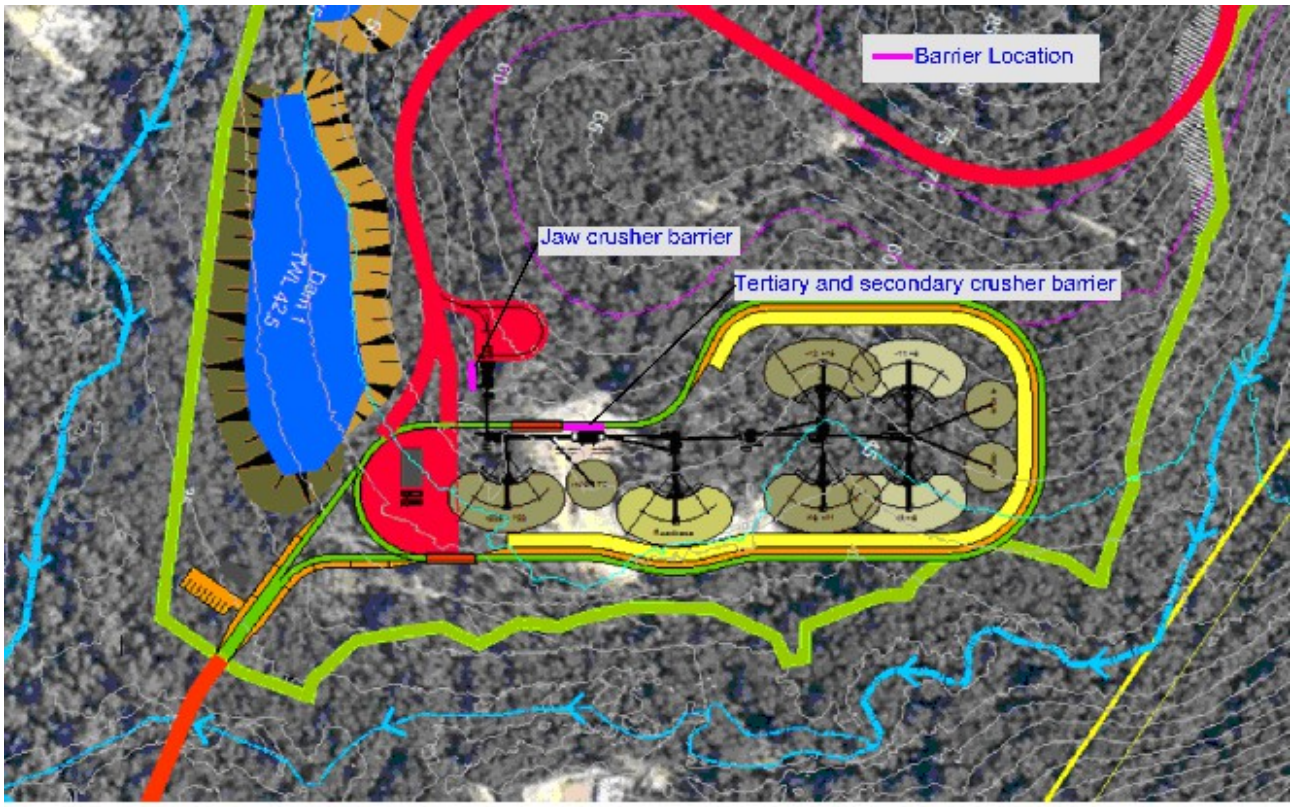


Figure 13: Proposed noise barrier locations, ultimate configuration

4 RESULTS

4.1 Construction Noise Assessment

Table 4.1 summarises predicted construction noise levels at receiver locations for the six construction activities proposed. Predicted results are compared to construction noise criteria.

No exceedance of construction noise criteria is predicted for any construction task, with the exception of the managers residence for the landscape supply operation (R23). It is understood the proponent intends to negotiate a private agreement with the owner of this property.

Table 4.1: CONSTRUCTION NOISE PREDICTIONS – $L_{Aeq,15minute}$ dB

Receiver ID	Criterion	Predictions						Exceedances					
		Mode1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
1	54	35	50	17	28	21	23	Nil	Nil	Nil	Nil	Nil	Nil
2	54	36	33	23	33	24	27	Nil	Nil	Nil	Nil	Nil	Nil
3	54	37	34	24	34	25	28	Nil	Nil	Nil	Nil	Nil	Nil
4	54	36	33	20	32	24	27	Nil	Nil	Nil	Nil	Nil	Nil
5	46	38	35	18	31	27	28	Nil	Nil	Nil	Nil	Nil	Nil
6	46	40	35	29	38	28	28	Nil	Nil	Nil	Nil	Nil	Nil
7	46	41	35	29	38	28	24	Nil	Nil	Nil	Nil	Nil	Nil
8	46	40	35	30	39	29	25	Nil	Nil	Nil	Nil	Nil	Nil
9	46	38	34	27	37	28	22	Nil	Nil	Nil	Nil	Nil	Nil
10	46	39	33	26	36	27	24	Nil	Nil	Nil	Nil	Nil	Nil
11	46	37	31	24	34	25	19	Nil	Nil	Nil	Nil	Nil	Nil
12	46	35	29	21	32	23	18	Nil	Nil	Nil	Nil	Nil	Nil
13	46	37	32	26	35	26	24	Nil	Nil	Nil	Nil	Nil	Nil
14	46	35	30	23	33	24	22	Nil	Nil	Nil	Nil	Nil	Nil
15	46	35	29	21	32	23	23	Nil	Nil	Nil	Nil	Nil	Nil
16	46	35	29	21	31	22	23	Nil	Nil	Nil	Nil	Nil	Nil
17	46	34	28	20	31	22	22	Nil	Nil	Nil	Nil	Nil	Nil

Receiver ID	Criterion	Predictions						Exceedances					
		Mode1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
18	46	29	28	19	30	19	15	Nil	Nil	Nil	Nil	Nil	Nil
19	46	29	27	18	30	18	14	Nil	Nil	Nil	Nil	Nil	Nil
20	46	29	27	18	30	18	14	Nil	Nil	Nil	Nil	Nil	Nil
21	46	26	24	12	25	11	16	Nil	Nil	Nil	Nil	Nil	Nil
22	46	22	23	-2	13	5	14	Nil	Nil	Nil	Nil	Nil	Nil
23	46	48	51	41	47	40	45	2	5	Nil	1	Nil	Nil
A	65	37	46	18	30	26	25	Nil	Nil	Nil	Nil	Nil	Nil
B	65	44	40	27	36	30	33	Nil	Nil	Nil	Nil	Nil	Nil
D	65	46	43	33	40	33	36	Nil	Nil	Nil	Nil	Nil	Nil
E	70	38	35	15	28	25	25	Nil	Nil	Nil	Nil	Nil	Nil

4.2 Operational Noise Assessment

Table 4.2 to Table 4.5 summarise predicted noise levels at receiver locations for Year 1, Year 5 (initial processing plant configuration), Year 5 (final processing plant configuration) and Year 30 respectively. Predicted results are compared to project specific noise levels and cumulative noise criteria.

No exceedance of either project specific noise levels or cumulative noise criteria is predicted for any stage with noise controls described in Section 3.4 implemented. The exception is the managers residence for the landscape supply operation (R23). It is understood the proponent intends to negotiate a private agreement with the owner of this property.

Table 4.2: PREDICTED NOISE LEVELS AT RECEIVERS – YEAR 1 (INITIAL PROCESSING PLANT CONFIGURATION) – $L_{Aeq,15minute}$ dB

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
1	43/52	49/55	48/50	34	35	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
2	43/52	49/55	48/50	32	36	38	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
3	43/52	49/55	48/50	35	37	39	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
4	43/52	49/55	48/50	34	36	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
5	39/42	41/47	39/42	35	38	39	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
6	39/42	41/47	39/42	35	40	39	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
7	39/42	41/47	39/42	37	41	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
8	39/42	41/47	39/42	35	40	40	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
9	39/42	41/47	39/42	33	38	38	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
10	39/42	41/47	39/42	35	39	39	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
11	39/42	41/47	39/42	32	37	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
12	39/42	41/47	39/42	31	35	34	26	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
13	39/42	41/47	39/42	34	38	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
14	39/42	41/47	39/42	32	36	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
15	39/42	41/47	39/42	32	36	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
16	39/42	41/47	39/42	32	35	35	26	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
17	39/42	41/47	39/42	31	35	34	25	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
18	39/42	41/47	39/42	23	29	29	18	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
19	39/42	41/47	39/42	22	29	28	17	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
20	39/42	41/47	39/42	22	29	28	17	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
21	39/42	41/47	39/42	15	26	24	10	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
22	39/42	41/47	39/42	14	26	27	8	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
23	39/42	41/47	39/42	48	50	53	44	9/Nil	8/3	12/6	5/2
A	65/57	65/57	65/57	36	38	40	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
B	65/57	65/57	65/57	42	44	47	38	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
D	65/57	65/57	65/57	43	45	49	38	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
E	70/62	70/62	70/62	35	38	40	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Table 4.3: PREDICTED NOISE LEVELS AT RECEIVERS – YEAR 5 (INITIAL PROCESSING PLANT CONFIGURATION) – $L_{Aeq,15minute}$ dB

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
1	43/52	49/55	48/50	34	36	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
2	43/52	49/55	48/50	34	36	39	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
3	43/52	49/55	48/50	35	37	40	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
4	43/52	49/55	48/50	34	36	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
5	39/42	41/47	39/42	35	38	39	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
6	39/42	41/47	39/42	37	39	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
7	39/42	41/47	39/42	37	41	41	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
8	39/42	41/47	39/42	37	41	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
9	39/42	41/47	39/42	35	40	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
10	39/42	41/47	39/42	35	40	39	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
11	39/42	41/47	39/42	33	37	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
12	39/42	41/47	39/42	32	36	34	26	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
13	39/42	41/47	39/42	34	39	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
14	39/42	41/47	39/42	32	36	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
15	39/42	41/47	39/42	32	36	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
16	39/42	41/47	39/42	32	36	35	26	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
17	39/42	41/47	39/42	31	35	34	25	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
18	39/42	41/47	39/42	23	30	28	18	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
19	39/42	41/47	39/42	22	30	28	17	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
20	39/42	41/47	39/42	22	29	28	17	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
21	39/42	41/47	39/42	15	27	22	9	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
22	39/42	41/47	39/42	18	25	26	13	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
23	39/42	41/47	39/42	48	49	54	44	9/6	8/2	13/7	5/2
A	65/57	65/57	65/57	36	38	40	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
B	65/57	65/57	65/57	42	44	47	38	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
D	65/57	65/57	65/57	44	45	49	39	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
E	70/62	70/62	70/62	35	38	40	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Table 4.4: PREDICTED NOISE LEVELS AT RECEIVERS – YEAR 5 (FINAL PROCESSING PLANT CONFIGURATION) – $L_{Aeq,15minute}$ dB

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
1	43/52	49/55	48/50	35	36	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
2	43/52	49/55	48/50	35	37	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
3	43/52	49/55	48/50	36	38	39	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
4	43/52	49/55	48/50	35	36	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
5	39/42	41/47	39/42	37	38	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
6	39/42	41/47	39/42	38	40	40	33	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
7	39/42	41/47	39/42	38	41	41	33	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
8	39/42	41/47	39/42	38	41	40	33	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
9	39/42	41/47	39/42	36	40	38	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
10	39/42	41/47	39/42	36	39	39	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
11	39/42	41/47	39/42	33	37	35	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
12	39/42	41/47	39/42	33	36	34	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
13	39/42	41/47	39/42	36	39	38	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
14	39/42	41/47	39/42	34	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
15	39/42	41/47	39/42	34	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
16	39/42	41/47	39/42	33	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
17	39/42	41/47	39/42	33	36	35	27	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
18	39/42	41/47	39/42	26	31	29	21	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
19	39/42	41/47	39/42	26	30	28	20	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
20	39/42	41/47	39/42	26	30	28	20	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
21	39/42	41/47	39/42	18	27	23	13	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
22	39/42	41/47	39/42	28	26	25	22	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
23	39/42	41/47	39/42	49	50	54	45	10/7	9/3	13/7	6/3
A	65/57	65/57	65/57	37	38	41	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
B	65/57	65/57	65/57	43	44	47	39	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
D	65/57	65/57	65/57	45	46	50	40	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
E	70/62	70/62	70/62	35	38	40	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Table 4.5: PREDICTED NOISE LEVELS AT RECEIVERS – YEAR 30 (FINAL PROCESSING PLANT CONFIGURATION) – $L_{Aeq,15minute}$ dB

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
1	43/52	49/55	48/50	35	36	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
2	43/52	49/55	48/50	35	36	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
3	43/52	49/55	48/50	36	37	39	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
4	43/52	49/55	48/50	35	36	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
5	39/42	41/47	39/42	37	38	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
6	39/42	41/47	39/42	38	40	41	33	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
7	39/42	41/47	39/42	38	41	41	33	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
8	39/42	41/47	39/42	39	41	41	34	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
9	39/42	41/47	39/42	37	40	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
10	39/42	41/47	39/42	37	40	40	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
11	39/42	41/47	39/42	35	38	38	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
12	39/42	41/47	39/42	34	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
13	39/42	41/47	39/42	37	40	39	31	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
14	39/42	41/47	39/42	35	37	37	29	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
15	39/42	41/47	39/42	34	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
16	39/42	41/47	39/42	33	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
17	39/42	41/47	39/42	33	36	36	28	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
18	39/42	41/47	39/42	30	31	33	25	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
19	39/42	41/47	39/42	30	30	32	24	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

Receiver ID	Criteria (Impact Assessment / Cumulative)			Predictions				Exceedances (Impact Assessment/Cumulative)			
	Morning Shoulder	Day	Evening	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6	Morning Shoulder Mode 6	Day Mode 1	Day Mode 2	Evening Mode 6
20	39/42	41/47	39/42	30	30	32	24	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
21	39/42	41/47	39/42	28	28	29	22	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
22	39/42	41/47	39/42	29	26	30	23	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
23	39/42	41/47	39/42	48	49	53	44	9/6	8/2	12/6	5/2
A	65/57	65/57	65/57	37	37	41	32	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
B	65/57	65/57	65/57	43	44	47	39	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
D	65/57	65/57	65/57	43	45	48	38	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil
E	70/62	70/62	70/62	35	38	40	30	Nil/Nil	Nil/Nil	Nil/Nil	Nil/Nil

4.3 Sleep Disturbance

Table 4.6 presents sleep disturbance predictions. Results apply to the morning shoulder period, and include assessment of meteorological enhancement due to temperature inversion effects. For Year 5, the highest result of the initial and final processing plant configurations was adopted for each receiver. No exceedances of sleep disturbance criteria are predicted, with the exception of R23.

Table 4.6: SLEEP DISTURBANCE PREDICTIONS – $L_{A1,1minute}$ dB

Receiver ID	Criterion	Predictions			Exceedances		
		Year 1	Year 5	Year 30	Year 1	Year 5	Year 30
1	46	42	42	42	Nil	Nil	Nil
2	46	44	44	44	Nil	Nil	Nil
3	46	45	45	45	Nil	Nil	Nil
4	46	44	44	44	Nil	Nil	Nil
5	49	45	46	46	Nil	Nil	Nil
6	49	44	48	47	Nil	Nil	Nil
7	49	48	48	48	Nil	Nil	Nil
8	49	45	48	48	Nil	Nil	Nil
9	49	43	47	47	Nil	Nil	Nil
10	49	46	46	46	Nil	Nil	Nil
11	49	43	44	44	Nil	Nil	Nil
12	49	42	42	42	Nil	Nil	Nil
13	49	45	45	45	Nil	Nil	Nil
14	49	43	43	43	Nil	Nil	Nil
15	49	42	42	42	Nil	Nil	Nil
16	49	42	42	42	Nil	Nil	Nil
17	49	41	42	42	Nil	Nil	Nil
18	49	32	35	35	Nil	Nil	Nil
19	49	31	34	34	Nil	Nil	Nil
20	49	31	34	34	Nil	Nil	Nil
21	49	23	24	35	Nil	Nil	Nil
22	49	22	36	36	Nil	Nil	Nil
23	49	58	58	57	9	9	8
A	NA	45	45	45	NA	NA	NA
B	NA	51	51	51	NA	NA	NA

Receiver ID	Criterion	Predictions			Exceedances		
		Year 1	Year 5	Year 30	Year 1	Year 5	Year 30
D	NA	52	54	51	NA	NA	NA
E	NA	44	44	44	NA	NA	NA

Notes:

1. *Sleep disturbance criteria as not applicable for commercial receivers.*

4.4 Vacant Land Assessment

$L_{Aeq,15minute}$ noise contours were generated using CadnaA modelling software for the worst case operational stage (Year 30), for each operating configuration. It is noted that amenity criteria in Table 2.1 of the INP are expressed in terms of $L_{Aeq,period}$; that is, noise levels are averaged over the full duration of the relevant time period (day, evening or night). $L_{Aeq,period}$ from extractive industries are typically 2 to 3 dB lower than $L_{Aeq,15minute}$. Therefore, noise contours generated for this assessment are considered conservative.

Figure 14 to Figure 17 present indicative noise contour figures for each of the Year 30 day period operating configurations. Privately owned lot boundaries are shown as blue lines. The orange contour line represents the $L_{Aeq,15minute}$ 55 dB contour, which is the relevant day period criterion for assessment of vacant land for rural areas in accordance with the VLAMP.

Figure 18 presents an indicative noise contour figure for the Year 30 evening period operating configuration. Privately owned lot boundaries are shown as blue lines. The blue contour line represents the $L_{Aeq,15minute}$ 50 dB contour, which is the relevant evening period criterion for assessment of vacant land for rural areas in accordance with the VLAMP.

