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Noise and Blasting Impact Assessment

BYLONG COAL PROJECT
Environmental Impact Statement

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ENVIRONMENTAL CONSULTANTS

Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

Report

BYLONG COAL PROJECT – NOISE AND BLASTING IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

Overview

KEPCO Bylong Australia Pty Ltd is seeking approval for the construction and operation of the Bylong Coal Project (the Project), to recover approximately 124 million tonnes of Run of Mine coal utilising open cut and underground mining methods. The Project's mine life is anticipated to be approximately 25 years, with construction activities occurring in the first two years. Open cut mining areas will be developed following construction and operations will continue for approximately eight years, with underground mining operations commencing in approximately Year 7.

The key potential noise issues for the project were identified as:

- Noise generated by construction and operation activities.
- Blasting overpressure and vibration.
- Rail and road traffic noise.

Existing Environment

The existing acoustic environment was quantified by seasonal long-term and short-term monitoring campaigns from autumn 2012 to summer 2014. The monitoring revealed that the noise environment is typical of a rural area. No significant existing industrial sources were observed. The rating background levels were measured to be at or below 30 dB(A) during the day, evening and night periods.

The meteorological environment was analysed using data from the on-site weather station. The analysis was made with reference to the procedures outlined in the Industrial Noise Policy (INP) (**EPA, 2000**) and the local topography. The analysis indicated dominant winds identified during the daytime from southeast to west-southwest. The occurrence of feature drainage flow winds was identified during the evening and night from the south south east.

The occurrence of temperature inversions was identified to be a feature of the area. The analysis indicated temperature inversions equivalent to stability class F conditions.

Assessment Methodology

The objective of the assessment was to address the Secretary's Environmental Assessment Requirements and Agency requirements.

The conceptual mine plans for the Project were analysed and used to develop detailed noise emission profiles for the key noise generating activities for four staged mine years (Year 3, Year 5, Year 9 and Year 11 onwards for underground only). The four years assessed were considered representative of worst-case operations, where coal and waste production are highest or where operations are located closest to private receivers.

Representative construction scenarios were also assessed to account for earthworks, construction of structures, road upgrade and realignment of Upper Bylong Road and open cut mining establishment.

Assessment criteria for noise and blasting were developed based on current guidelines and policies utilising background noise monitoring results where appropriate.

The operational noise level predictions considered dominant gradient winds, temperature inversions and drainage flow conditions.

The assessment of impacts was made with reference to the INP and the Department of Planning and Environment's *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments* (**DP&E, 2014**).

Operational Noise Impact Assessment

A computer based noise model was developed for the four operational scenarios to predict noise levels at the surrounding sensitive receivers. The noise model included all significant noise sources and accounted for meteorological conditions and attenuation due to ground effects, shielding from topographical features and barriers, air absorption and geometrical spreading.

The four operational noise modelling scenarios were developed based on the number and type of mobile and fixed plant operating during that year. Sound power levels were assigned to each item based on previous measurements, data from other similar operations or published sources.

The initial noise modelling results indicated potentially significant noise exceedances requiring the investigation of noise mitigation options for the Project. The investigation considered up to 18 different scenarios including mitigation of sources and the propagation path. Each mitigation scenario was considered for implementation where feasible and reasonable. The adopted noise mitigation measures were:

- Mitigation of fixed and mobile plant sources including excavators, front-end loaders, haul trucks, dozers, underground mining loaders, water carts, sizers, crusher, the Coal Handing and Preparation Plant, transfer stations, ventilation fans and compressors.
- Alteration of haul route and waste emplacement activities from the North West Overburden Emplacement Area to the South West Overburden Emplacement Area from the Western Mining Area during the day under adverse weather conditions.
- Alteration of haul route and waste emplacement activities from the North West Overburden Emplacement Area to the South West Overburden Emplacement Area from the Western Mining Area and Eastern Mining Area during the night under adverse weather conditions.

With the adopted noise mitigation measures, 12 residual receivers were predicted to be affected by noise above the noise criteria. Of the 12, three are predicted to be significantly impacted (receivers 60, 63 and 69), six moderately impacted (receivers 58, 65A, 68, 141, 151 and 158) and impacts were negligible at the remaining three (receivers 56, 57A and 57C). For the moderately impacted receivers, voluntary at-property mitigation rights should be applied. For significantly impacted receivers, either at-property mitigation or acquisition rights should be applied.

The assessment of affected land parcels indicated that property 69 is predicted to exceed for more than 25% of the property area and is therefore likely to be provided land acquisition rights within the Development Consent.

The assessment indicated that low frequency noise is predicted to be within acceptable levels. The assessment also indicated that no privately owned receiver would experience noise levels above the guideline levels for sleep disturbance, with the exception of receiver 69.

Cumulative noise impacts are not expected to occur due to the absence of existing or proposed industrial noise sources in the area.

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Construction Impact Assessment

The construction impact assessment was conducted using the model developed for the operational assessment. The assessment considered five scenarios including:

1. Bulk earthworks for the establishment of the rail loop and infrastructure areas.
2. Construction of structures for the rail loop and mine infrastructure.
3. Upgrade of Upper Bylong Road between the mine entrance and Bylong Valley Way.
4. Realignment of Upper Bylong Road between the mine entrance and Wooleys Road.
5. Establishment of open cut mining areas and clearing.

The assessment was conducted with reference to the INP for the earthworks, structures and establishment of mining. For the road upgrades, the Interim Construction Noise Guidelines (**EPA, 2009**) was used for the assessment as these activities are not directly related to the establishment of the mine.

The results show that for scenario 1, one receiver (receiver 69) is predicted to be moderately impacted and negligible impacts are predicted at three receivers (receivers 60, 53 and 65A).

For scenario 3, predicted exceedances of the construction noise management level are expected at up to five receivers (receivers 60, 63, 65A, 68 and 69) when works are at their closest to Bylong village. When works are at their furthest, compliance with the noise management levels is predicted.

Predicted noise levels for scenario 5 indicate that compliance with the INP goals would be achieved under daytime neutral and adverse conditions. During the night significant impacts are predicted at receiver 69 and moderate impacts at receivers 60, 65A, 63 and 68.

Construction noise management measures were recommended for receivers affected by scenario 3. For scenarios 1 and 5, the measures recommended as part of the operational assessment are considered sufficient to mitigate impacts at these receivers.

No receivers are predicted to be highly noise affected for any of the construction scenarios.

A construction vibration assessment was conducted and safe working distances for vibration generating activities were developed to minimise adverse impacts.

Road Impact Assessment

The road noise impact assessment used measured traffic volumes to estimate the impact of Project generated traffic on Bylong Valley Way, Wollar Road and Upper Bylong Road.

The assessment concluded that noise level increases associated with Project generated traffic would be within acceptable levels.

Rail Impact Assessment

The rail noise impact assessment was conducted using a relative increase approach with reference to the Rail Infrastructure Noise Guideline (**EPA, 2013**). The assessment utilised existing rail movement data and approved but not yet operating movements on the Sandy Hollow to Gulgong Railway Line to provide an indication of impacts at receivers from the introduction of additional trains from the Project.

The assessment considered the nearest sensitive receivers to the rail line between Bylong to Mangoola and Bengalla to Muswellbrook where it joins the main rail line.

On the Bylong to Mangoola Section, Project traffic generation is predicted to increase the number of receivers by:

- Four, compared with existing rail movements (11 Fontana Way Denman, 12 Fontana Way Denman, 66 Craigend Access Mangoola).
- Three, compared with existing and approved rail movements (11 Fontana Way Denman, 12 Fontana Way Denman, 66 Craigend Access Mangoola).

On the Bengalla to Muswellbrook section, Project traffic generation is predicted to increase the number of receivers by:

- Four, compared with existing rail movements (35 Kenilworth Street Denman, 8 Fontana Way Denman, 15 Fontana Way Denman, 154 Louges Lane Muswellbrook).
- No additional receivers are expected to be impacted compared with existing and approved movements.

Blasting Impact Assessment

The blasting assessment identified a number of blast sensitive features and receivers where no specific criteria exist to assess impacts from blasting vibration and overpressure. Where this occurs, criteria from Australian Standard 2187-2006 for structural damage was used in consideration that further monitoring, condition inspection and trial blasts would be carried out to determine appropriate guideline limits.

The blasting assessment indicated that no privately owned receivers were predicted to be impacted by blast vibration or overpressure levels in excess of the guideline limits.

Blast calculations indicate the heritage receptors including Tarwyn Park, Harley Hill Cottage and Swiss Cottage were predicted to potentially exceed the vibration and overpressure limits due to proximity to the Eastern Open Cut. A blast management plan will need to consider specific heritage receiver mitigation measures at these locations including trial blasts to develop suitable Maximum Instantaneous Charge and blast design to meet vibration limits, blast monitoring, and ongoing condition surveys.

Rock escarpments and rock shelters would also be considered as part of the blast management plan.

Noise and Blast Management and Monitoring

Noise management and monitoring measures have been recommended to assist in the control and reduction of adverse noise impacts. A noise management and a blast management plan are recommended and should include a number of operational considerations and administrative controls to reduce impacts detailed in this report.

A monitoring program is recommended to include a system of real-time unattended and attended noise monitoring. In addition, the use of predictive meteorology is recommended to allow for operational alterations when adverse conditions are predicted.

Site rules will be incorporated into the Noise Management Plan to guide reallocation of mining equipment and operations during periods of adverse meteorological conditions. These rules will include a combination of meteorological predictions and real time monitoring.

Blast overpressure and vibration monitoring is recommended in addition to condition surveys for potentially affected receivers.

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GLOSSARY OF TERMS

Item	Explanation
ABL	The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined by calculating the 10th percentile (lowest 10 percent) background level (L_{A90}) for each period.
Adverse meteorological conditions	Meteorological conditions under which noise propagation is enhanced. This typically includes the presence of wind and temperature inversions.
Ambient Noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
A-weighting	Refers to an adjustment made to noise levels to take into account the frequency composition of an acoustic signal relative to the ear's response to the various frequencies that make up the noise. A-weighting is applied to approximate the perception of noise by an "average" human ear response.
AWS	Automatic weather station.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
C-weighting	Refers to an adjustment made to noise levels to take into account the frequency composition of an acoustic signal relative to the ear's response to various frequencies with added sensitivity in the low frequencies compared with the A-weighting.
CALMET	A meteorological model which includes a diagnostic wind field generator containing objective analysis and parameterised treatment of slope flows, terrain effects and a micro-meteorological model for overland and overwater boundary layers
dB(A)	Decibel level with an applied A-weighting.
dB(C)	Decibel level with an applied C-weighting
dB(Lin)	Decibel level with a Linear weighting i.e. no frequency weighting applied.
Decibel, dB	Decibel is a logarithmic unit used to describe the ratio of a signal level relative to a reference level and is used to describe sound pressure and sound power magnitudes.
H_2	Hydrogen
ICNG	Interim Construction Noise Guidelines
INP	Industrial Noise Policy
L_1	The L_1 level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_1 level for 99% of the time.
L_{10}	The L_{10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{10} level for 90% of the time. The L_{10} is a common noise descriptor for environmental noise and road traffic noise.
L_{50}	The L_{50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{50} level for 50% of the time.
L_{90}	The L_{90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{90} level for 10% of the time. This measure is commonly referred to as the background noise level.
L_{eq}	The equivalent continuous sound level (L_{eq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
L_{max}	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
L_n	The level exceeded for N% of the monitoring time.
Neutral meteorological conditions	Meteorological conditions under which no enhancements to noise propagation are present, i.e. temperature inversions and windy conditions.
Peak Particle Velocity (PPV)	The peak particle velocity is a measure of the maximum instantaneous velocity of a particle during a given time period.
RBL	The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night-time.
Rw	Weighted sound reduction index. Rw is measured in a laboratory. Rw is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.

Item	Explanation
Sound Power Level (SWL)	A logarithmic measure of source acoustic power expressed in dB. The sound power level is fixed and inherent to the source similar to how electric power is inherent to an electrical device. The resulting sound pressure level due to a given sound power level is dependent on various environmental factors such as distance, acoustic shielding, meteorological factors etc.
Stability Class	The system of classifying atmospheric stability using considerations of solar radiation, surface wind speed, cloud cover and temperature lapse rate. The scale ranges from A (strongly unstable) to F (moderately stable). Typically Stability Class D is considered to represent neutral atmospheric conditions and the conventional temperature gradient, typical of daytime conditions. Stability Class F is considered to represent stable atmospheric conditions when a moderate temperature inversion is present.
TAPM/	The Air Pollution Model that predicts three-dimensional meteorology and air pollution concentrations (designed by CSIRO)
Temperature Inversion	An atmospheric condition when the temperature gradient in the air is inverted so that sound waves are refracted in the air back towards the ground, enhancing the distance over which noise propagates.
Vibration Dose Value (VDV)	The vibration does value defines a relationship that provides a consistent assessment of vibration which correlates well with receivers responses taking into account the magnitude and duration of vibration exposure as defined in *BS6472 2008 Guide to evaluation of human exposure to vibration in buildings.*

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1 INTRODUCTION

1.1 Background

In December 2010 KEPCO Bylong Australia Pty Ltd (KEPCO) acquired Authorisations (A) 287 and 342. Since this time, extensive exploration and mine planning work has been undertaken to determine the most socially responsible and economically viable mine plan to recover the known coal resources within the two Authorisations.