Figure 19 presents an indicative noise contour figure for the Year 30 morning shoulder period operating configuration. Privately owned lot boundaries are shown as blue lines. The blue contour line represents the $L_{Aeq,15minute}$ 50 dB contour, which is the adopted morning shoulder period criterion for assessment of vacant land for rural areas in accordance with the VLAMP.

The relevant criterion contour does not cross any private lot boundary for any scenario. Therefore, predictions do not exceed relevant VLAMP criteria over more than 25% of the area of any privately owned land (with or without a dwelling). Voluntary land acquisition rights are not deemed applicable on the basis of assessment of vacant land.

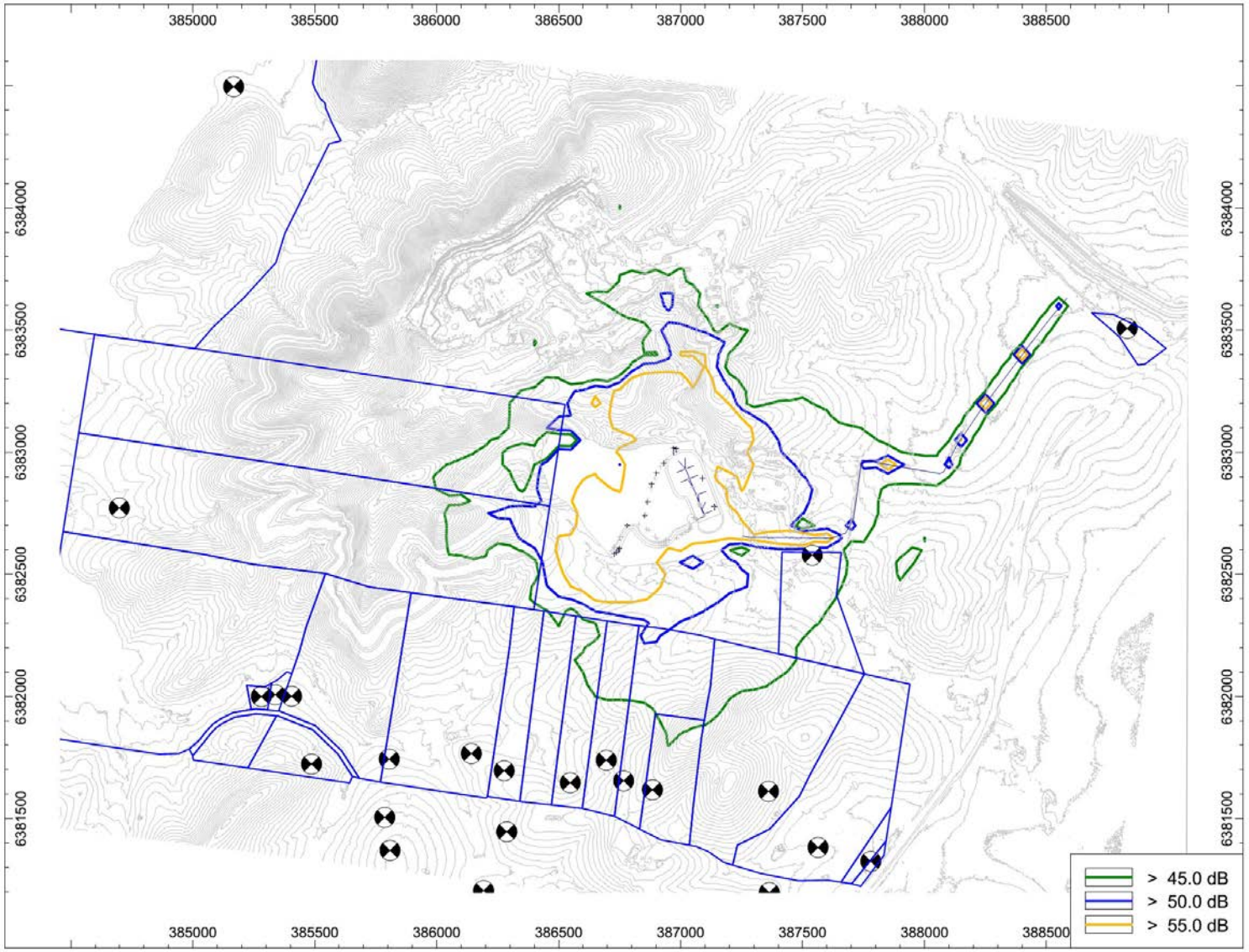


Figure 14: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 1A

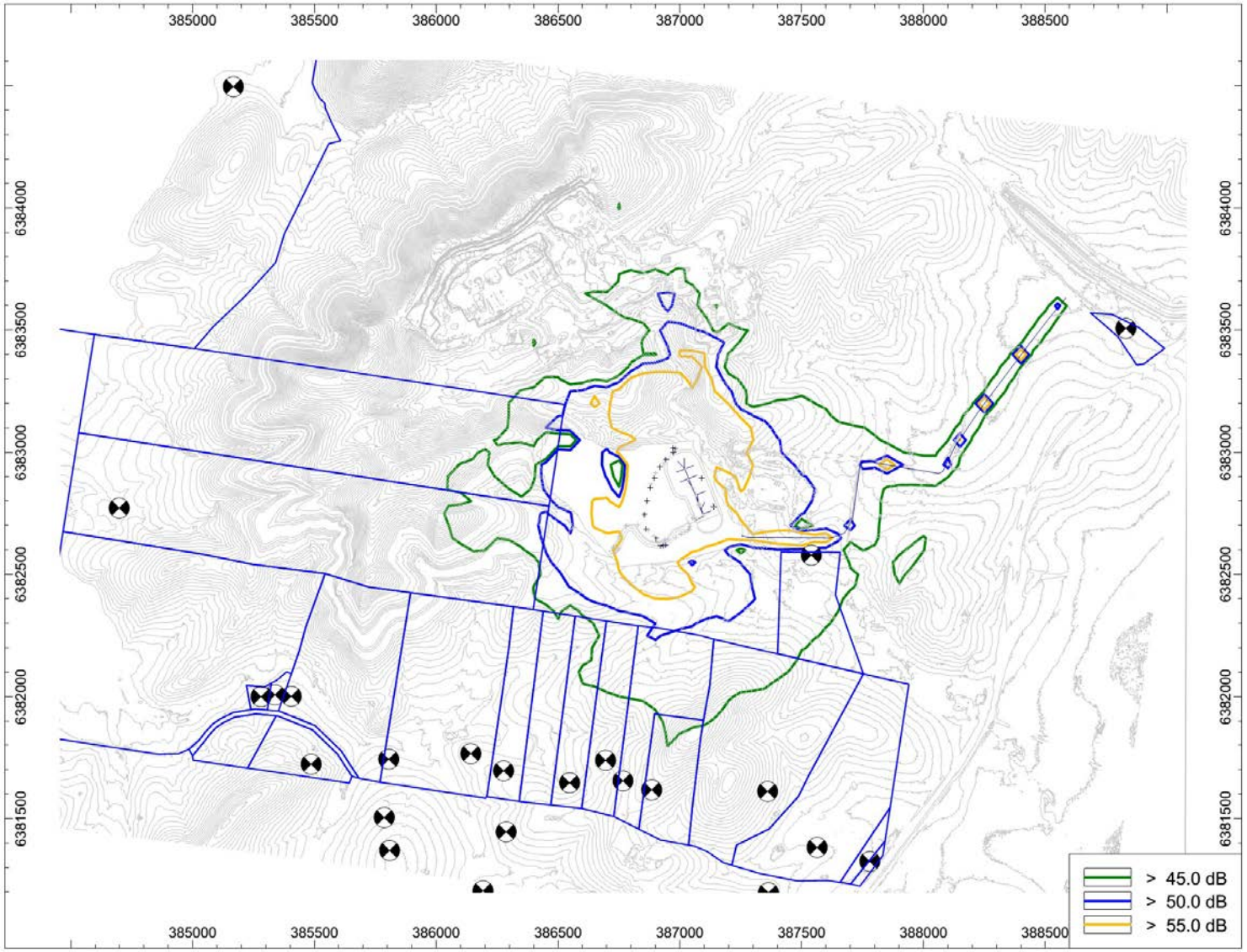


Figure 15: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 1B

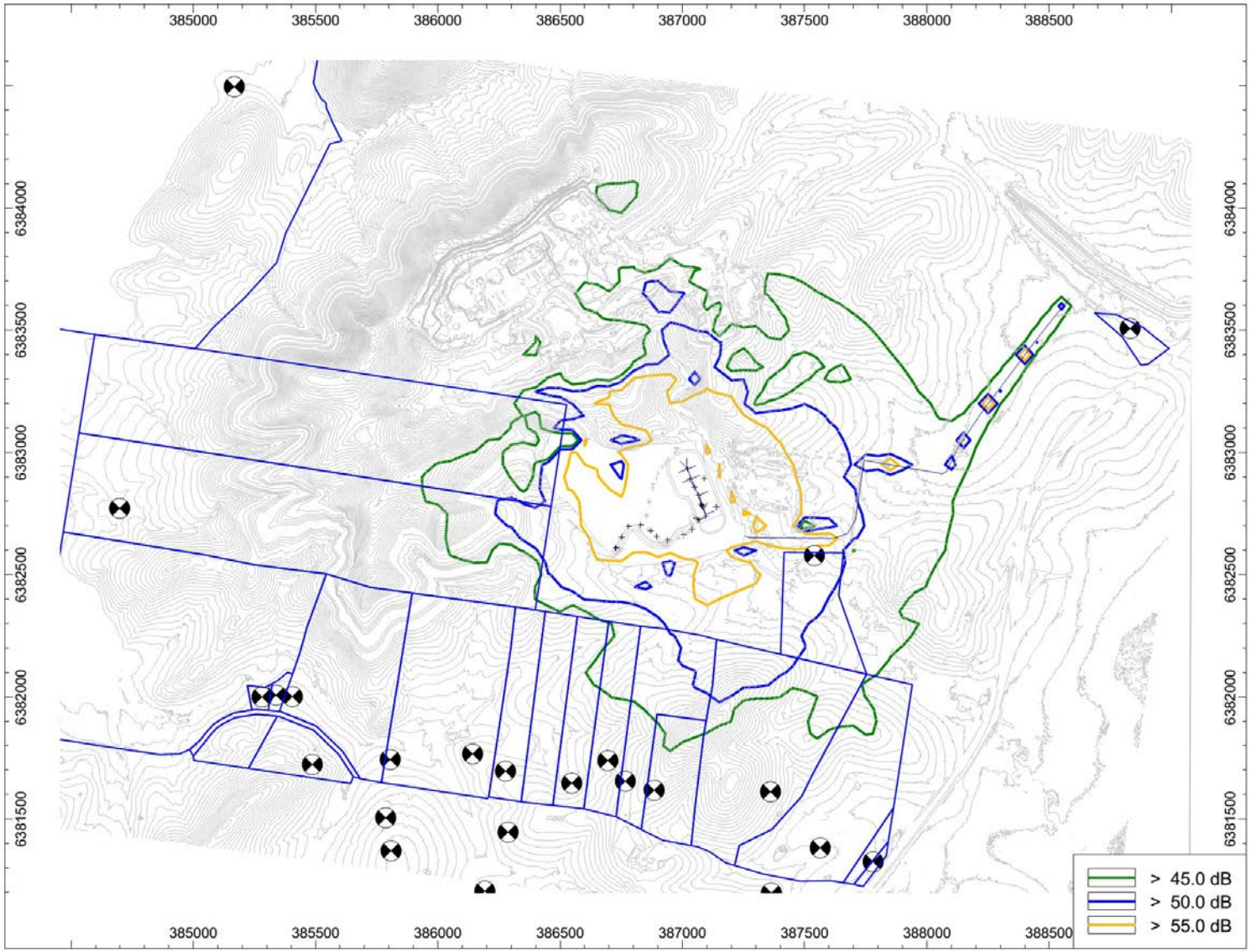


Figure 16: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 2A

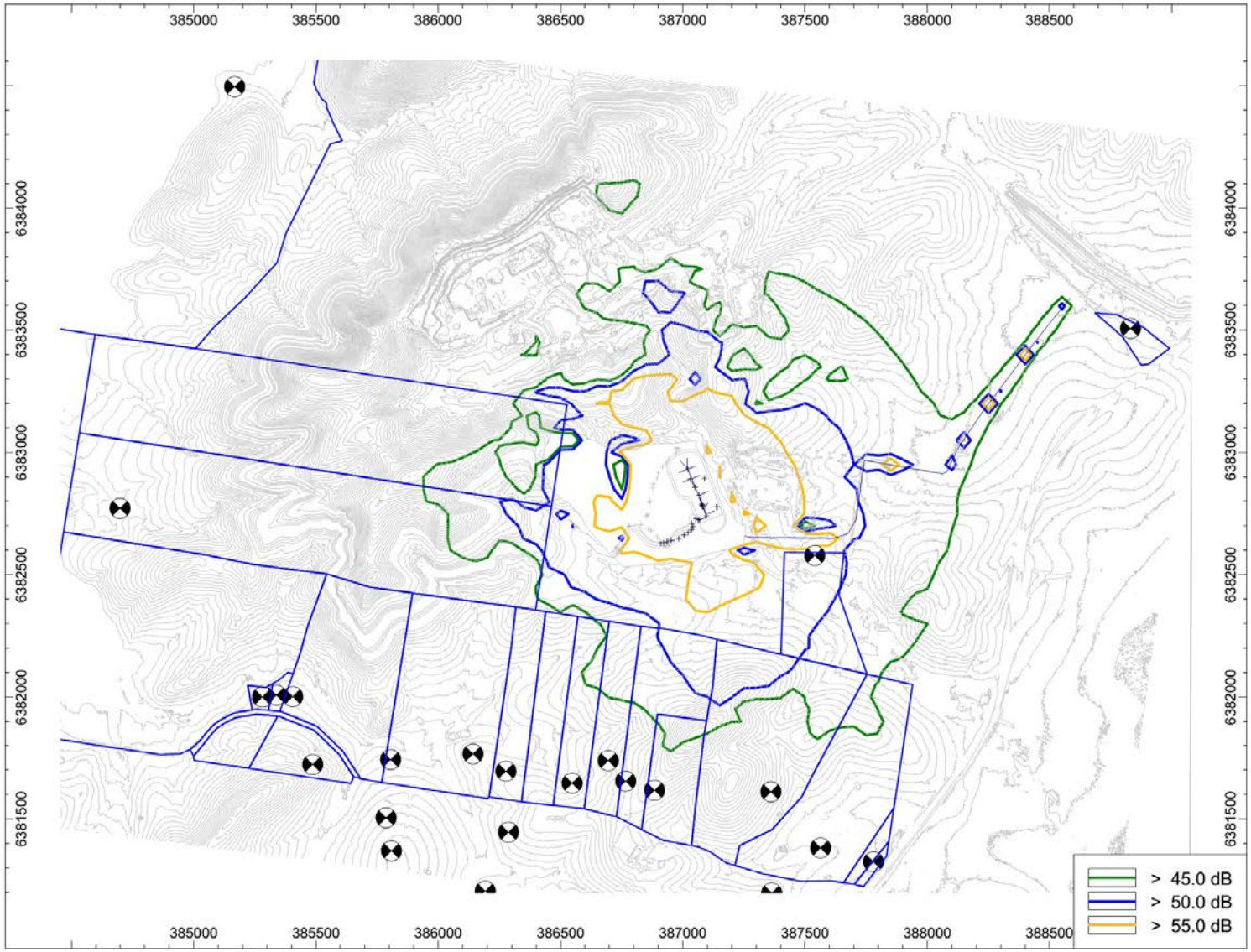


Figure 17: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 2B

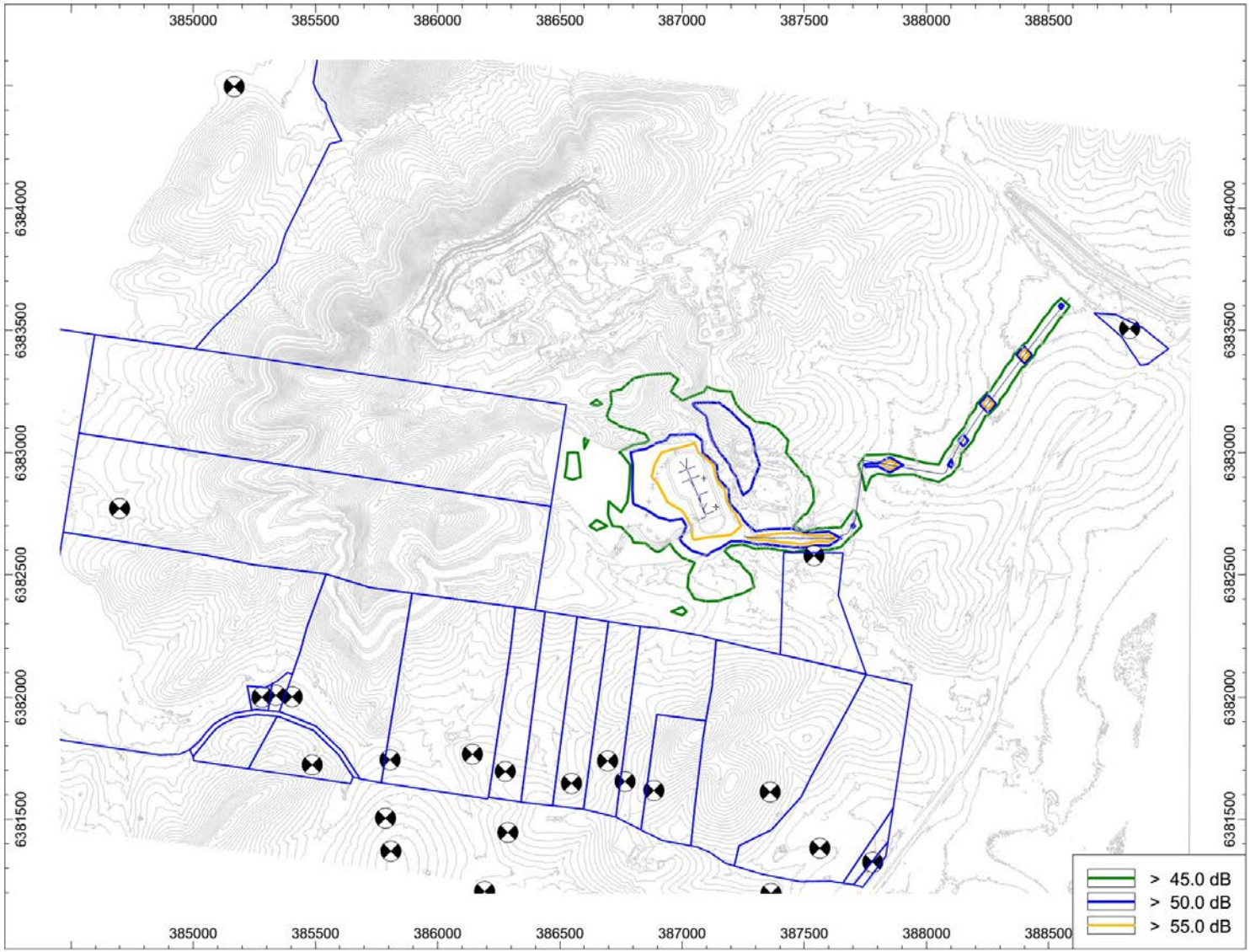


Figure 18: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 6 (evening)