In August 2014 KEPCO commissioned WorleyParsons Services Pty Ltd (WorleyParsons) to manage the Project exploration activities, mine feasibility study planning, environmental approvals and ongoing environmental monitoring for the Bylong Coal Project (the Project).

The Project is located wholly within A287 and A342 which are located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA). The closest regional centre is Mudgee, located approximately 55 km south west of the Project Boundary. The Project is approximately 230 km by rail from the Port of Newcastle. **Figure 2.1** illustrates the locality of the Project within New South Wales (NSW). **Figure 2.3** shows the regional locality of the Project in relation to the neighbouring town centres, mining authorities, major transport routes and reserves.

KEPCO is seeking State Significant Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the development and operation of the Project. The State Significant Development Application will be supported by an Environmental Impact Statement (EIS), which is being prepared by Hansen Bailey.

Pacific Environment Limited (PEL) has been commissioned by Hansen Bailey, on behalf of WorleyParsons, to prepare a Noise and Blasting Impact Assessment for the Project.

1.2 Study Requirements

The noise and blasting assessment considers the following aspects of the Project:

- Operational Noise;
- Rail Noise;
- Road Traffic Noise;
- Blasting Overpressure and Vibration;
- Construction Noise and Vibration; and
- Cumulative Noise.

The Noise and Blasting Assessment is guided by the Secretary's Environmental Assessment Requirements (SEARs) and Agency requirements, as outlined in **Table 1-1**.

The assessment of these issues was conducted in consideration of the following policies and guidelines, currently in use in NSW including:

- Industrial Noise Policy (INP) (**EPA, 2000**).
- Industrial Noise Policy Application Notes (**DECC, 2008**),
- Road Noise Policy (RNP) (**DECCW, 2011**).
- Noise Criteria Guideline (NCG) (**RMS, 2014**).
- Rail Infrastructure Noise Guidelines (RING) (**EPA, 2013**).
- Interim Construction Noise Guidelines (ICNG) (**DECC, 2009**).
- Assessing Vibration: A Technical Guideline (**DEC, 2006**).
- Australia and New Zealand Environmental Council (ANZEC) Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC guidelines) (**ANZEC, 1990**).

- Department of Planning and Environment (DP&E) Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (**DP&E, 2014**).
- Australian Standard 2182.2: 2006
- British Standard 7385.2: 1993

Table 1-1: Agency Requirements for Noise and Blasting Assessment

Requirement	Agency	Relevant section of report
Noise and Blasting including:	NSW DPE	
▪ An assessment of the likely operational noise impacts of the development (including construction noise) under the NSW Industrial Noise Policy, paying particular attention to the obligations in chapters 8 and 9 of the policy;		Sections 3, 4, 5 and 7
▪ If a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;		Sections 4.3 and 7
▪ An assessment of the likely road noise impacts of the development under the NSW Road Noise Policy;		Section 9
▪ An assessment of the likely rail noise impacts of the development under the NSW Rail Infrastructure Noise Guideline; and		Section 8
▪ An assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant features, having regard to the relevant ANZEC guidelines;		Section 10
Potential impacts on the noise amenity of the surrounding area should be assessed in accordance with the NSW Government's Industrial Noise Policy (INP) and other relevant guidelines mentioned below accounting for all noise sources associated with the project. In particular, seasonality assessments are to be undertaken to assess the impact of temperature inversions and wind conditions.	Environmental Protection Agency	Sections 3, 5, 7, 8, 9 and 10
The noise assessment must include (but not be limited to) an assessment of the C-weighted noise (low frequency) as well as A-weighted noise.		Section 5
In relation to noise the following matters should be addressed (where relevant) as part of the Environmental Assessment:		
Construction noise associated with the proposed development should be assessed using the Interim Construction Noise Guideline (DECC, 2009)		Section 7
Operational noise from all industrial activities (including private haul roads and private railways lines) to be undertaken on the premises must be assessed in accordance with the guidelines contained within NSW Industrial Noise Policy (**EPA, 200**) and Industrial Noise Policy Application Notes.		Section 5
Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the Assessing Vibration: a technical guideline (**DEC, 2006**)		Sections 7 and 10
If blasting is required for any reasons during the construction or operation stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in Australian and New Zealand Environment Council Technical basis for guidelines to minimise annoyance due to blasting operations and ground vibration (**ANZEC 1990**).		Section 10
Clearly identify the noise management strategies to be implemented including but not necessarily limited to, the: ▪ Use of real time noise monitoring management procedures and response trigger levels and predictive noise/meteorological monitoring/modelling for noise management; and ▪ Noise management procedures/options for affected residences		Sections 5 and 11
Undertake a road traffic noise assessment in accordance with the requirements of the NSW Road Noise Policy and should include an		Section 9

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Requirement	Agency	Relevant section of report
assessment of noise on existing, new or upgraded roads from increased road traffic generated by the project.		
Noise Impact ▪ The SEARs should include a requirement for a detailed Noise Assessment Report covering the whole Bylong Valley and the potential impact on Bylong Upper Public School.	Mid-Western Regional Council	All sections
The impact on the fabric and significant of any identified heritage items from potential subsidence of blasting from mining activities should also be assessed as part of the EIS.	Heritage Council of NSW	Section 10

2 PROJECT DESCRIPTION

2.1 The Site

The Project life is anticipated to be approximately 25 years, comprising an approximate two year construction period and a 23 year operational period, with open-cut mining during Years 3 to 10 and underground mining operations commencing in Year 7. Various rehabilitation and decommissioning activities will be undertaken during both the course of, and following the 25 years of the Project.

A conceptual project layout is shown in **Figure 2.2**. The Project comprises of the following main aspects:

- The initial development of two open cut mining areas with associated haul roads and Overburden Emplacement Areas (OEAs), utilising a mining fleet of excavators, trucks and supporting ancillary equipment.
- The two open cut mining areas will be developed and operated 24 hours a day, 7 days a week over a period of approximately 10 years and will ultimately provide for the storage of coal processing reject materials from the longer term underground mining activities.
- Construction and operation of administration, workshop, bathhouse, explosives magazine and other open cut mining related facilities.
- Construction and operation of an underground coal mine operating 24 hours a day, 7 days a week for a 20 year period, with mining activities commencing in around year 7 of the Project.
- A combined maximum extraction rate of up to 6.5 Million tonnes per annum (Mtpa) Run of Mine (ROM) coal.
- A workforce of up to approximately 800 during the initial construction phase and a peak of 470 full-time equivalent operations employees at full production.
- Underground mining operations utilising longwall mining techniques with primary access provided via drifts constructed adjacent to the rail loop and the Coal Handling and Preparation Plant (CHPP).
- The construction and operation of facilities to support underground mining operations including personnel and materials access to the underground mining area, ventilation shafts, workshop, offices and employee amenities, and fuel and gas management facilities.
- Construction and operation of a CHPP with a designed throughput of approximately 6 Mtpa of ROM coal, with capacity for peak fluctuations above this rate.
- The dewatering of fine reject materials through belt press filters within the CHPP and the co-disposal of dewatered fine and coarse reject materials within OEAs and final open cut voids (avoiding the need for a tailings dam).
- Construction and operation of a rail loop and an associated rail load out facility and connection to the Sandy Hollow to Gulgong Railway Line to facilitate the transport of product coal.