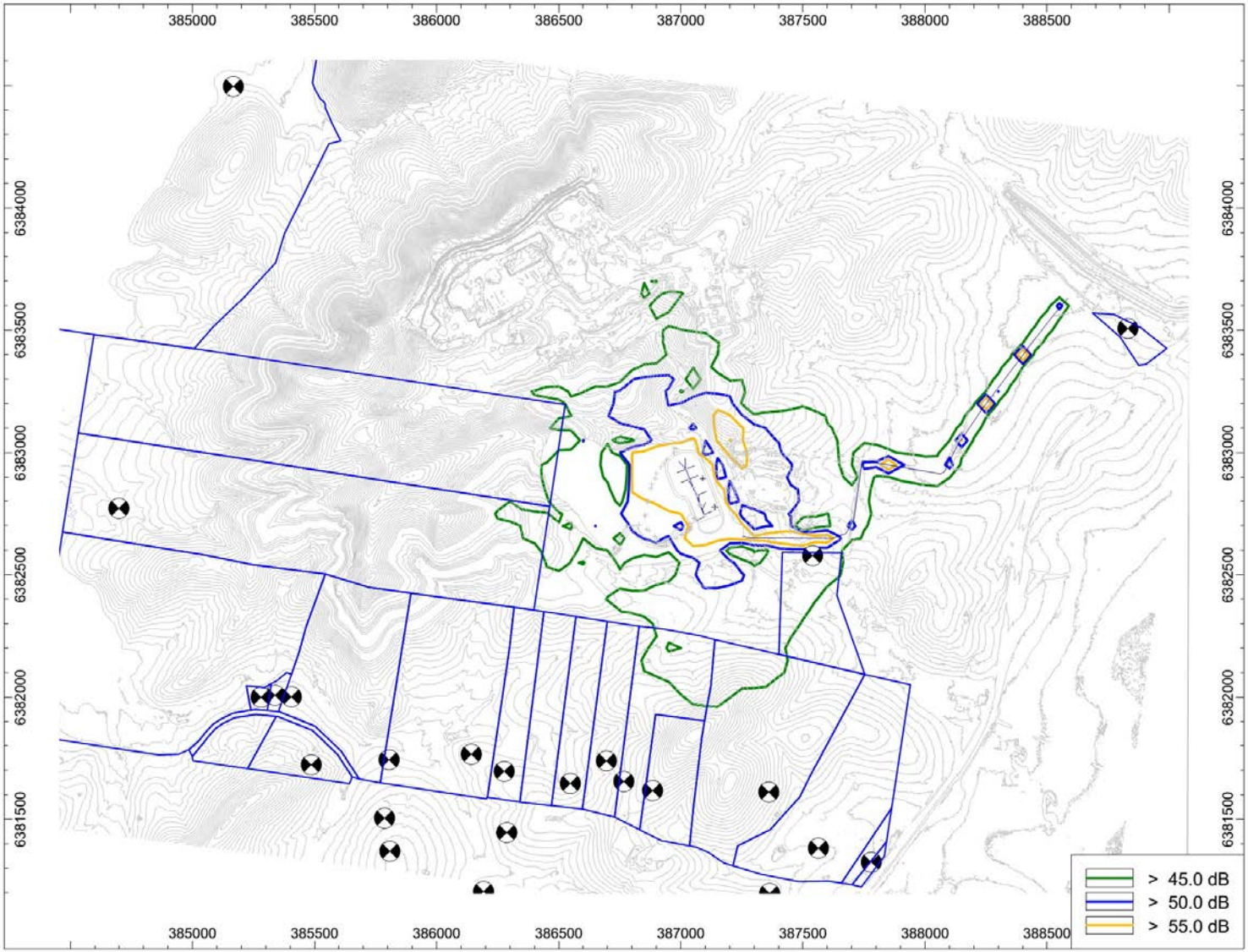


Figure 19: $L_{Aeq,15minute}$ Noise Contours - Year 30 Mode 6 (morning shoulder)

BLAST VIBRATION & OVERPRESSURE ASSESSMENT

4.5 Blast Vibration & Overpressure Parameters

It is proposed to have 12 blasts per year, an average of one per month, with 100 holes per blast. The allowable maximum instantaneous charge (MIC) mass per blast to comply with the blast vibration and overpressure levels was calculated.

Three receptors closest to the blasting area were selected for assessment, other receivers further from the blast location should experience noise and vibration levels lower than predicted for those nearest.

The following values typical for average rock under worst-case conditions have been used for calculations. K and B are constants related to site and rock properties.

- K = 1140, B = 1.6

4.6 Blast Vibration & Overpressure Results

4.6.1 Private Residences

Maximum instantaneous charge (MIC) limits to ensure blast criteria are met at the nearest residences are provided Table 4.7.

Table 4.7: ALLOWABLE MIC (ANFO) FOR VIBRATION & OVERPRESSURE

Year	Sector	Closest Receptor	Distance (m)	Vibration Criterion (mm/sec)	Overpressure Criterion (dB-Lin)	Allowable MIC (kg) – Vibration	Allowable MIC (kg) – Overpressure
Year 1	Sector 2	C	1066	5	115	1283	850
		8	1086	5	115	1332	899
		7	1174	5	115	1554	1133
Year 1	Sector 3	13	1226	5	115	1696	1291
		8	1238	5	115	1730	1330
		10	1268	5	115	1815	1429
Year 5	Sector 2	C	1046	5	115	1236	803
		8	1094	5	115	1350	916
		7	1179	5	115	1569	1148
Year 5	Sector 3	8	1241	5	115	1738	1339
		C	1253	5	115	1772	1378
		13	1277	5	115	1840	1458

Year	Sector	Closest Receptor	Distance (m)	Vibration Criterion (mm/sec)	Overpressure Criterion (dB-Lin)	Allowable MIC (kg) – Vibration	Allowable MIC (kg) – Overpressure
Year 10	Sector 1	8	883	5	115	879	482
		C	922	5	115	959	549
		7	966	5	115	1053	632
Year 10	Sector 2	8	1047	5	115	1236	803
		C	1059	5	115	1266	832
		7	1135	5	115	1454	1024
Year 10	Sector 3	8	1238	5	115	1731	1331
		13	1253	5	115	1772	1378
		10	1289	5	115	1874	1499
Year 20	Sector 1	8	874	5	115	863	468
		C	910	5	115	935	825
		7	957	5	115	1033	614
Year 20	Sector 2	8	993	5	115	1112	686
		C	1036	5	115	1212	780
		7	1081	5	115	1320	886
Year 20	Sector 3	8	11285	5	115	1430	999
		13	1168	5	115	1541	1118
		C	1190	5	115	1597	1180
Year 30	Final Stage	8	869	5	115	853	460
		C	666	5	115	501	207
		7	929	5	115	974	561

4.6.2 Power Transmission Lines

The proponent provided locations of power/transmission lines in the vicinity of the quarry. These are shown in Figure 20. Power lines north and south of the quarry are located further from blasting areas than private residences, but have a PPV criterion of 25 mm/s as opposed to 5 mm/s for residences. Limiting MIC to allow compliance at residences will, by default, provide compliance for power lines in those directions.

East of site, the nearest power line is located approximately 900 metres from the nearest blast area (shown by a blue star in Figure 20). A limiting MIC of 6,836 kg applies to restrict PPV to 25 mm/s. This is significantly higher than required to control impacts at residences.

Managing MIC to control blast impact at residences will, by default, manage vibration to acceptable levels at the nearest power lines to the site.

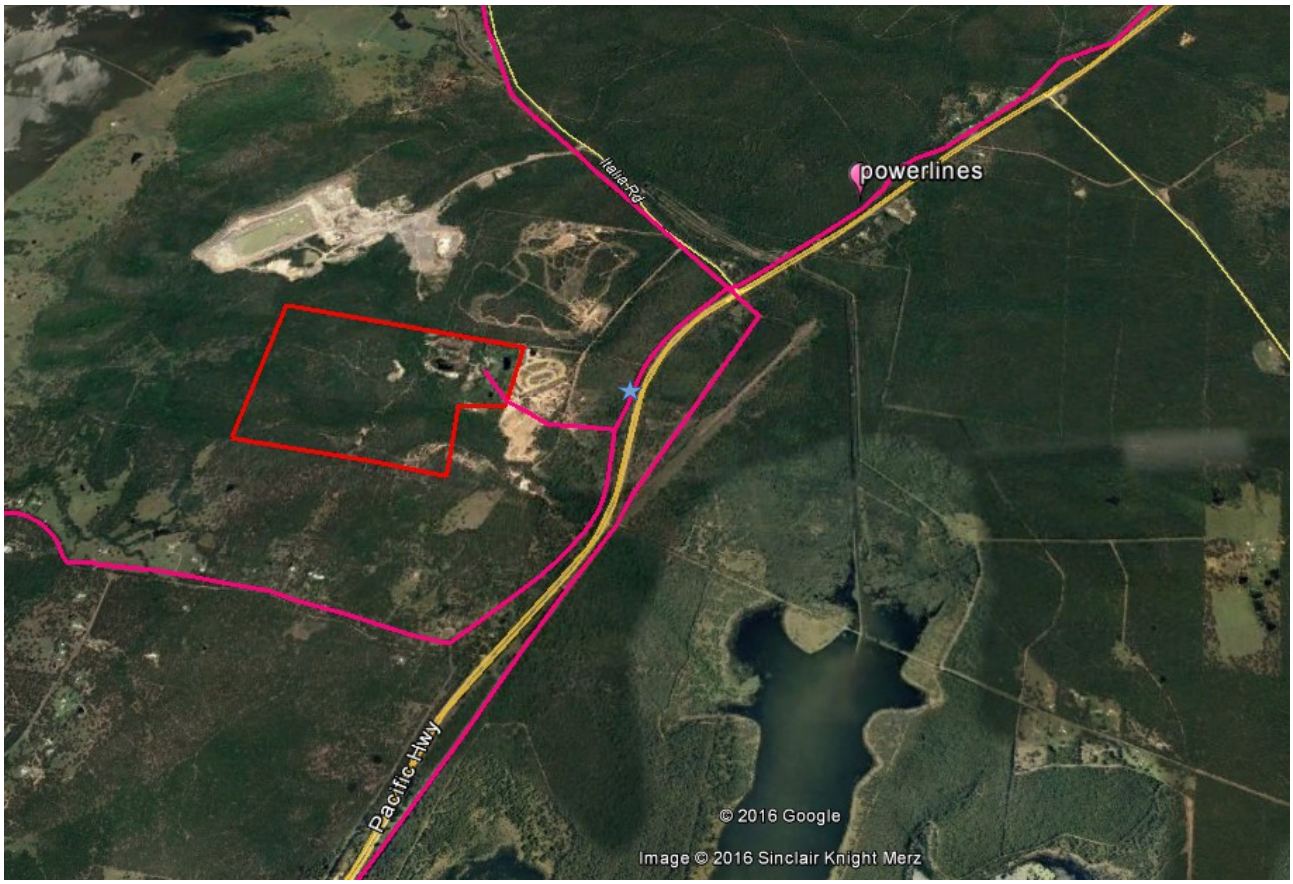


Figure 20: Power Line Locations

4.6.3 Commercial Buildings

Commercial buildings at the neighbouring landscape supply operation, and, the managers residence for the landscape operation on Lot 1 DP1108702 have been assessed to determine MIC limits to minimise potential for structural damage. The managers residence has also been assessed as for private residential receivers in case an agreement is not achieved.

The managers residence and nearest commercial buildings are approximately 300 metres from the active quarry area at the closest point. MIC limits to ensure blast criteria are met at the nearest commercial buildings are provided Table 4.8. Higher MIC will be possible when blasting at greater distances; blast design will be refined over the course of the project.

Table 4.8: ALLOWABLE MIC (ANFO) FOR COMMERCIAL BUILDINGS

Receptor	Distance (m)	Vibration Criterion (mm/sec)	Overpressure Criterion (dB-Lin)	Allowable MIC (kg) – Vibration	Allowable MIC (kg) – Overpressure
Managers residence with agreement	300	10	133	242	3,365
Managers residence without agreement	300	5	120	80	3,365
Commercial buildings	300	25	133	760	3,365

It is recommended employees at the landscape supply operation and tenants of the managers residence be provided notification prior to blasting.

5 ROAD TRAFFIC ASSESSMENT

5.1 Traffic Volume Data and Model Parameters

The proponent provided existing traffic volumes on Italia Road and the Pacific Highway from 2011 for morning peak hours (06.45-09.30) and afternoon-peak hours (15:15-18:00).

Average volumes per hour and the percentage of heavy vehicles (HV) were estimated for existing and projected traffic. This data is summarised in Table 6.1.

Table 5.1: TRAFFIC VOLUME DATA

	Year 1-5			Year 5-30		
	Italia Road AM peak hour	**Italia Road PM peak hour**	**Pacific Highway**	**Italia Road AM peak hour**	**Italia Road PM peak hour**	**Pacific Highway**
Existing Vehicles /hour	17.1	28.4	363	17.1	28.4	363
Existing Percentage HV	79%	13%	17%	79%	13%	17%
Existing HV/Hour	13.5	3.6	62	13.5	3.6	62
Add Total Vehicles/Hour	4.3	4.3	4.3	6.0	6.0	6.0
Add HV/Hour	3.2	3.2	3.2	4.6	4.6	4.6
Projected Total Vehicles/Hour	21.4	32.6	367	23.1	34.3	369
Projected HV/Hour	16.7	6.9	65	18.1	8.3	67
Projected Percentage HV	78%	21%	18%	78%	24%	18%

Traffic noise impact potential was assessed for receptors on Italia Road based on current daily traffic volumes and additional traffic generated by the proposed development. However, no assessment has been undertaken for potential receptors near the Pacific Highway given that daily traffic volumes on that road are significant and the proposed development will only generate an additional 4.6 heavy vehicles per hour, which is a very small increase (relatively) and should have no discernible impact

Two scenarios for Italia Road were modelled for traffic noise:

- Existing traffic volumes; and
- Existing traffic volumes plus additional generated by the quarry.

The noise levels calculated from both models were compared to relevant assessment criteria. Model parameters were:

- Existing/additional total vehicles per hour for day periods;
- Existing/additional percentage heavy vehicles (HV) for day periods;
- Traffic speeds of 90 kilometres per hour; and
- Impervious, bituminous road surface.

5.2 Road Traffic Noise Assessment Results

Predicted $L_{Aeq,15hour}$ from existing and projected traffic for the receptor on Italia Road are presented in Table 6.2. Conservatively, the peak hourly flows are considered to be constant over the full 15-hour duration.

Table 5.2: PREDICTED TRAFFIC NOISE LEVELS – $L_{Aeq,15hour}$ dB

Receptor ID	Day Limit	Year 1-5						Year 5-30					
		Italia Road – AM peak hour			Italia Road – PM peak hour			Italia Road – AM peak hour			Italia Road – PM peak hour		
		Existing Level	Projected Level	Change	Existing Level	Projected Level	Change	Existing Level	Projected Level	Change	Existing Level	Projected Level	Change
R01	60	57	58	1	54	56	2	57	58	1	54	56	2

6 SUMMARY

Global Acoustics was engaged by Eagleton Rock Syndicate Pty Ltd to conduct an assessment of potential noise impacts from a proposed quarry at Lot 2 DP1108702, Killaloe Lane (Off Italia Road), Eagleton.

This assessment considered impacts associated with potential noise from the proposed quarry. Modelling details such as sound power data, equipment quantities, barriers and other noise model parameters have been detailed in Section 3.

6.1 Construction Noise

Six construction activities are proposed. Each was modelled as a separate scenario, as these tasks will not be undertaken concurrently. Predicted noise levels were compared with construction noise criteria.

No exceedances of construction noise criteria were predicted, with the exception of the managers residence for the landscape supply operation (R23). It is understood the proponent intends to negotiate a private agreement with the owner of this property.

6.2 Operational Noise

Modelling was performed for Years 1, 5, 30. Two processing plant configurations were included. A series of noise controls were developed and included in the modelling assessment. Predicted noise levels were compared with project specific noise levels.

No exceedance of either project specific noise levels or cumulative noise criteria is predicted for any stage with noise controls described in Section 3.4 implemented, with the exception of the managers residence for the landscape supply operation (R23).

6.3 Cumulative Noise

No exceedances of derived cumulative noise criteria are predicted, with the exception of the managers residence for the landscape supply operation (R23).

6.4 Sleep Disturbance

A sleep disturbance model was developed to represent operations during the morning shoulder period for each stage. Meteorological effects due to temperature inversions were assessed.

No exceedances of sleep disturbance criteria are predicted, with the exception of the managers residence for the landscape supply operation (R23).

6.5 Vacant Land Assessment

Predictions for worst case operating configurations do not exceed relevant VLAMP criteria over more than 25% of the area of any privately owned land (with or without a dwelling). Voluntary land acquisition rights are not deemed applicable on the basis of assessment of vacant land.

6.6 Road Traffic Noise

The increase in road traffic on Italia road was assessed and predicted model results show no exceedance of criteria as per the NSW Road Noise Policy (RNP, March 2011).

No assessment has been undertaken for potential receptors near the Pacific Highway given that the daily traffic volumes on the Pacific Highway are significant and the proposed development will only generate a very small increase that should have no discernible impact.

6.7 Blast Overpressure and Vibration

An assessment of potential noise and vibration impacts from blasting was conducted for various stages of quarrying. The results indicate the limiting MIC for all blasts would be governed by overpressure to manage impacts at residential receives, and by vibration for infrastructure and commercial buildings.

It is recommended careful blast design and shot firing be employed to avoid possible blast impacts. It is recommended that multiple blast monitors be used for initial blasting to establish site-specific K and B constants. This will allow more accurate blast vibration predictions and therefore optimisation of the allowable MIC. It is strongly recommended that dilapidation surveys be conducted at any potentially affected receivers prior to any blasting.

APPENDIX

A RECEPTOR LOCATIONS AND NOISE IMPACT ASSESSMENT CRITERIA

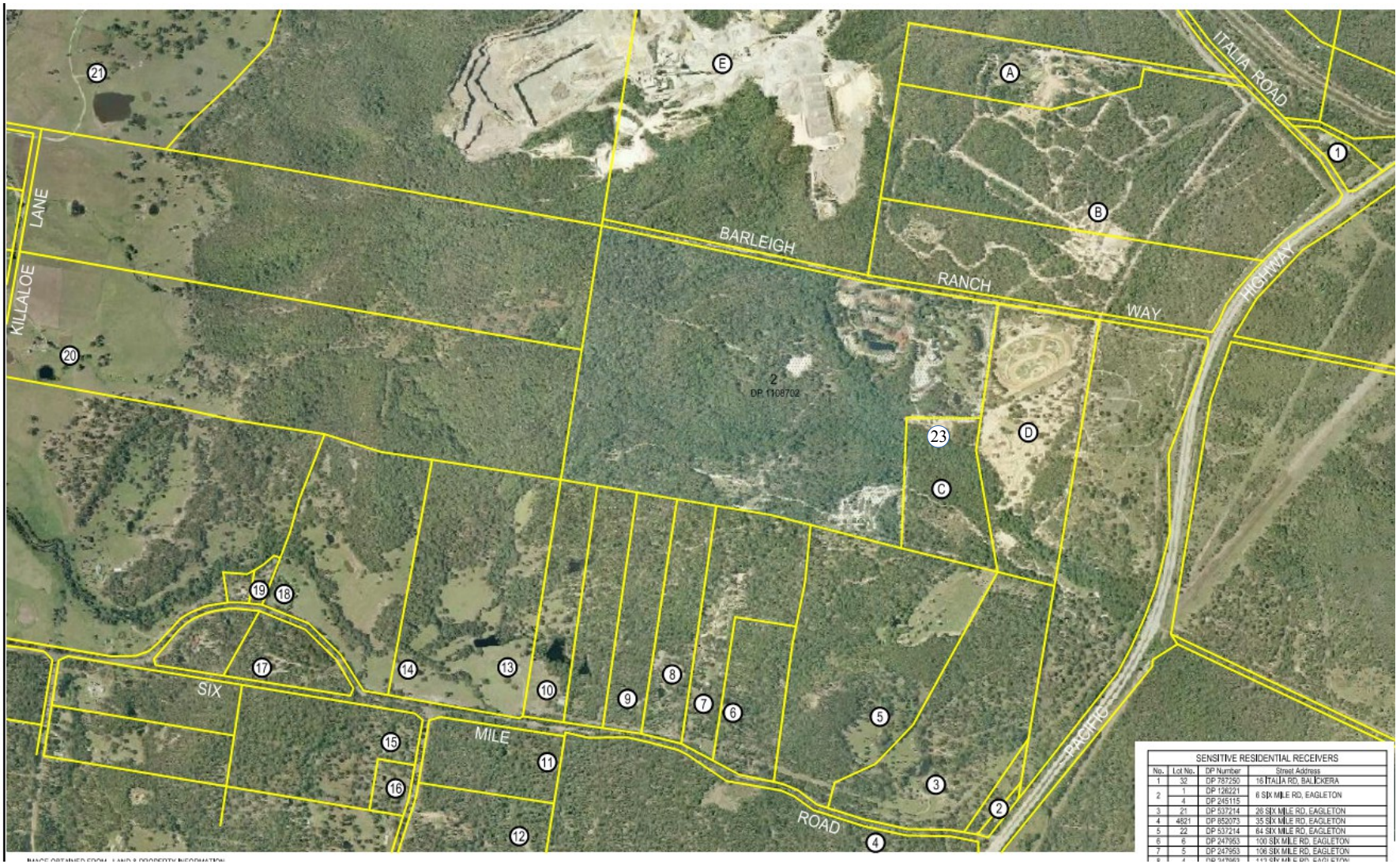
Table A.1 and Table A.2 list receptor locations included in modelling, and project specific noise levels. Figure A.1 shows the location of the receptors.

Table A.1: MODELLED RESIDENTIAL RECEPTORS AND PROJECT SPECIFIC NOISE LEVELS

				Project Specific Noise Levels – $L_{Aeq,15minute}$ dB			
Receptor Number	**Lot Number**	**DP**	**Property Address**	**Morning Shoulder**	**Day**	**Evening**	**Night**
1	32	787250	16 Italia Road, Balickera	43	49	48	36
2	1 & 4	126221 & 245115	6 Six Mile Road, Eagleton	43	49	48	36
3	21	537214	26 Six Mile Road, Eagleton	43	49	48	36
4	2821	852073	35 Six Mile Road, Eagleton	43	49	48	36
5	22	537214	64 Six Mile Road, Eagleton	39	41	39	37
6	6	274953	100 Six Mile Road, Eagleton	39	41	39	37
7	5	247953	106 Six Mile Road, Eagleton	39	41	39	37
8	4	247953	112 Six Mile Road, Eagleton	39	41	39	37
9	3	247953	132 Six Mile Road, Eagleton	39	41	39	37
10	1	247953	160 Six Mile Road, Eagleton	39	41	39	37
11	33	255228	149 Six Mile Road, Eagleton	39	41	39	37
12	32	255288	35 Winston Road, Eagleton	39	41	39	37
13	162	594368	164 Six Mile Road, Eagleton	39	41	39	37
14	162	594368	164 Six Mile Road, Eagleton	39	41	39	37
15	2	1056776	213 Six Mile Road, Eagleton	39	41	39	37
16	1	1056776	30 Winston Road, Eagleton	39	41	39	37
17	163	594368	229 Six Mile Road, Eagleton	39	41	39	37
18	161	594368	258 Six Mile Road, Eagleton	39	41	39	37
19	1	773324	264 Six Mile Road, Eagleton	39	41	39	37
20	18	56758	3 Killaloe Lane, Balickera	39	41	39	37
21	1	794944	8 Killaloe Lane, Balickera	39	41	39	37
22	1	794944	8 Killaloe Lane, Balickera	39	41	39	37
23	1	1108702	11 Barleigh Ranchway, Eagleton	39	41	39	37

Table A.2 MODELLED COMMERCIAL RECEPTORS AND PROJECT SPECIFIC NOISE LEVELS

				Project Specific Noise Levels – $L_{Aeq,15minute}$ dB			
Receptor Number	**Lot Number**	**DP**	**Property Address**	**Morning Shoulder**	**Day**	**Evening**	**Night**
A	1	1158962	53 Italia Road, Balickera	65	65	65	65
B	1 & 2	245116	45-49 Italia Road, Balickera	65	65	65	65
D	481	611651	7 Barleigh Ranchway, Eagleton	65	65	65	65
E	C & 66	164505 & 753200	139A & 139 Italia Raod, Eagleton	70	70	70	70



Source: PCB Surveyors

Figure 21: Receptor Locations

APPENDIX

B CALIBRATION CERTIFICATES

Acoustic Research Laboratories
Proprietary Limited A.B.N. 47 060 100 804
Noise and Vibration Monitoring Instrumentation for Industry and the Environment

Sound Level Meter Test Report

Report Number : 10556

Date of Test : 04/11/2010

Report Issue Date : 05/11/2010

Equipment Tested/ Model Number: **EL-215 Environmental Noise Logger**

Instrument Serial Number: 194636

Client Name : Acoustic Research Laboratories Pty Ltd

Level 7, Building 2, 423 Pennant Hills Road

Pennant Hills NSW 2120

Contact Name : Katie Fairjones

Tested by : Michelle Youssef

Approved Signatory :

Date : **5 November 2010**

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WORLD RECOGNISED ACCREDITATION

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Telephone +61 2 9484 0800 ♦ Facsimile +61 2 9484 0884
www.acousticresearch.com.au

Acoustic Research Laboratories
Proprietary Limited A.B.N. 47 050 100 804
Noise and Vibration Monitoring Instrumentation for Industry and the Environment

Sound Level Meter Test Report

Report Number : C11233

Date of Test : 20/05/2011

Report Issue Date : 23/05/2011

Equipment Tested/ Model Number: **EL-215 Environmental Noise Logger**

Instrument Serial Number: 194638

Microphone Serial Number: N/A

Preamplifier Serial Number: N/A

Client Name : Acoustic Research Laboratories Pty Ltd
Level 7, Building 2, 423 Pennant Hills Road
Pennant Hills NSW 2120

Contact Name : Katie Fairjones

Tested by : Michael Wastell

Approved Signatory :

Date : 23/05/2011

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Acoustic Research Laboratories
Proprietary Limited A.B.N. 47 050 100 804
Noise and Vibration Monitoring Instrumentation for Industry and the Environment

Acoustic Calibrator Test Report

Report Number : C12122

Date of Test : 27/02/2012

Report Issue Date : 29/02/2012

Equipment Tested: **Acoustic Calibrator**

Model Number: Rion NC-73

Serial Number: 11248300

Client Name : Acoustic Research Laboratories

Level 7, Building 2, 423 Pennant Hills Road

Pennant Hills NSW 2120

Contact Name : Katie Fairjones

Tested by : Brianna Sparre

Approved Signatory :