- The construction and operation of surface and groundwater management and water reticulation infrastructure including diversion drains, dams (clean, dirty and raw water), pipelines and pumping stations.
- The installation of communications and electricity reticulation infrastructure.
- Construction and operation of a Workforce Accommodation Facility (WAF) and associated access road from the Bylong Valley Way.
- The upgrade of Upper Bylong Road and the construction and operation of a Mine Access Road to provide access to the site facilities.
- Relocation of sections of some existing public roads to enable alternate access routes for private landholders surrounding the Project.
- Infilling of mining voids, progressive rehabilitation of disturbed areas, decommissioning of Project infrastructure and rehabilitation of the land progressively following mining operations.

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Figure 2.1: Project Locality

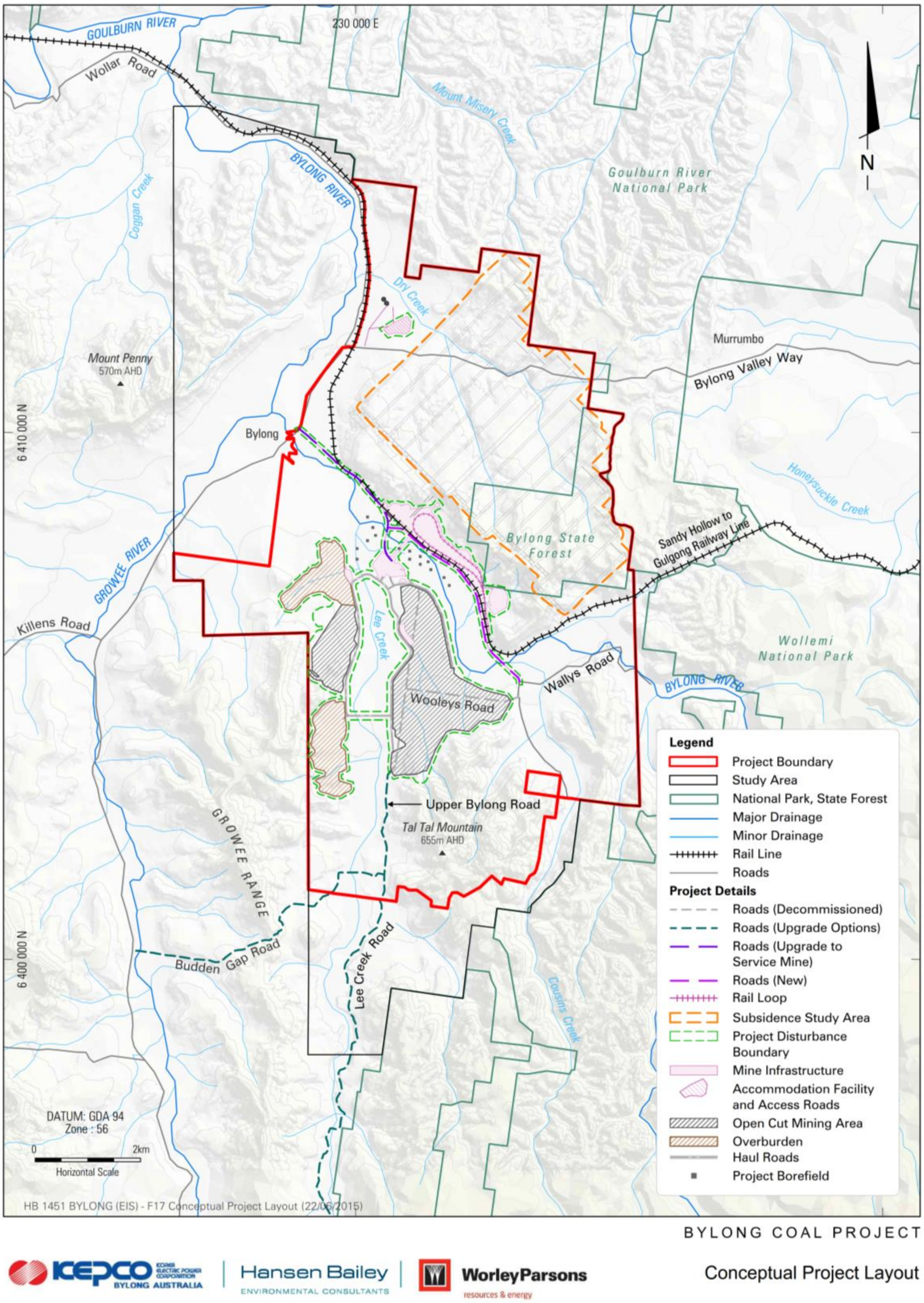


Figure 2.2: Conceptual Project Layout

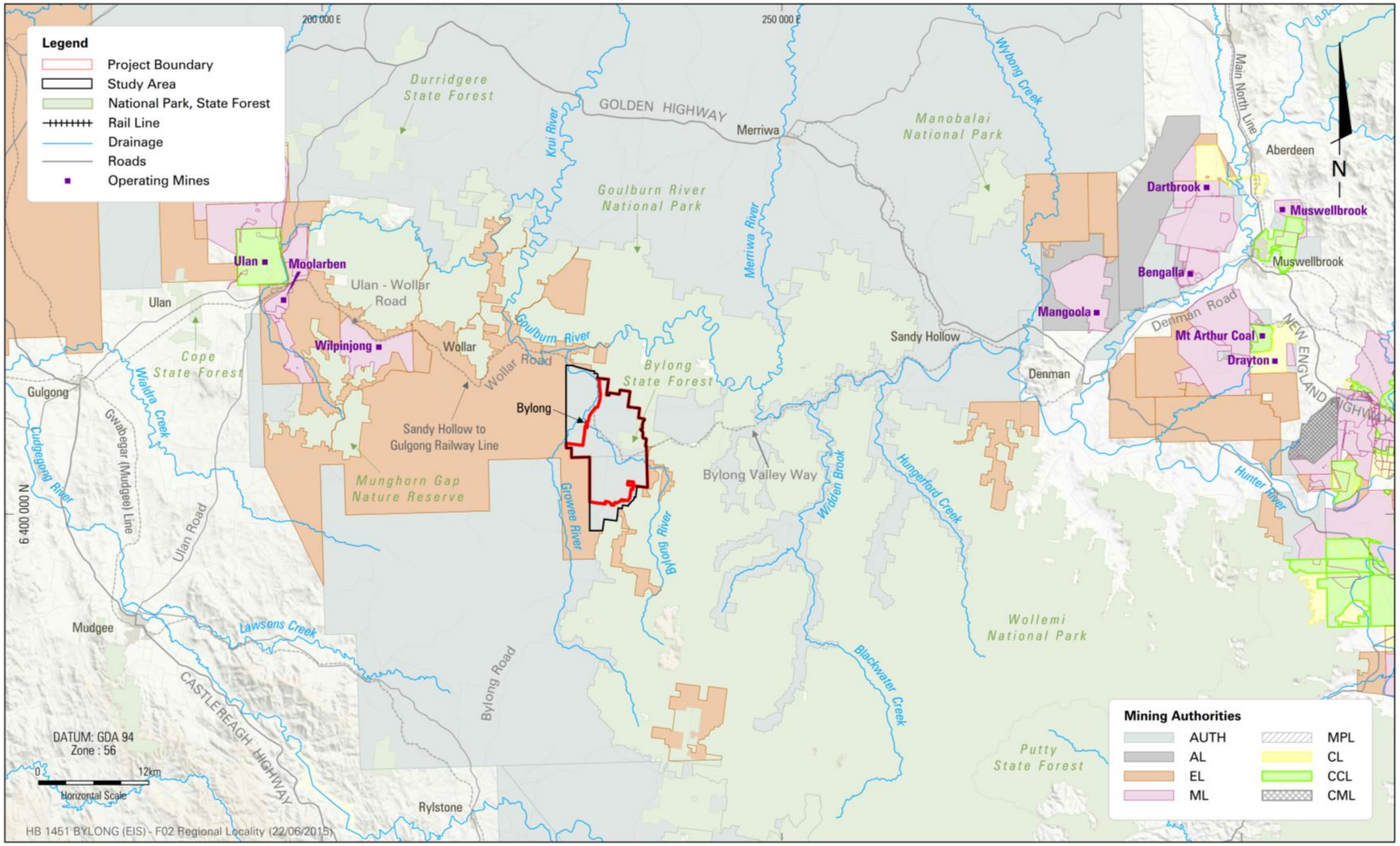
2.2 Local Setting

The Project is located wholly within Authorisation (A) 287 and A342 (the Authorisations) which are located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA) and cover an area of approximately 10,300 hectares, as shown in **Figure 2.3**. The Project is located approximately 55 km southwest of Mudgee and approximately 230 km by rail from the Port of Newcastle.

The Project Boundary is located partly on cleared and pasture improved agricultural land within the lower valley areas and native woodland and forest within the more elevated Bylong State Forest and other portions of Crown Land. The land within the Project Boundary is currently being utilised for fodder cropping and grazing activities on the lower slopes and cattle grazing on the steeper slopes. The small settlement of Bylong Village is located to the northwest of the Project Boundary.