Ken Williams

Date : **29th February 2012**

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APPENDIX

C SOURCE LOCATION FIGURES

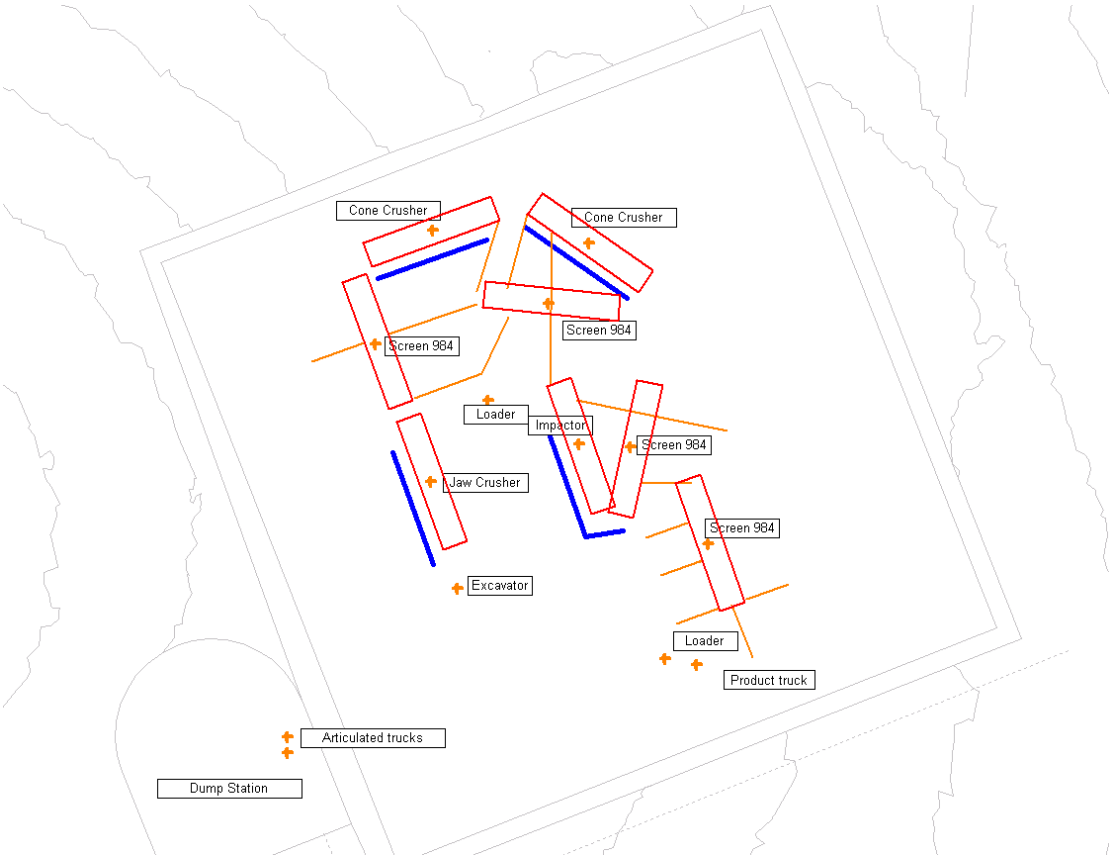


Figure 22: Initial Processing Plant Configuration

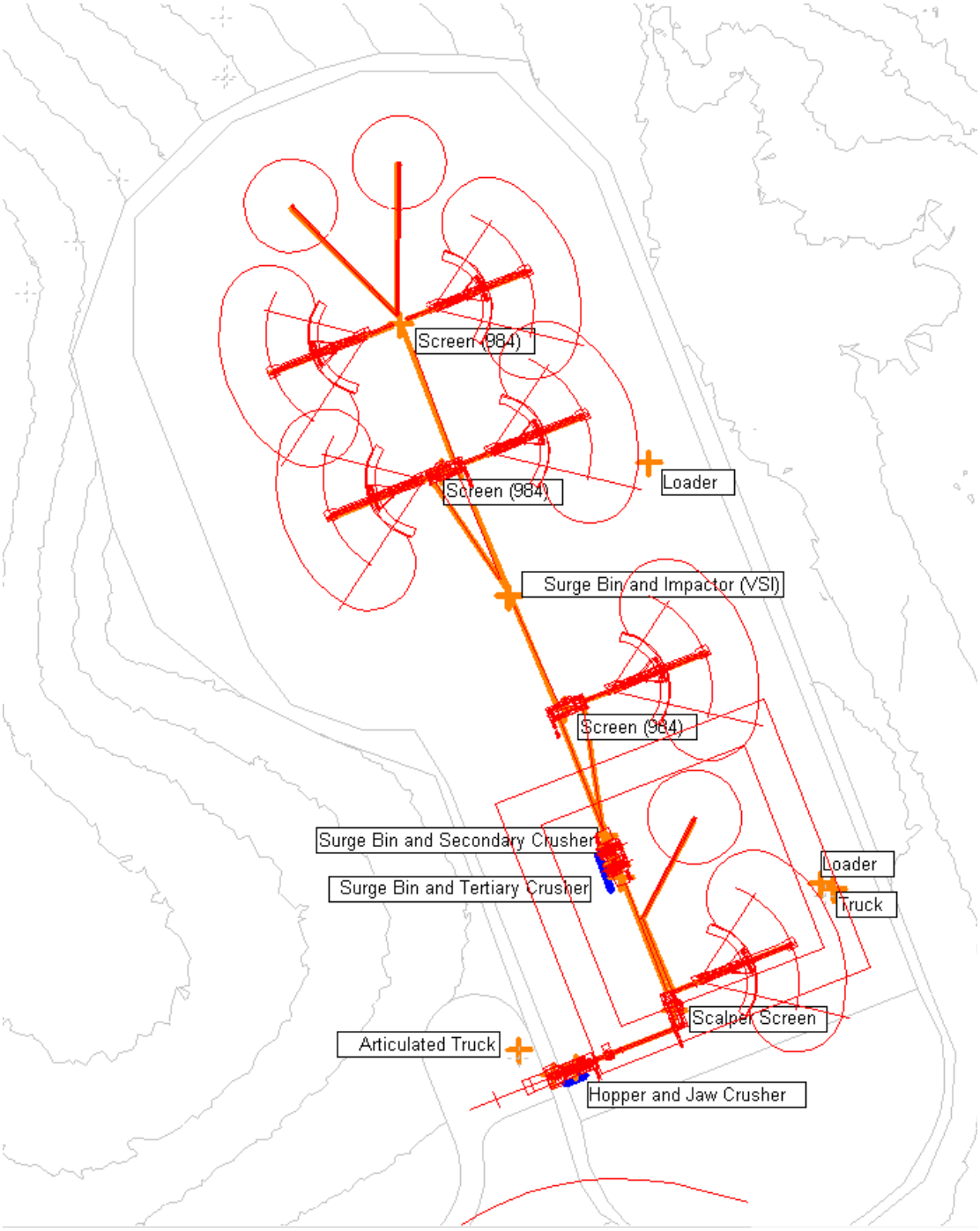


Figure 23: Ultimate Processing Plan Configuration

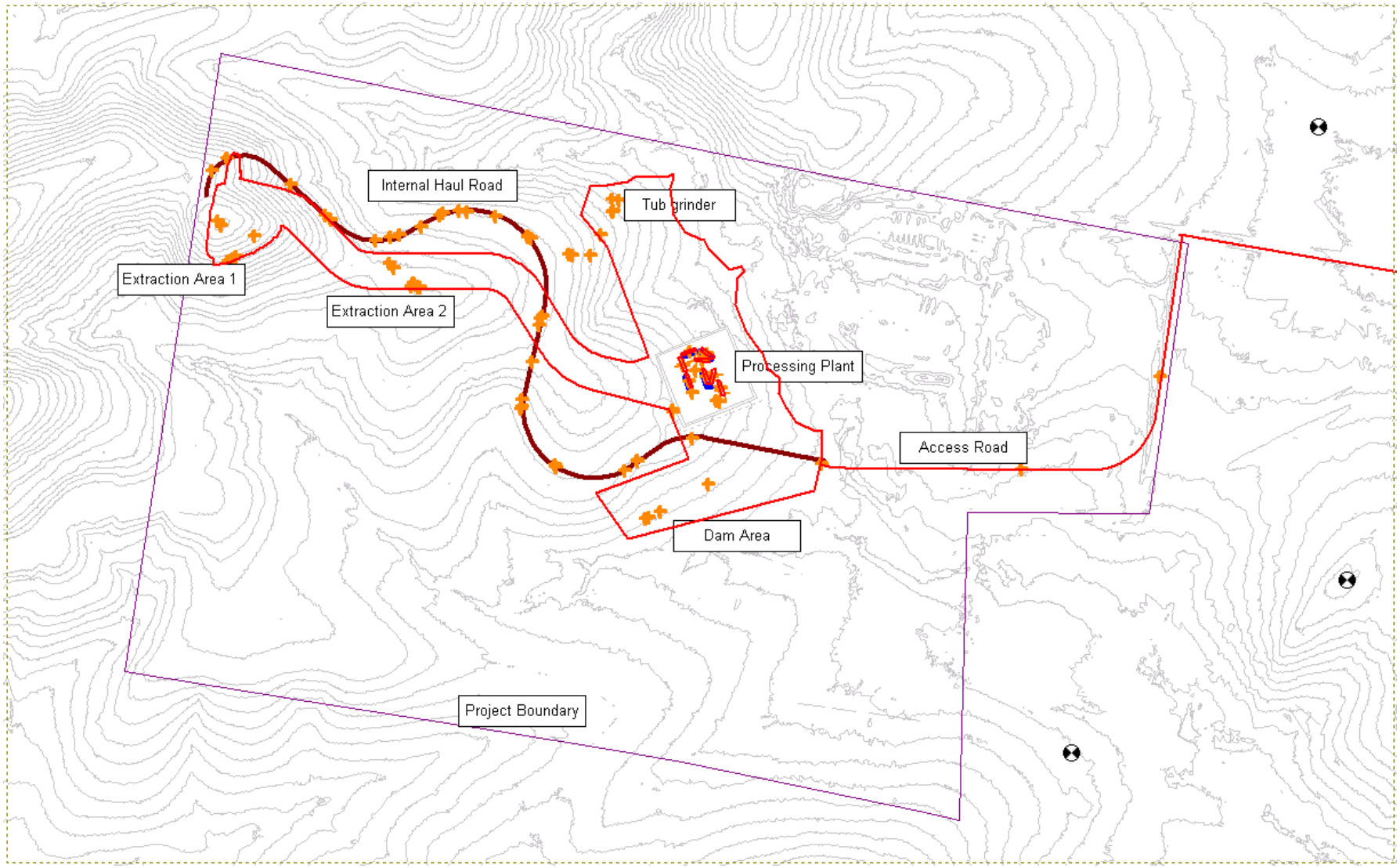


Figure 24: Year 1 Operational Plant Layout

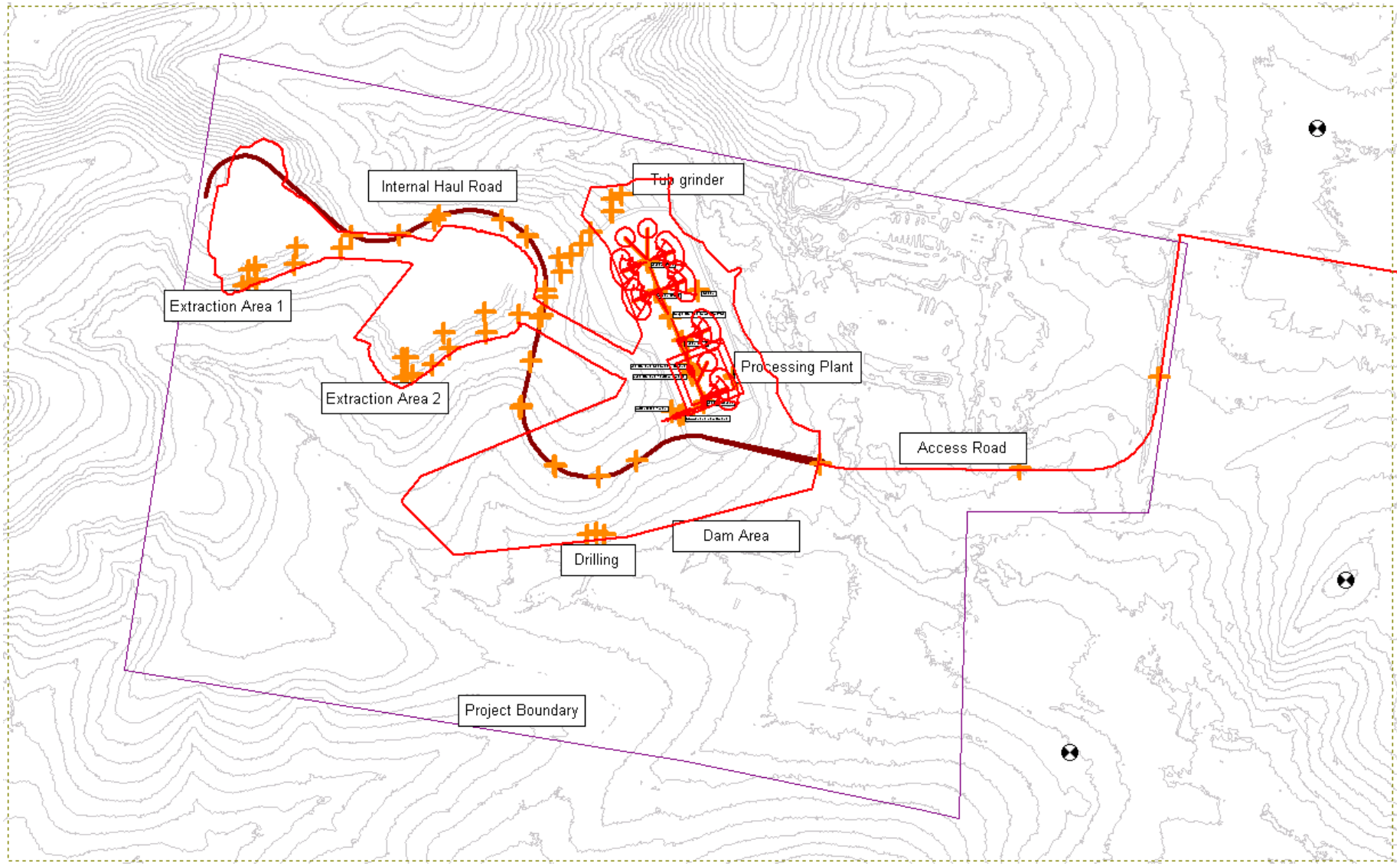


Figure 25: Year 5 Operational Plant Layout

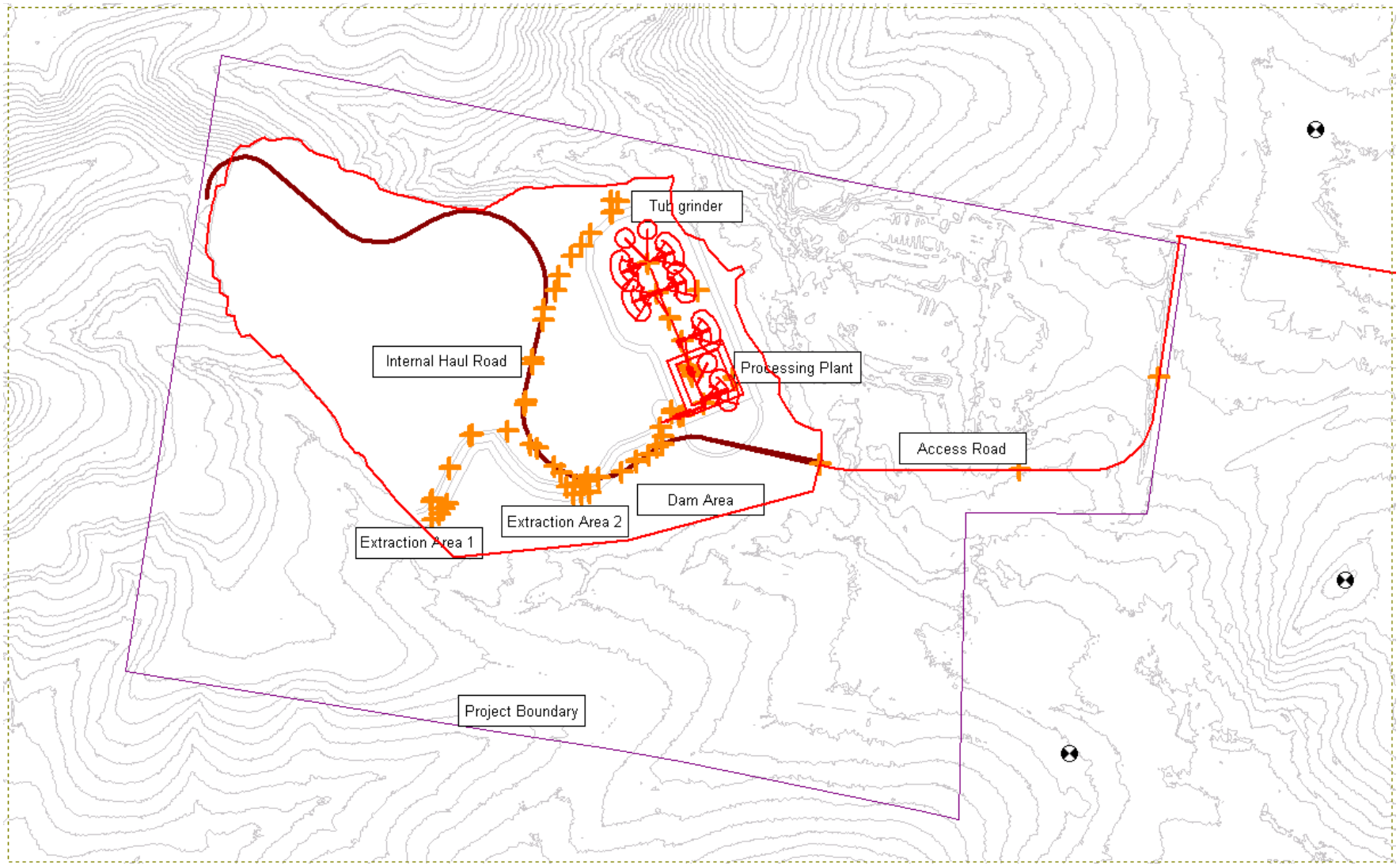


Figure 26: Year 30 Operational Plant Layout

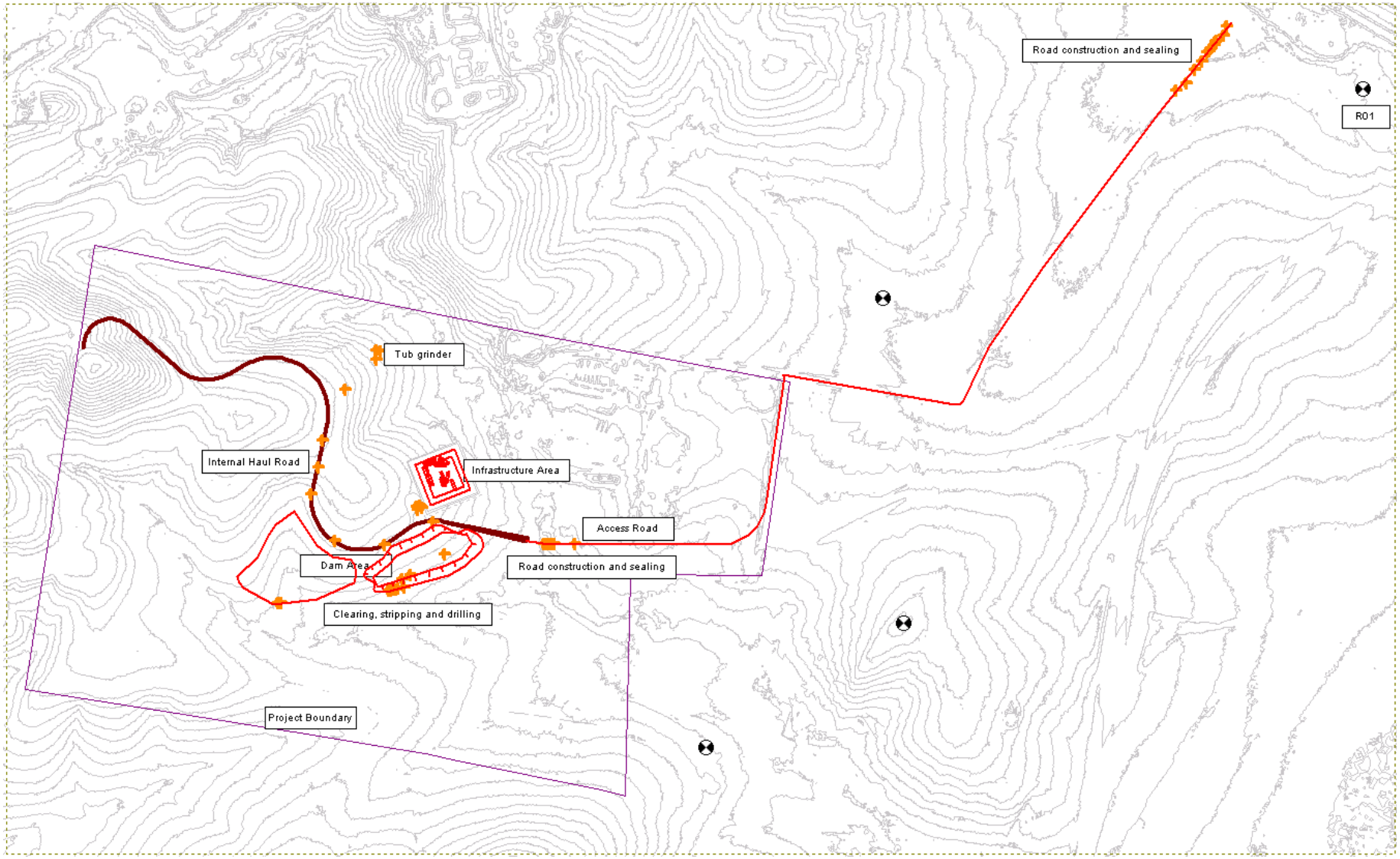
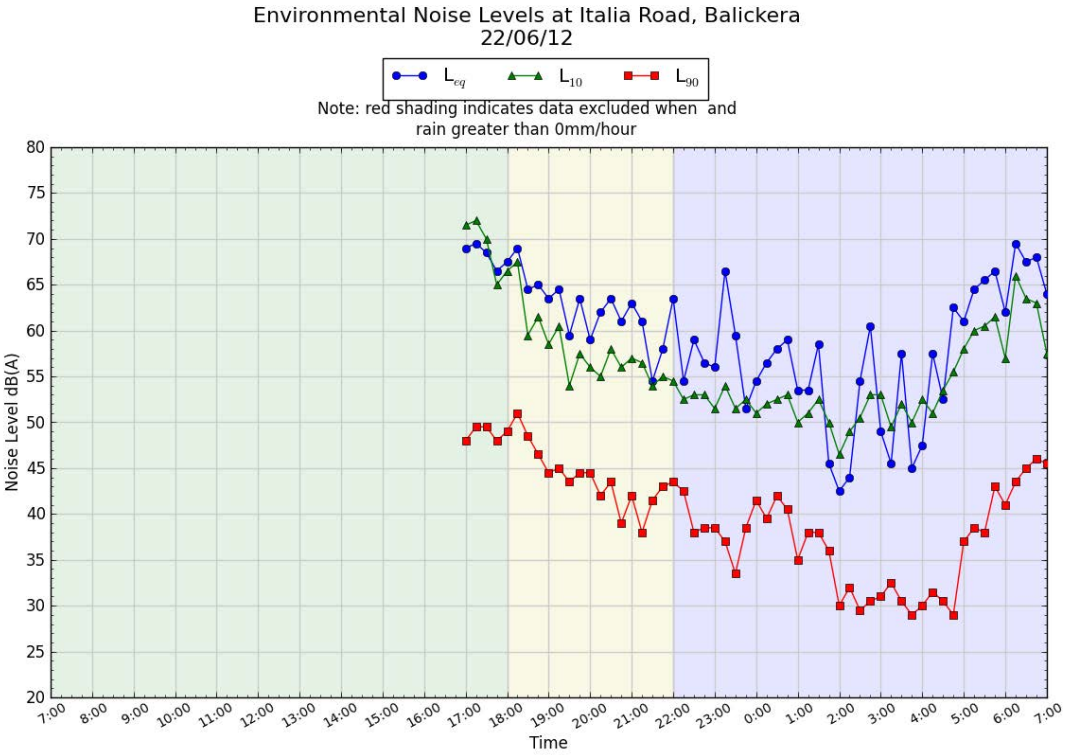