The land within the Project Boundary comprises complex topography. To the northwest of Bylong Village is Mt Penny, rising to a height of approximately 570 m Australian Height Datum (AHD). Goulburn River National Park is located immediately northeast of the Project Boundary with the Wollemi National Park to the east and southeast of the Project Boundary. The Growee Range borders the south western side of the Project Boundary. A northwest to southeast oriented ridge is located to the immediate northeast of the proposed open cut areas and mine infrastructure areas, rising to a height of approximately 480 m AHD and comprising the Bylong State Forest. Located south of the proposed open-cut area is Tal Tal Mountain, rising to a height of approximately 655 m AHD. Topography for the local area and surrounds is shown in **Figure 2.4**.

Land ownership and receiver locations are illustrated in **Figure 2.5** and **Figure 2.6**. Since purchasing the Project in 2010, KEPCO has acquired a substantial proportion of the freehold land within the Project Boundary. It is noted that there are two sensitive receivers (142A and 142B) shown on **Figure 2.5** and **Figure 2.6** that will not exist at time of mining. These properties are owned by the Department of Education and Communities who has confirmed that they will either decide to relocate or permanently close the school in the future. The Department of Education and Communities has confirmed that the school in its current location does not need to be assessed as a sensitive receiver and accordingly these receivers have not been further assessed in this report.



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Regional Locality

Figure 2.3: Local Setting

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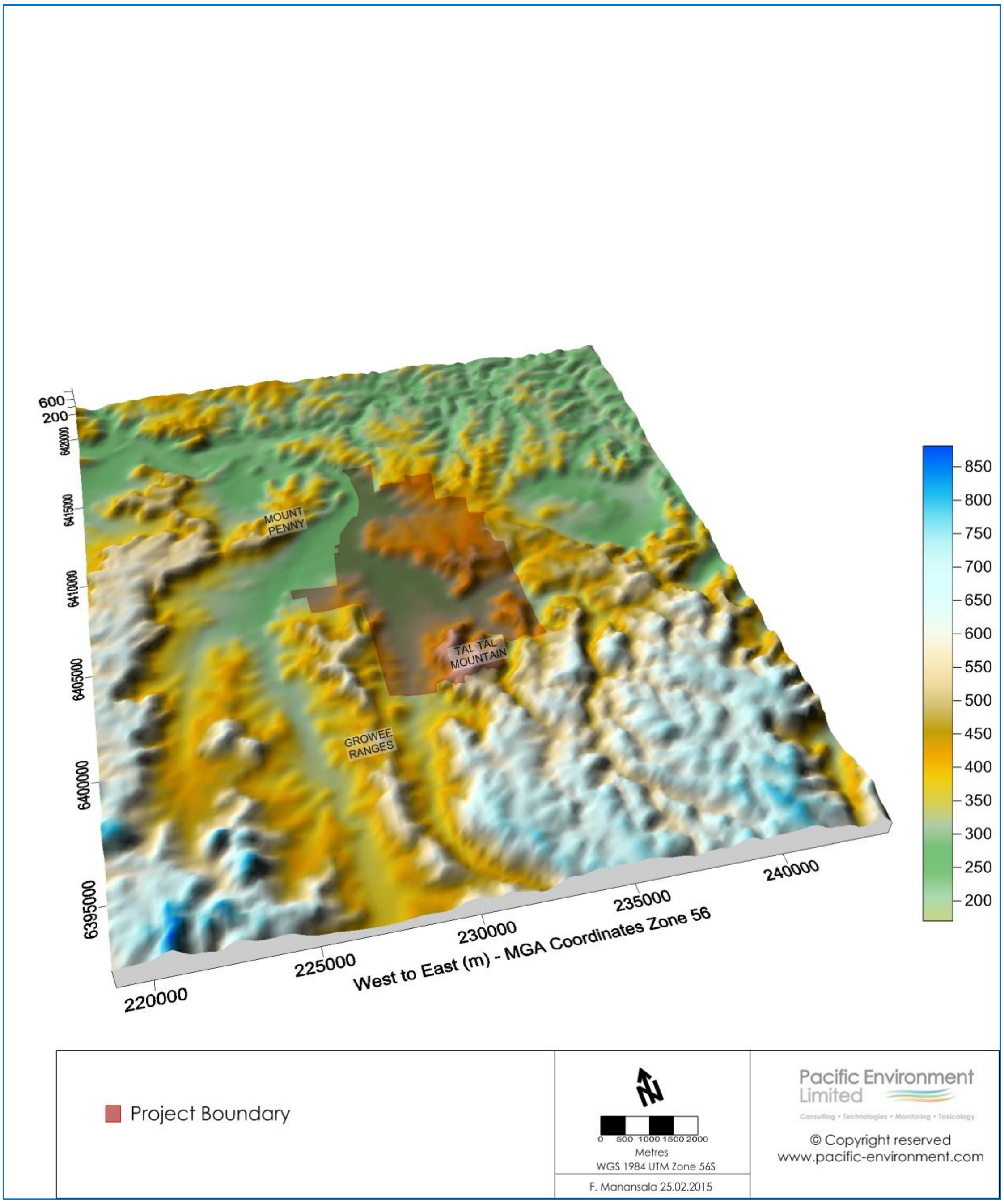

Figure 2.4: Pseudo 3-D Representation of Regional Topography

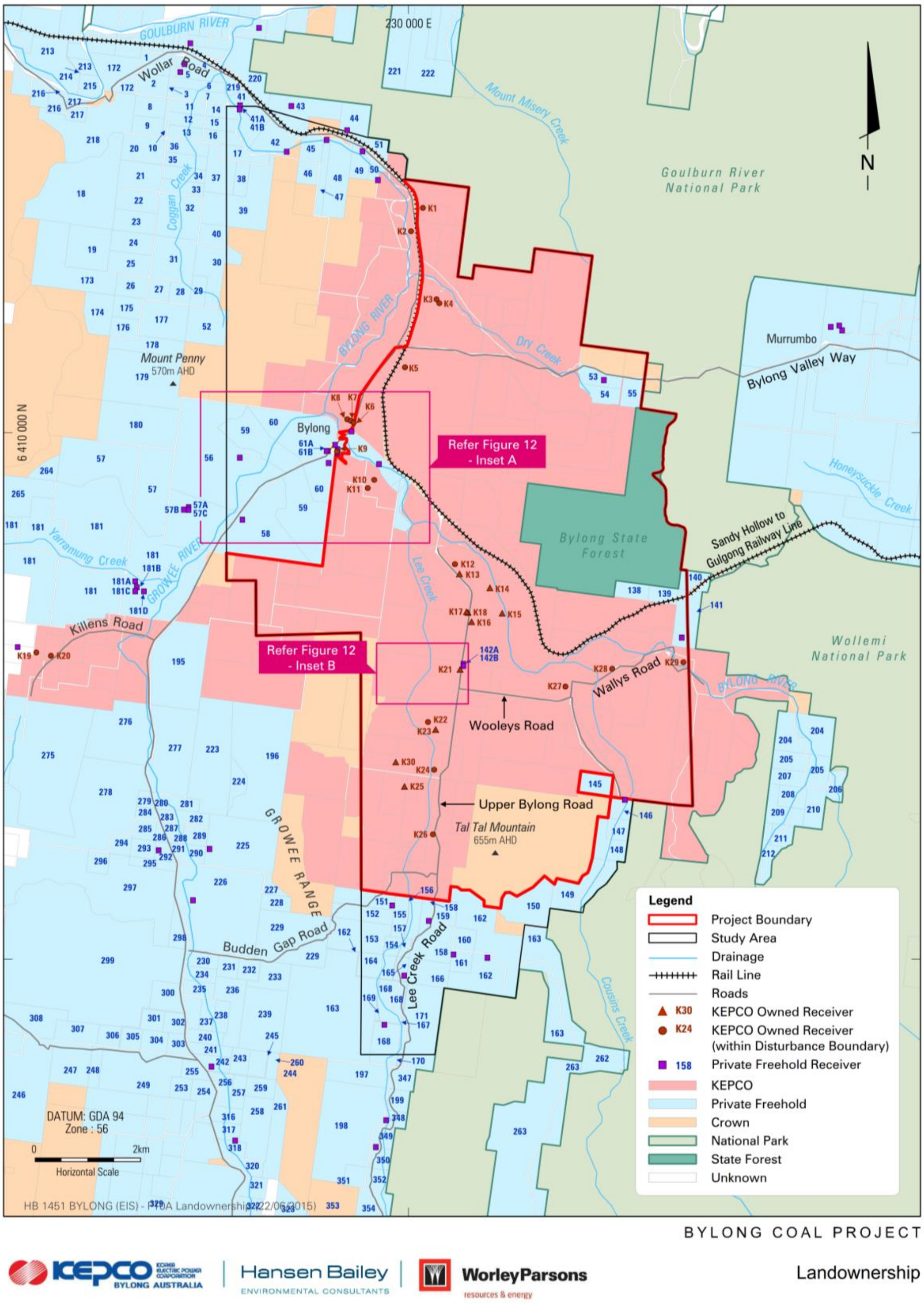

Figure 2.5: Land Ownership

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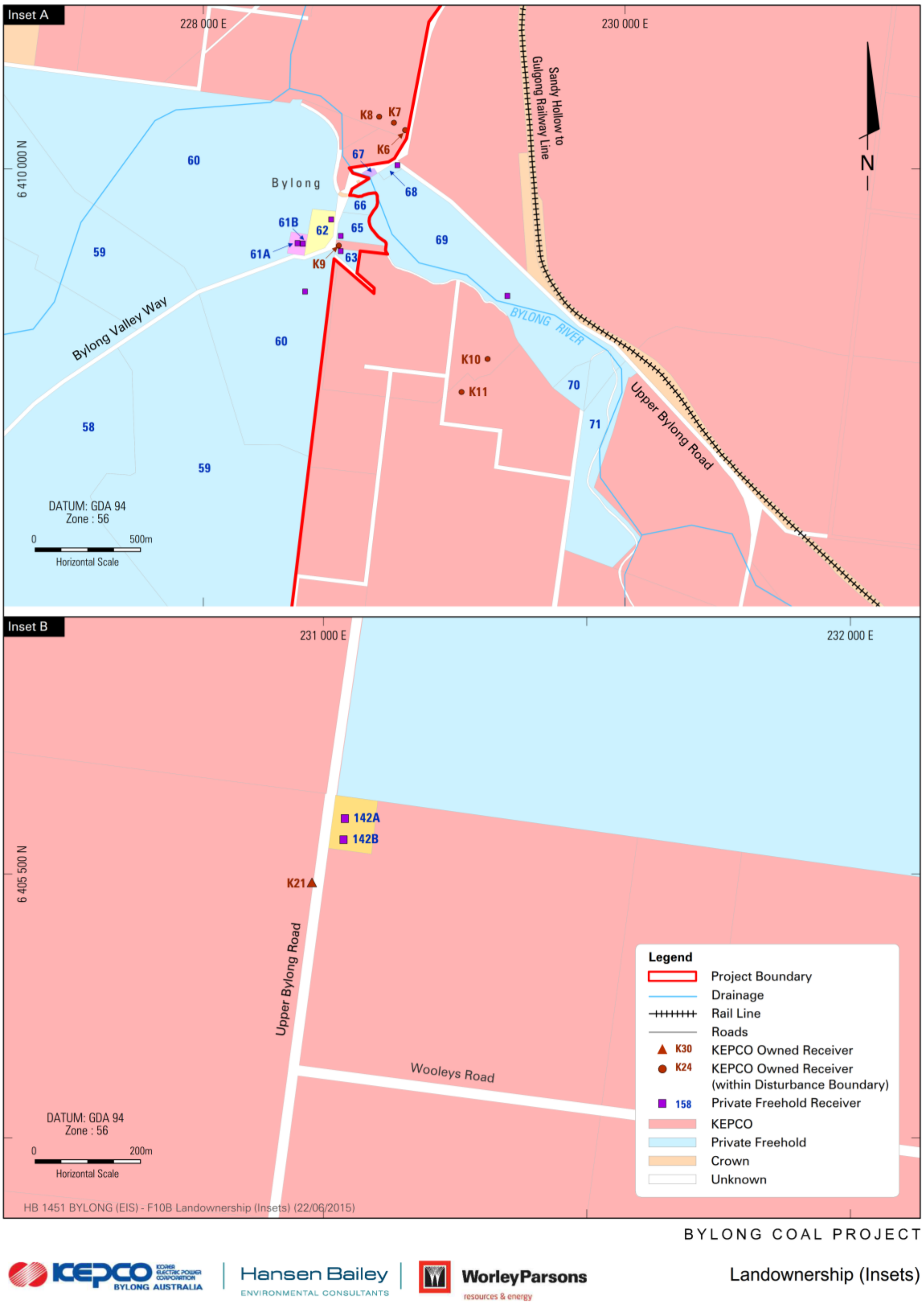

Figure 2.6: Land Ownership - inset

2.3 Noise Sensitive Receivers

There are a number of noise sensitive receivers located in the vicinity of the Project. Receiver locations are shown in **Figure 2.5** and **Figure 2.6.** A full list of receiver locations is presented in **Appendix A**. The majority of receivers are residential receivers. Other sensitive receivers include:

- Active Recreational Area – Bylong Community Sports Ground (located in Bylong Village).
- Passive Recreational Area – Wollemi and Goulburn River National Park.
- Place of Worship – St Stephens Church (located in Bylong Village).
- Passive Recreation Area – St Stephens Church graveyard.