Figure 27: Construction Plant Layout

APPENDIX

D LOGGER GRAPHS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L_{90}
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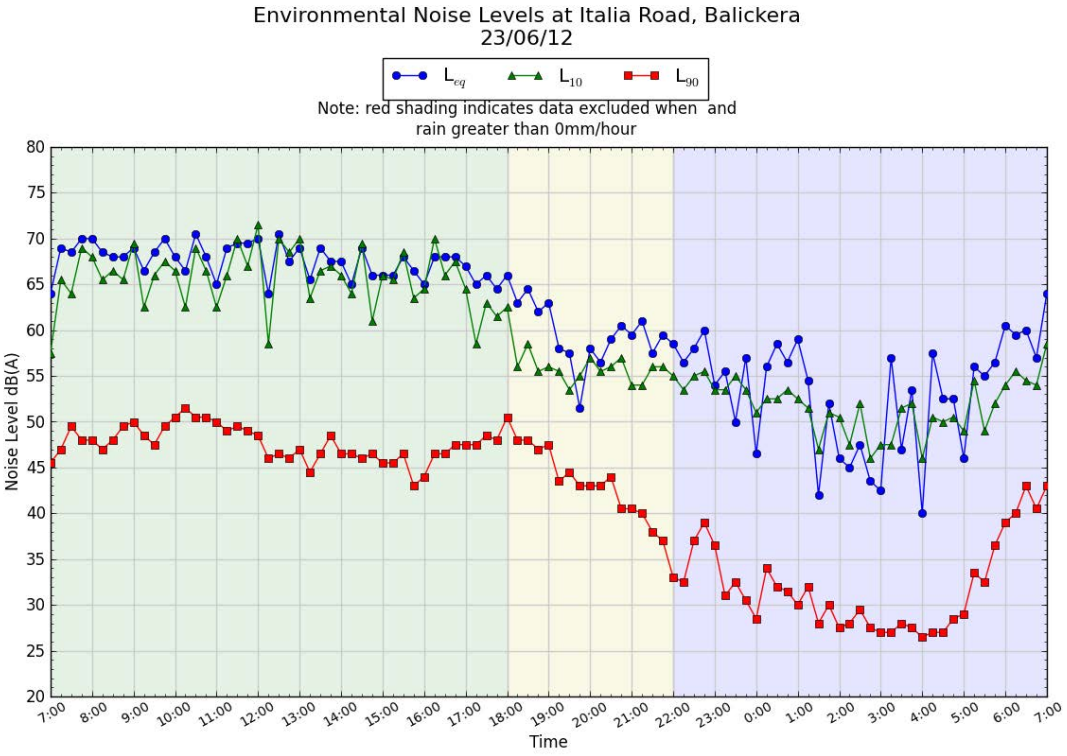
Noise Level dB(A)
Time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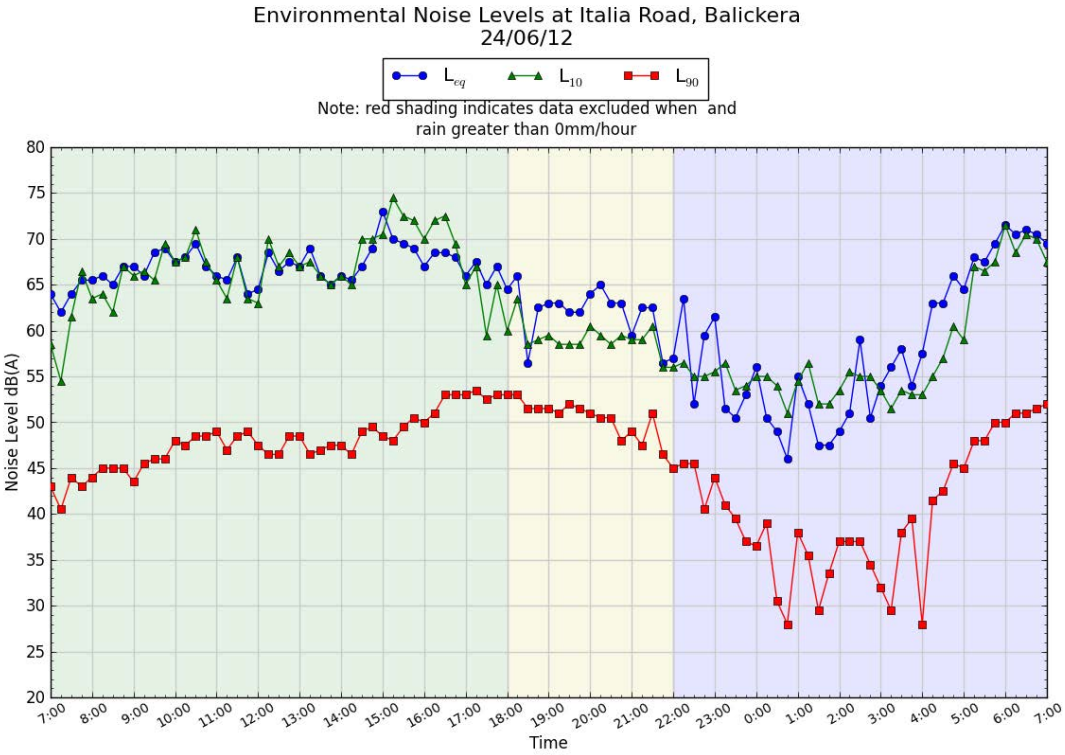
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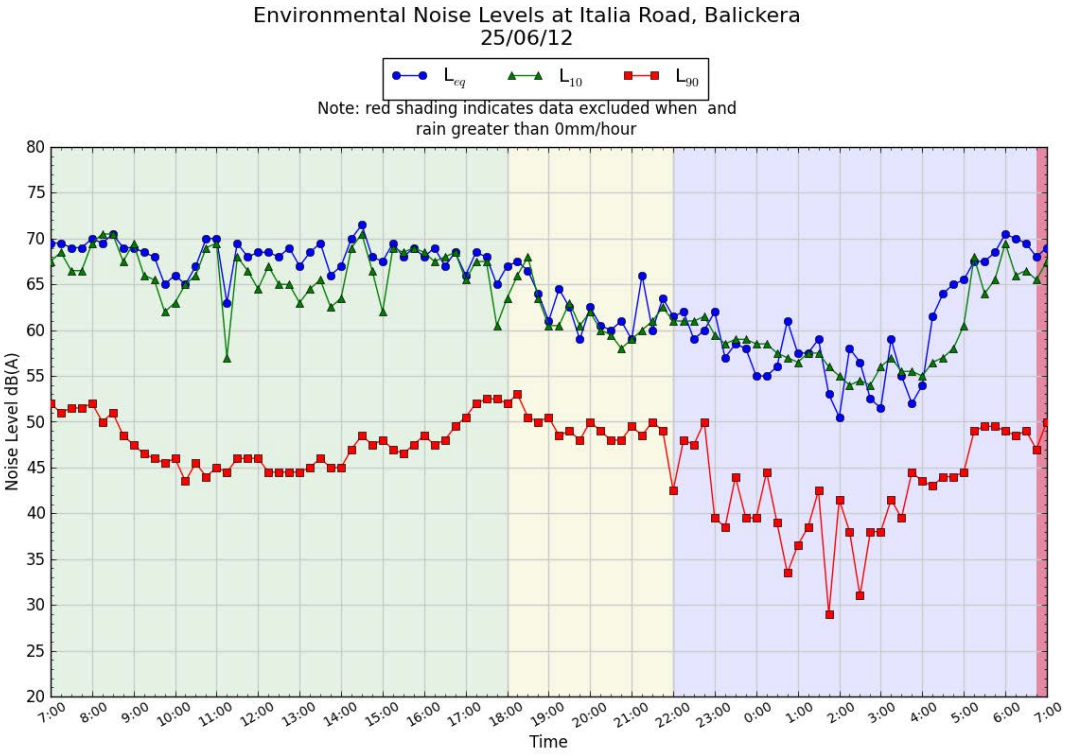
Noise Level dB(A)
Time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Noise Level dB(A)
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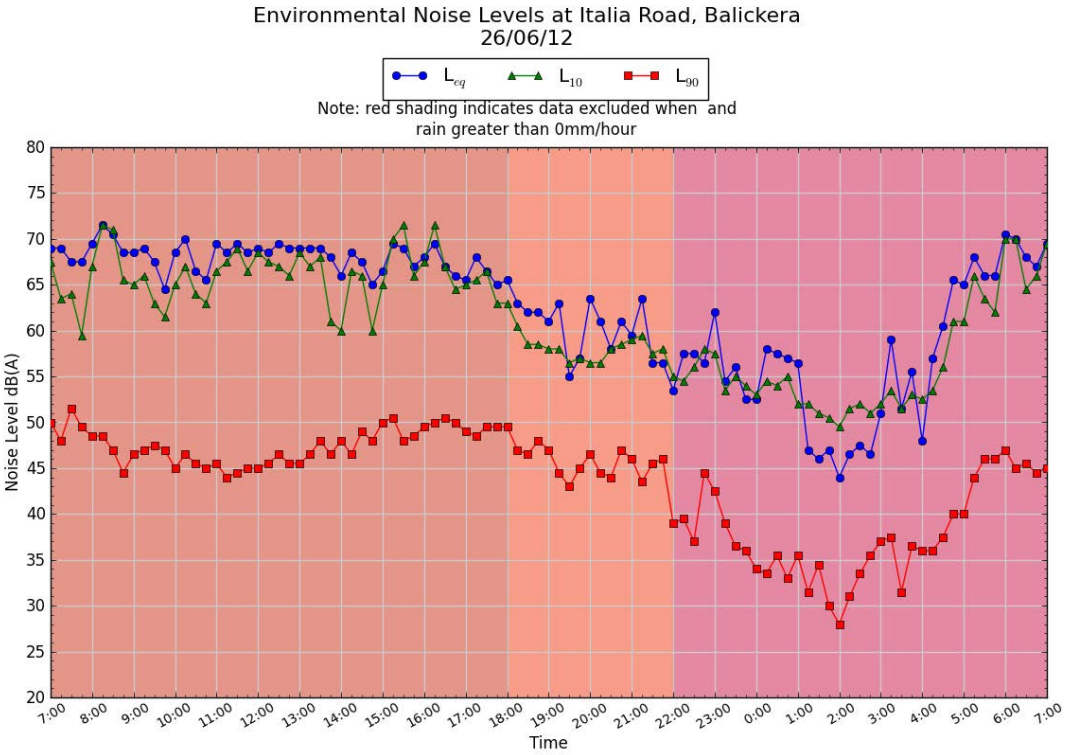
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Noise Level dB(A)
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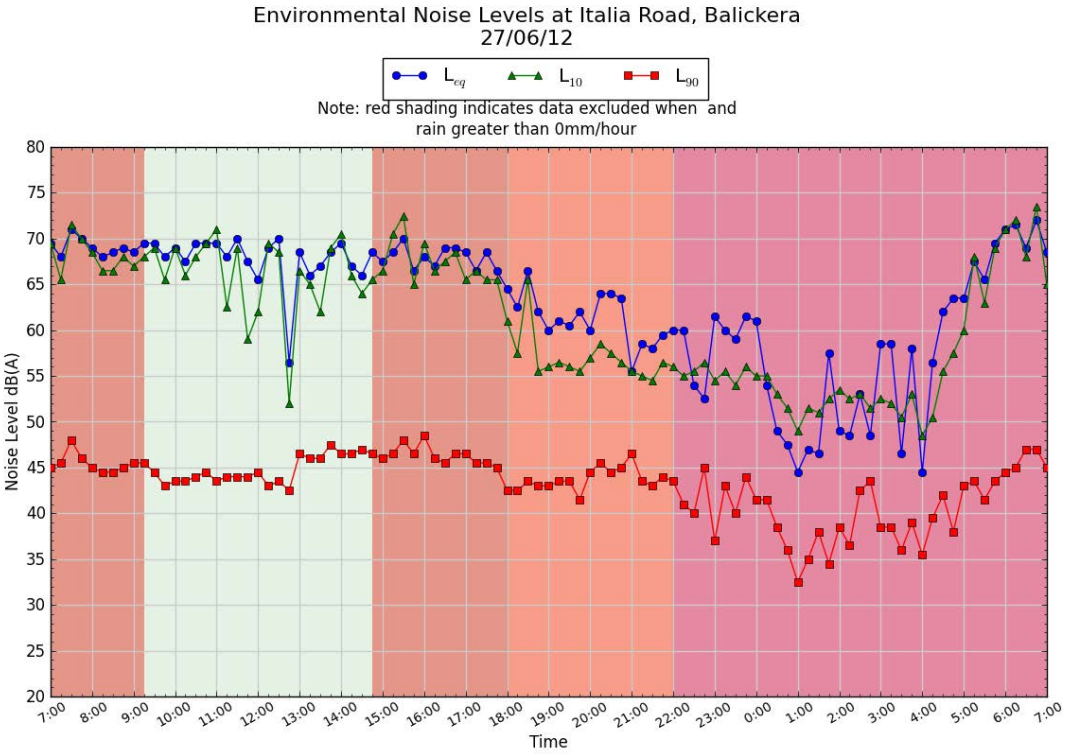
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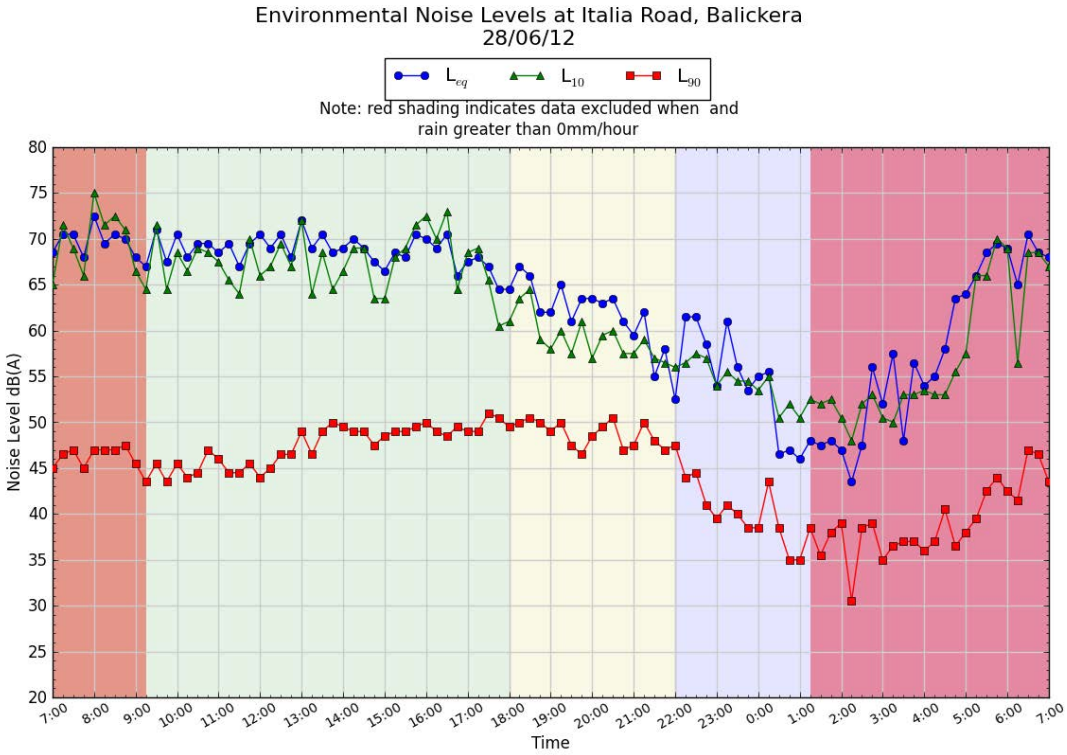
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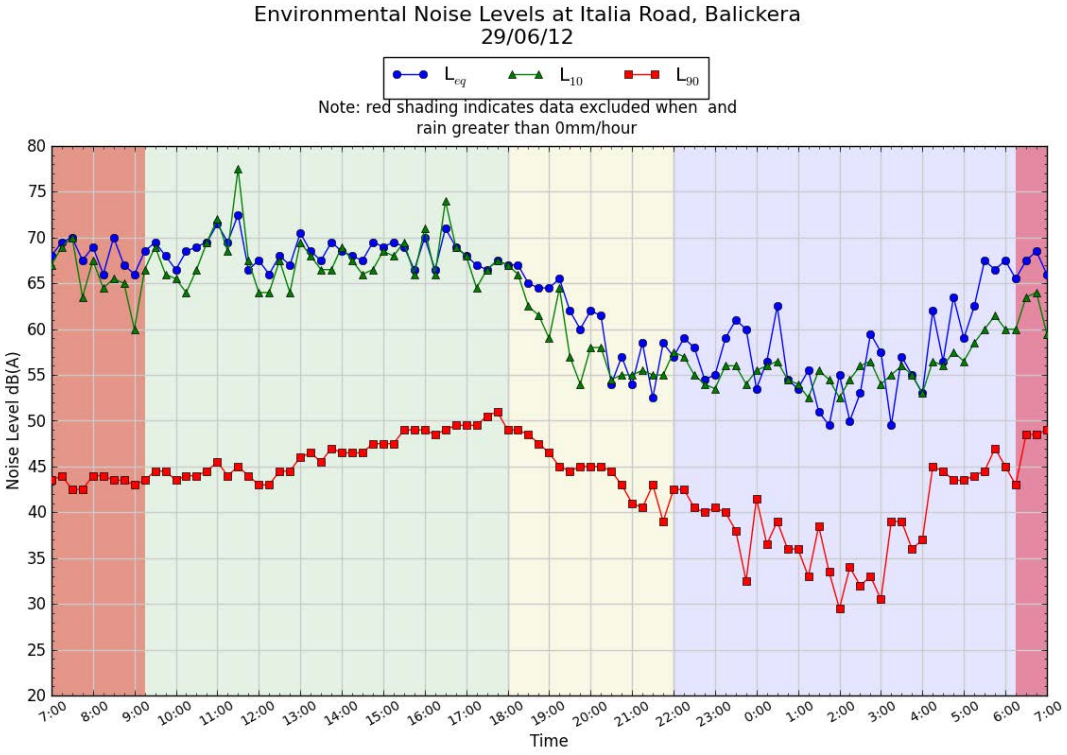
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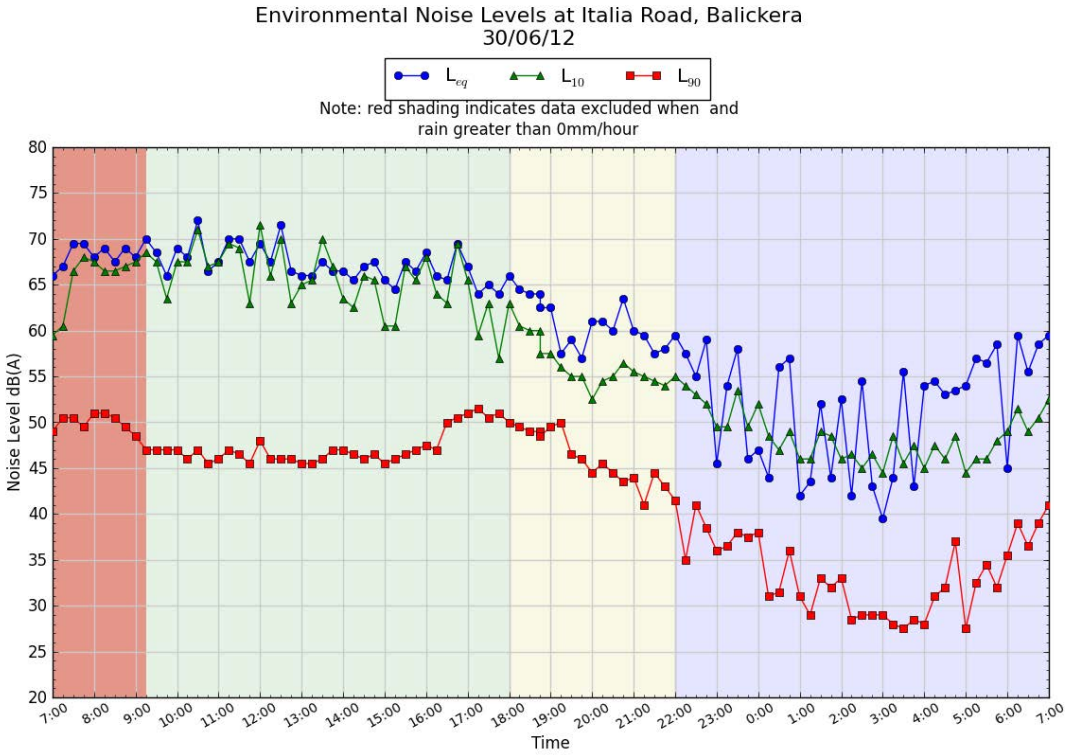
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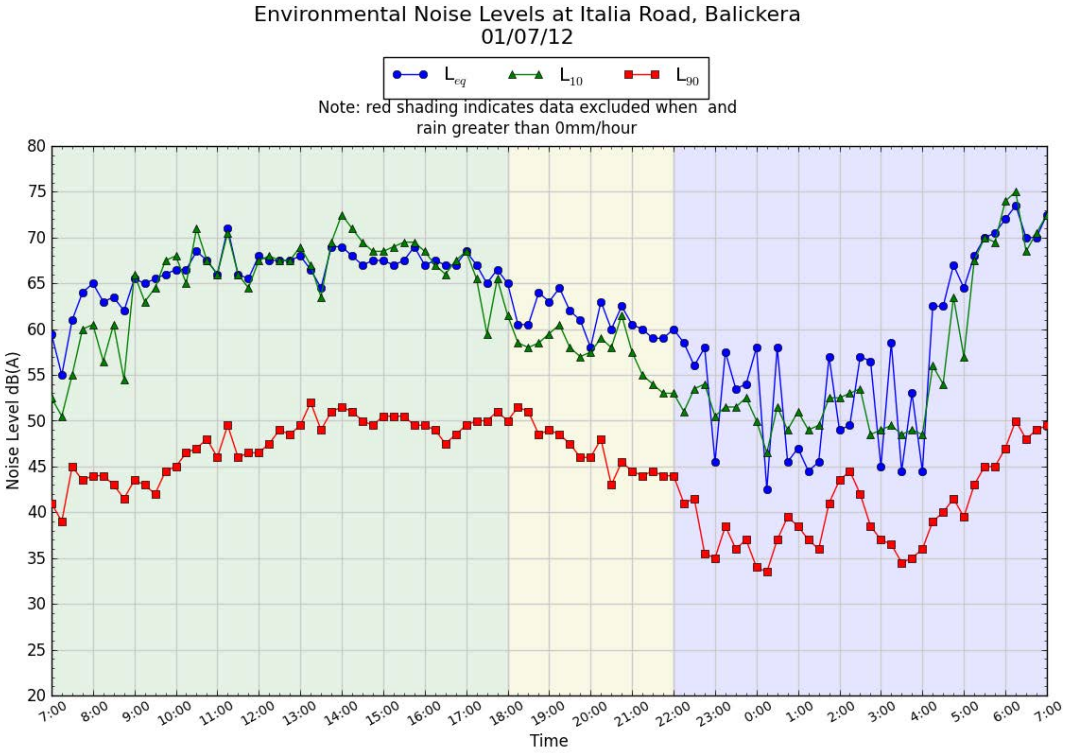
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Time