- Commercial Premises - Bylong General Store (located in Bylong Village).
- Industrial – Bylong Quarry.

Receivers located within the open cut mining footprint are KEPCO, owned with the exception of Bylong Upper Public School (discussed **Section 2.2**) and have not been assessed.

2.4 Blast Sensitive Receivers and Features

A number of blast sensitive receivers and features are located within the vicinity of the Project.

In addition to residential receivers, blast sensitive features include Aboriginal and European Heritage artefacts, cliff escarpments, built infrastructure such as roads, the railway line and associated structures.

Table A-2 in **Appendix A** provides a list of the blast sensitive receivers and features identified for the Project. **Figure 2.7** shows the location of the heritage, infrastructure and significant cliff lines features.

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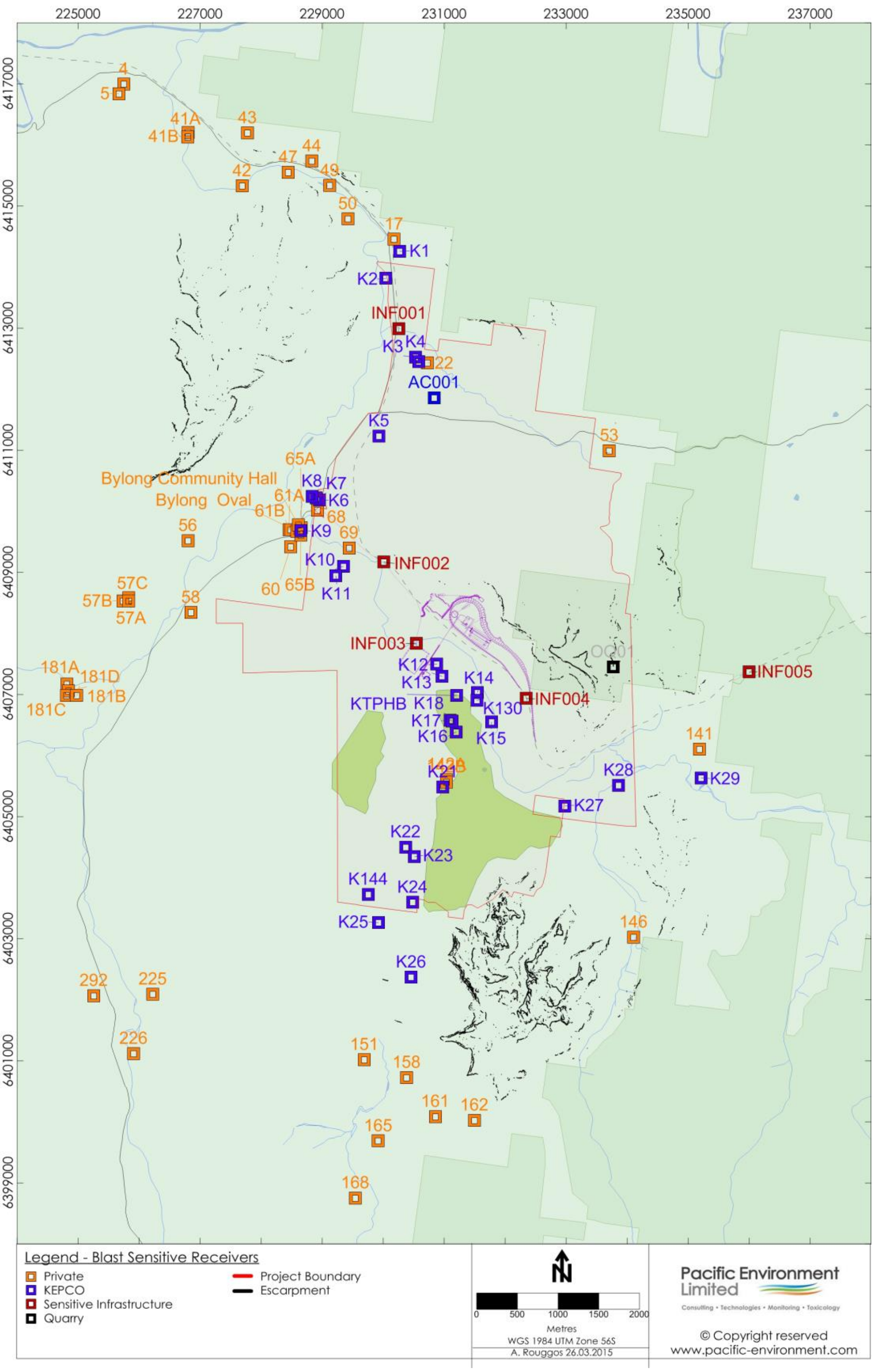