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L_{10}
L_{90}
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70
65
60
55
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45
40
35
30
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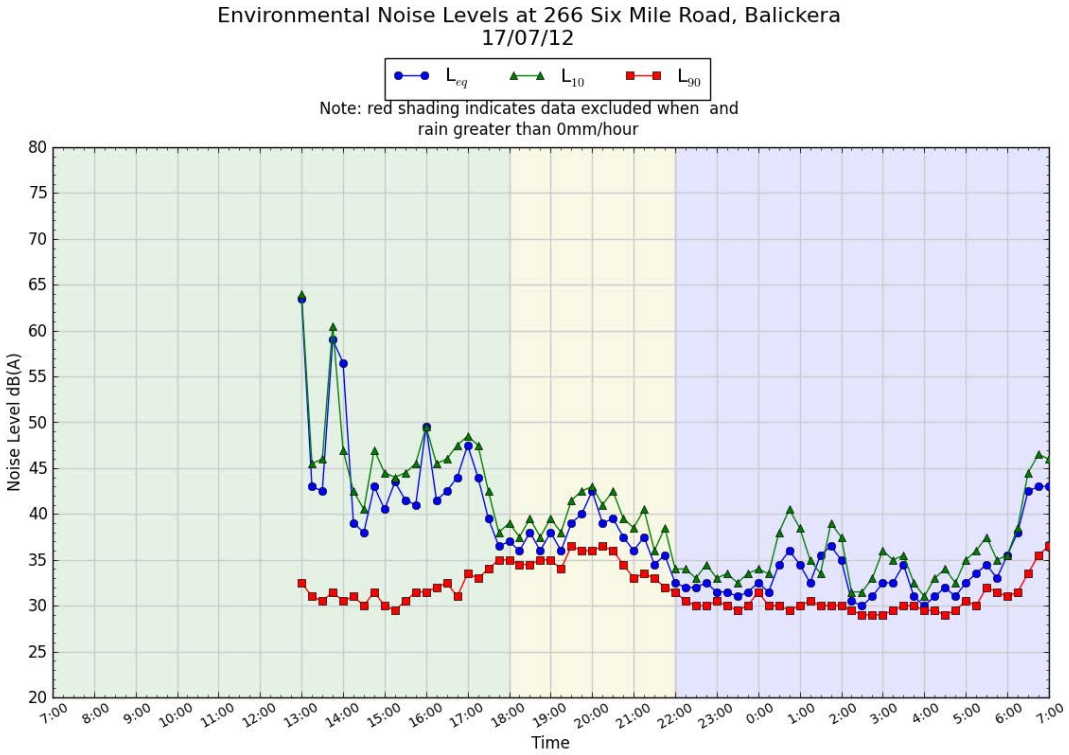
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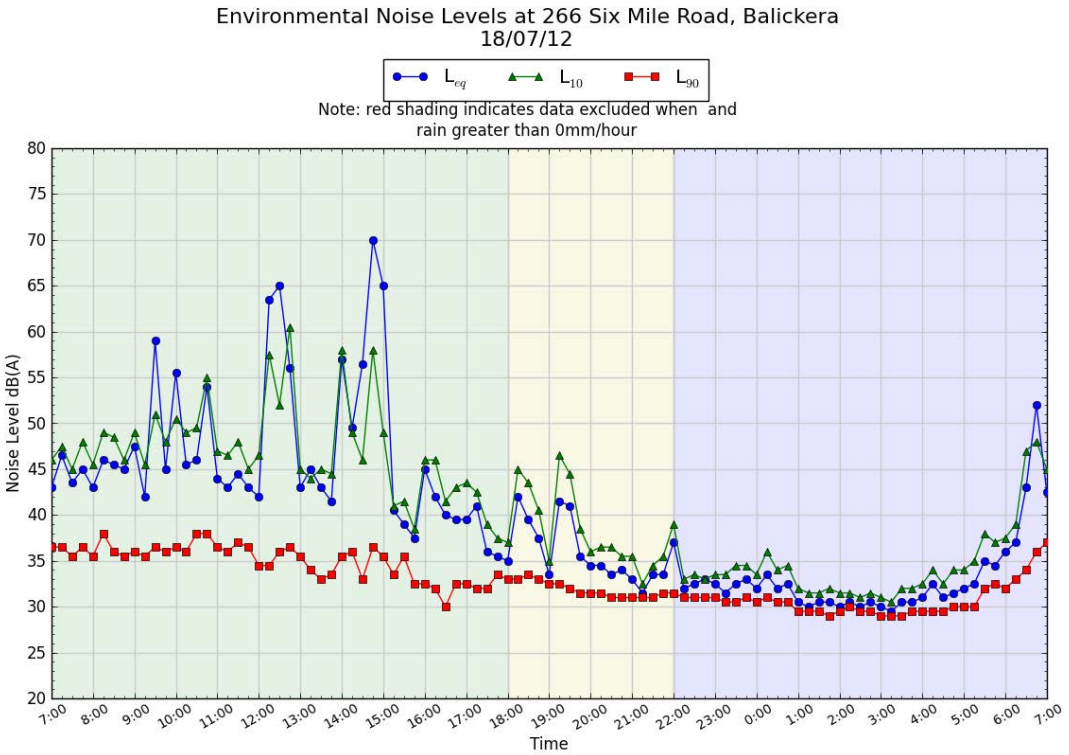
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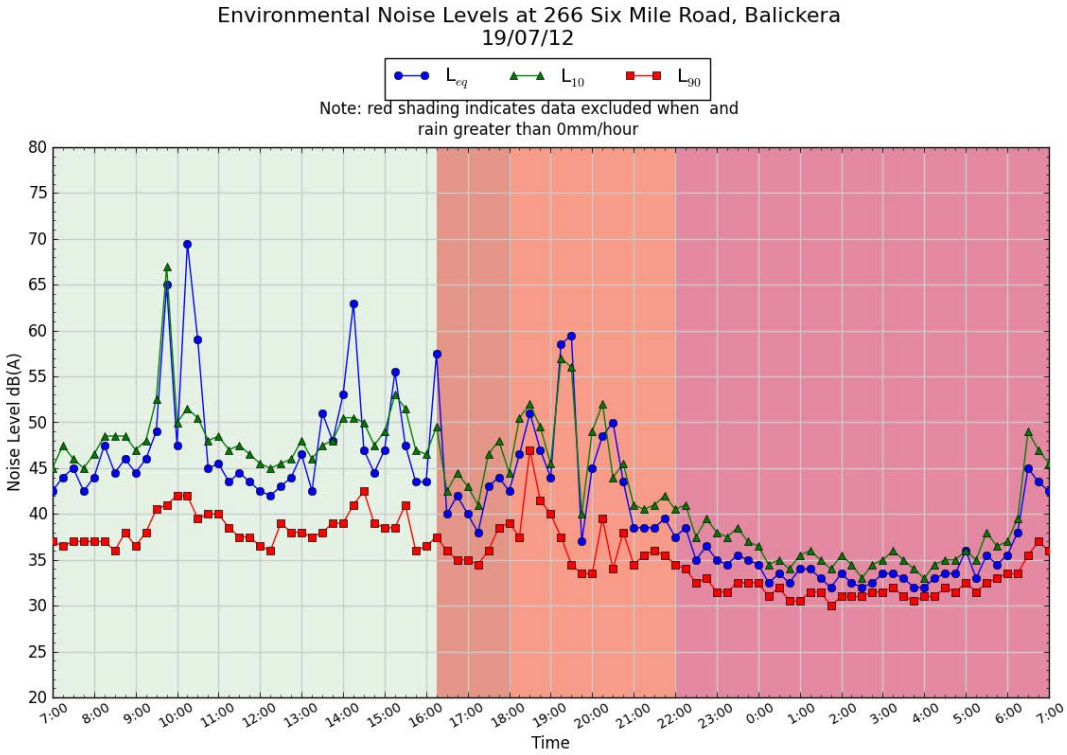
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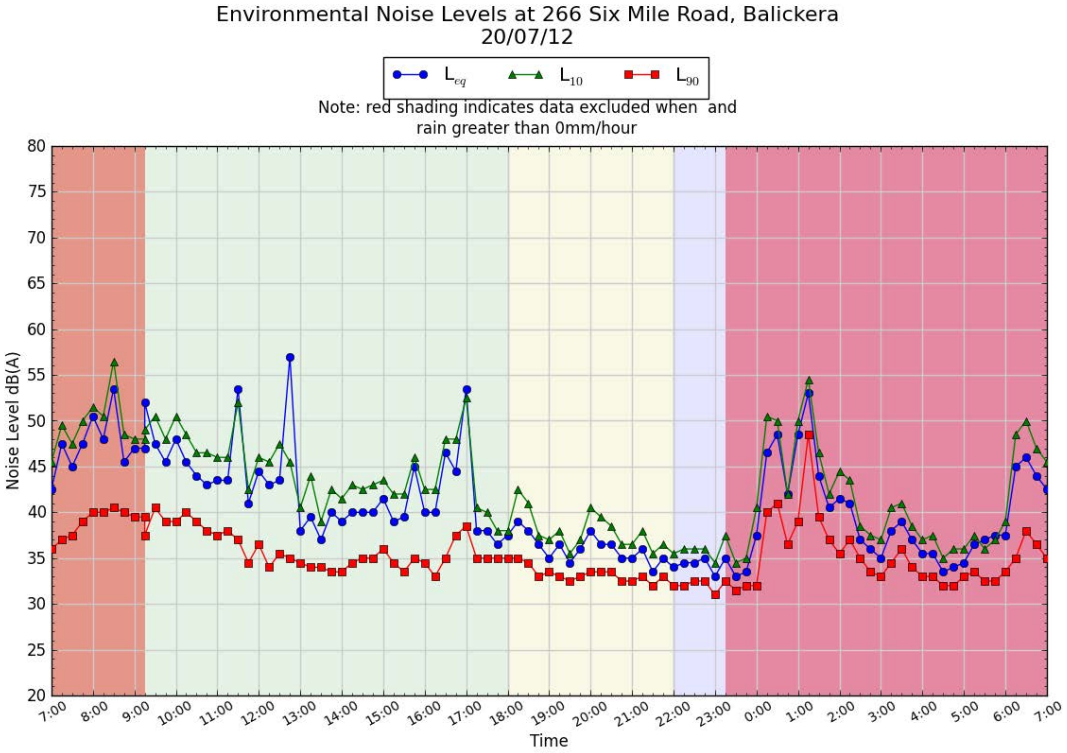
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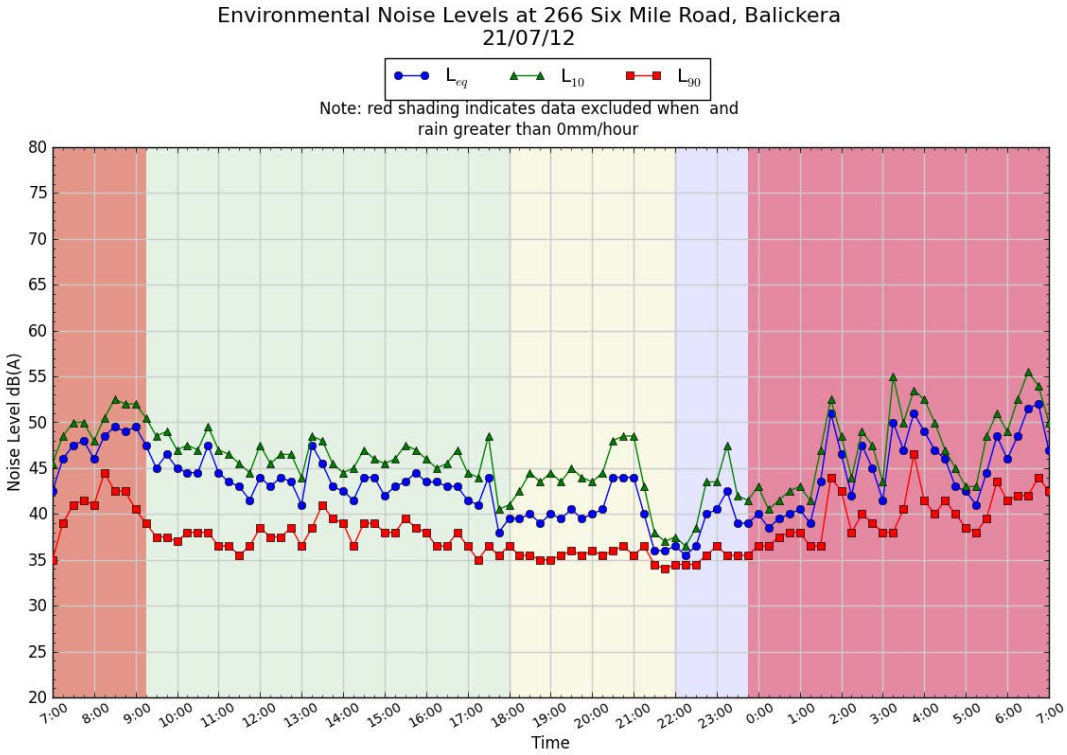
Time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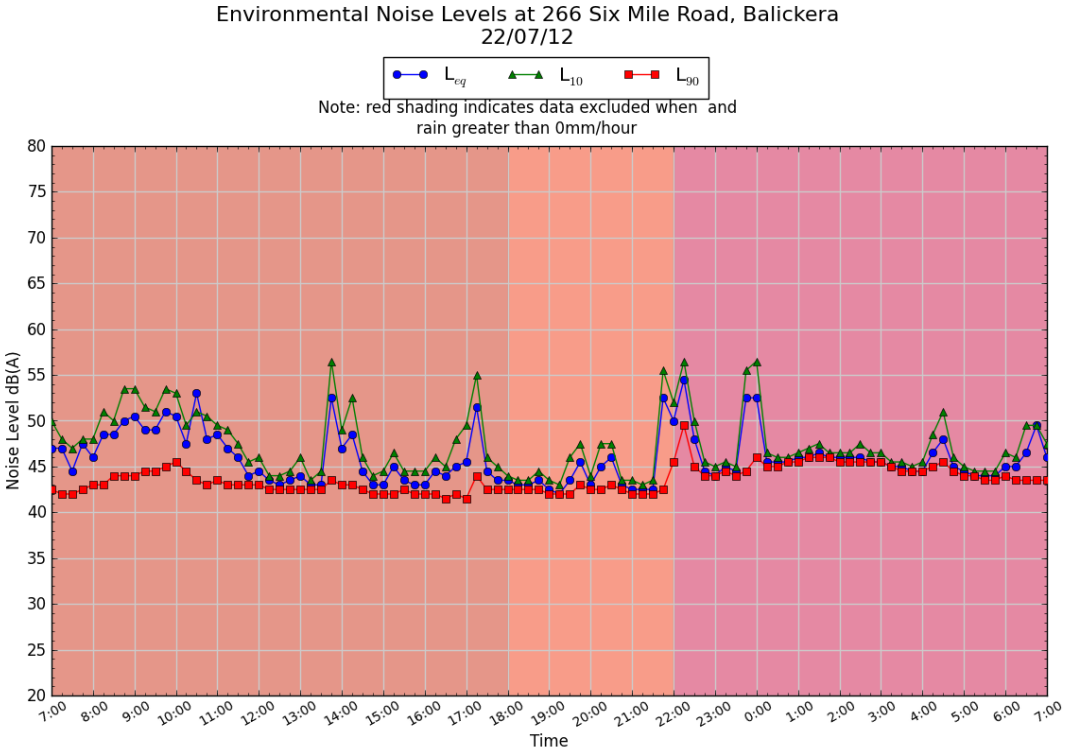
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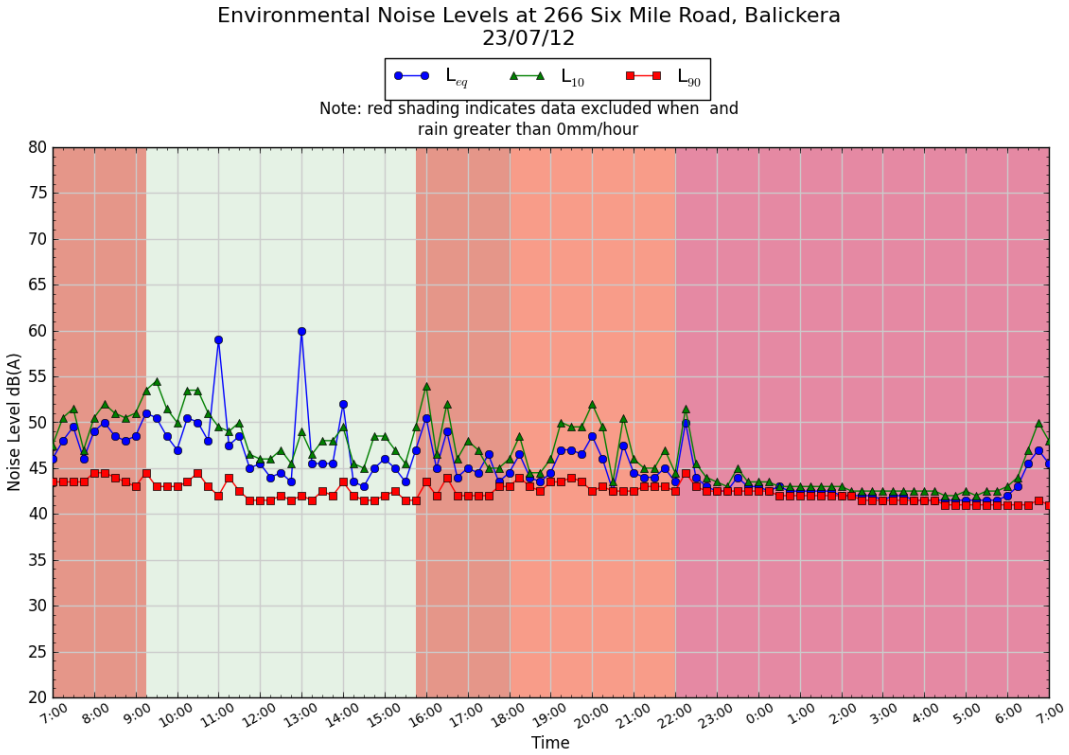
Time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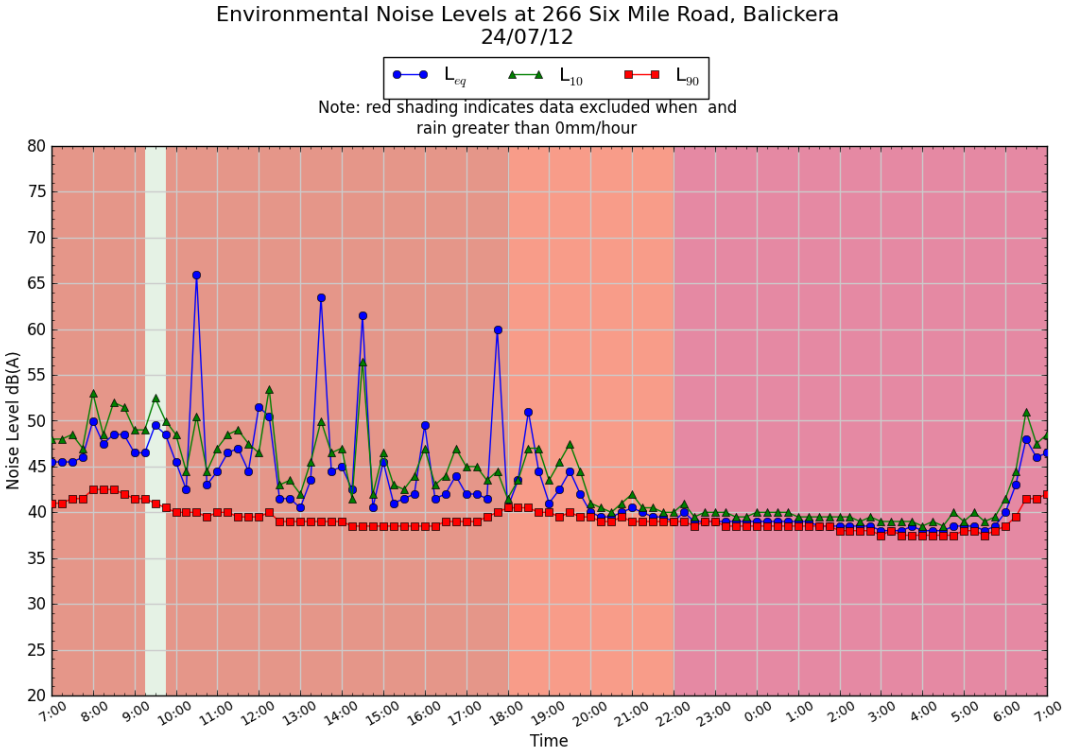
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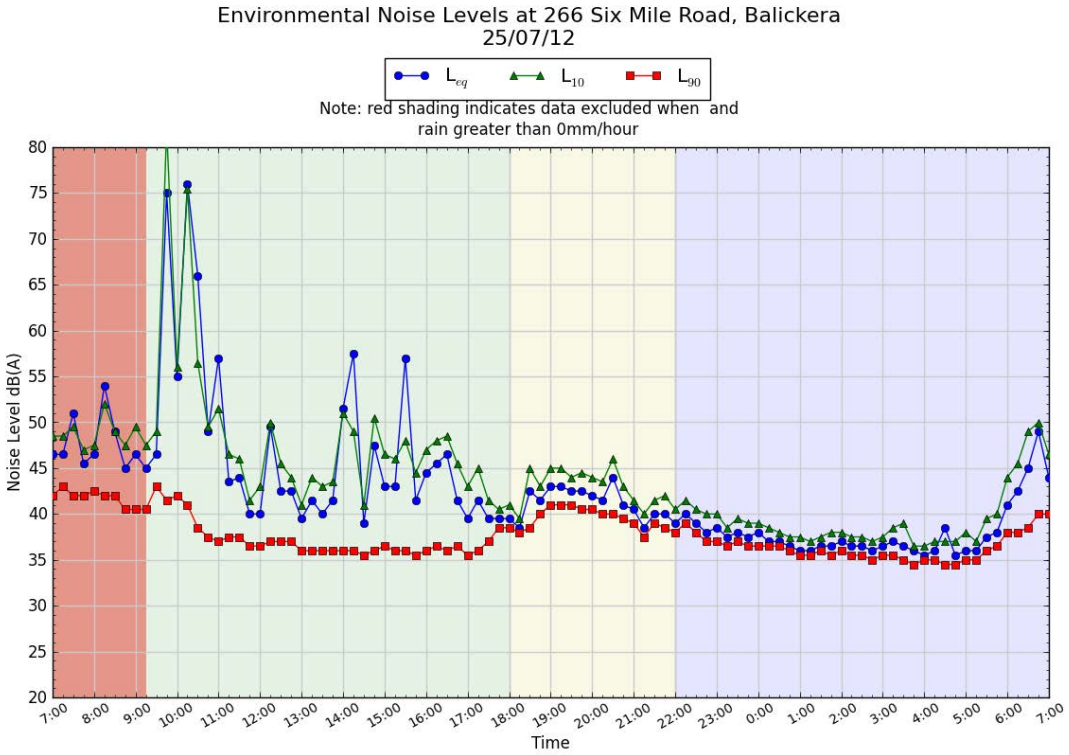
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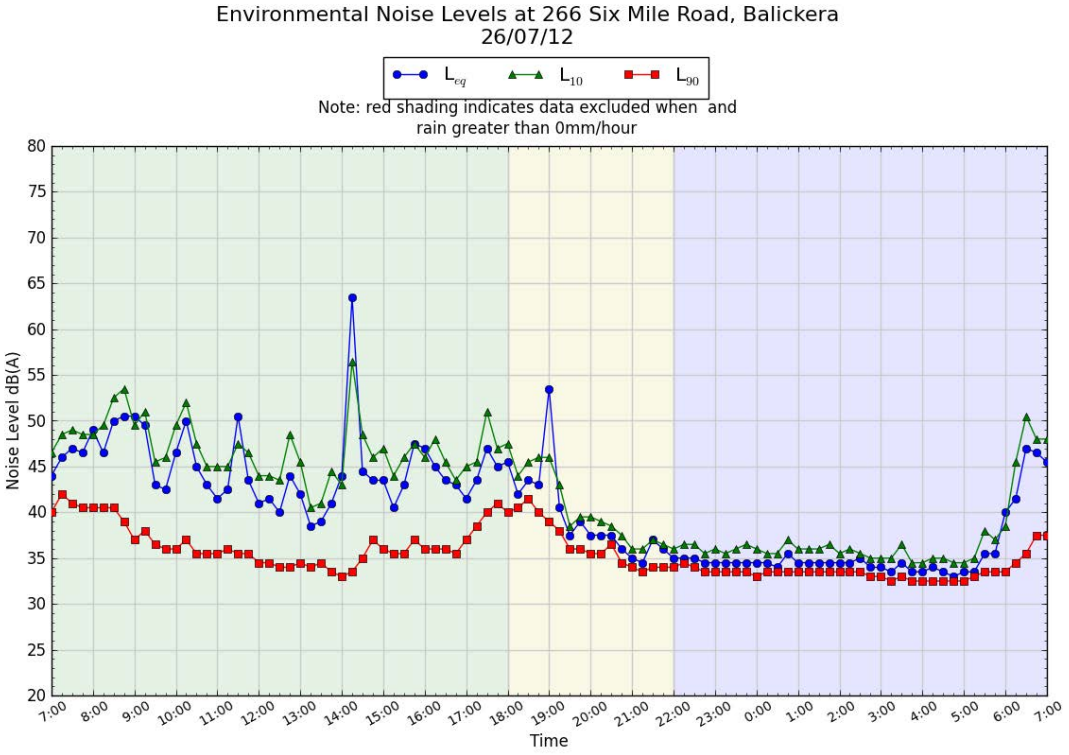
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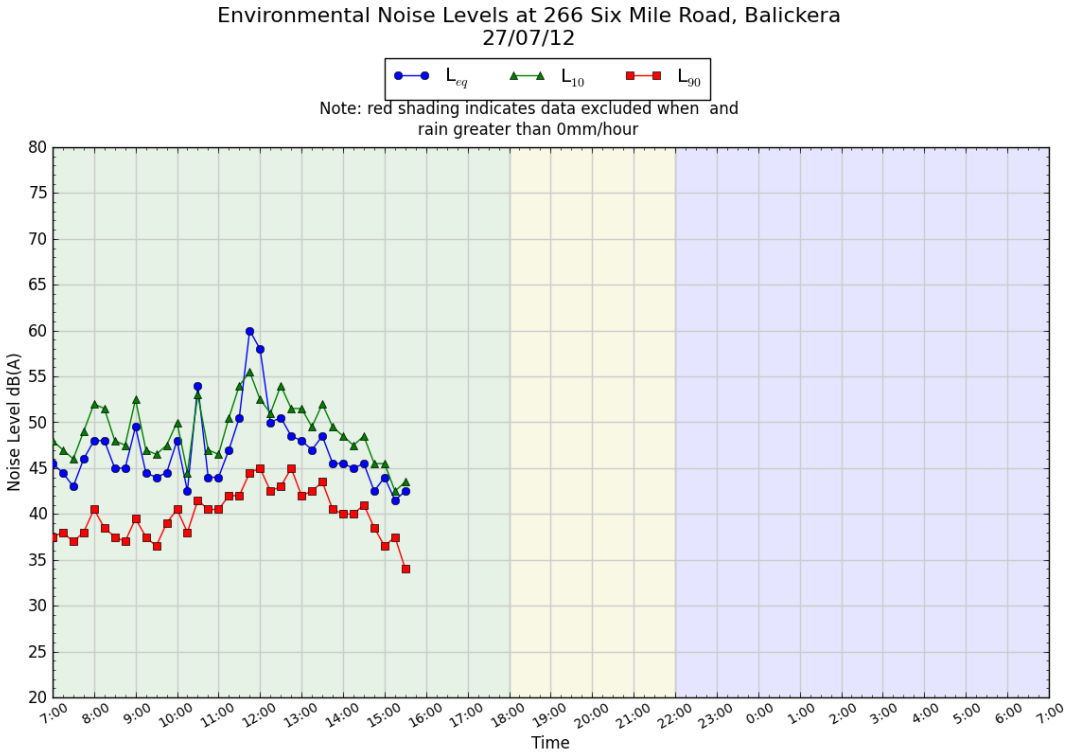
Noise Level dB(A)
Time


Environmental Noise Levels at 266 Six Mile Road, Balickera
27/07/12
L_{eq}
L_{10}
L_{90}
Note: red shading indicates data excluded when and
rain greater than 0mm/hour
Noise Level dB(A)
80
75
70
65
60
55
50
45
40
35
30
25
20
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
Time