a)

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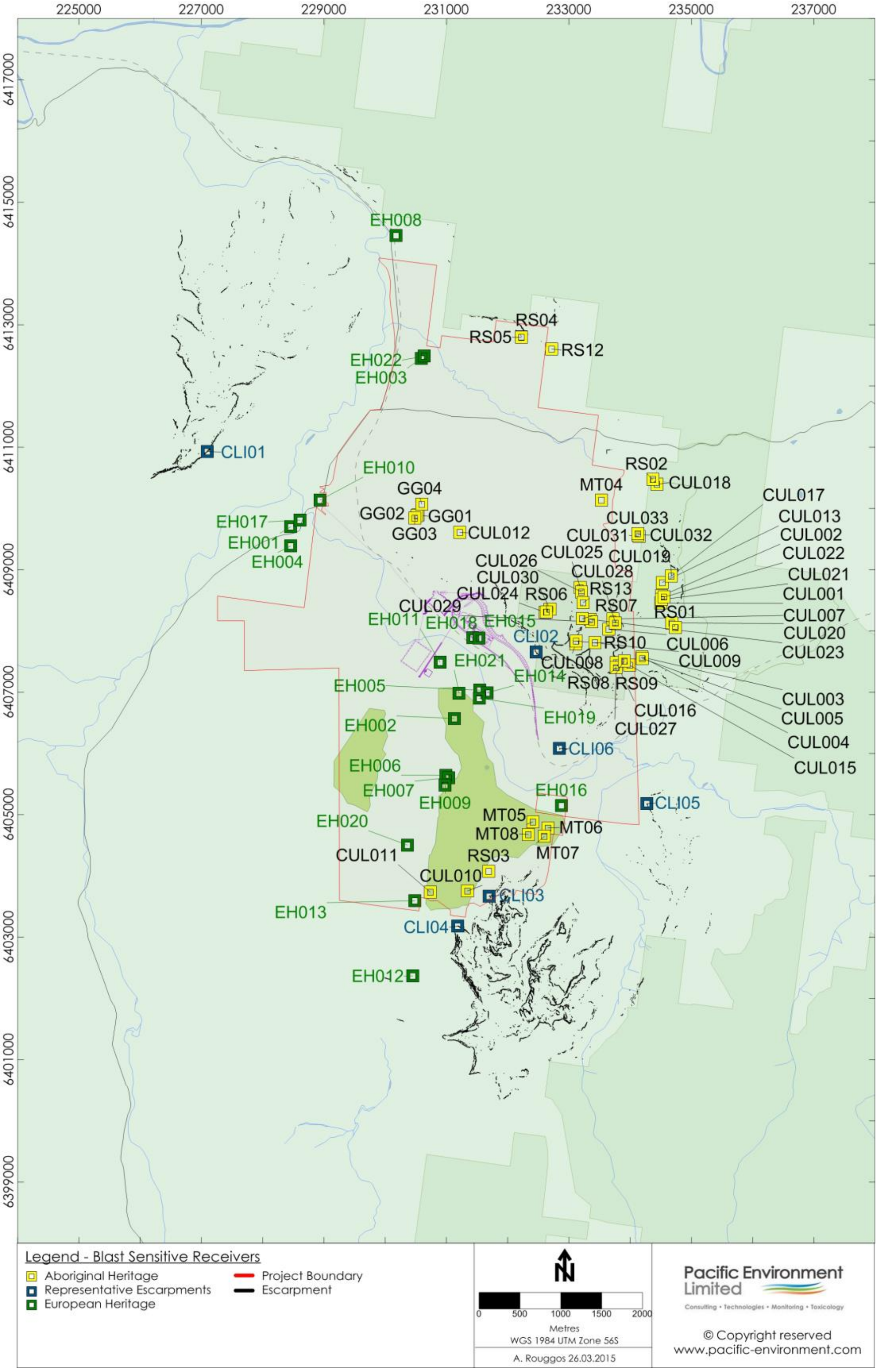

b)

Figure 2.7: Blast Sensitive Receivers comprised a) private, KEPCO, infrastructure and commercial; and b) heritage receivers.

3 EXISTING ENVIRONMENT

3.1 Existing Noise Environment

An extensive campaign of seasonal background noise monitoring was undertaken. Eight periods of background noise monitoring were undertaken between autumn (May) 2012 and summer (February) 2014. Unattended background noise monitoring was carried out at the five locations shown in **Table 3-1** and **Figure 3.1** during these monitoring periods.

Table 3-1: Noise Monitoring Locations, MGA Zone 56

Location ID	Location Name	Easting (m)	Northing (m)
BG01	Bylong Station	231037	6412301
BG02	Bylong Village	228734	6409666
BG03	Wingarra	225001	6406386
BG04	Harley Hill	230407	6402297
BG05	Redbank Cottage	231533	6400082

The five monitoring locations are situated in a rural setting with no appreciable existing industrial noise sources in their vicinity. BG01 and BG02 are located on farmland while BG04 and BG05 are located within the grounds of residential dwellings. BG03 is located on a farm in the vicinity of residential buildings. The monitoring locations are presented in **Figure 3.1**.

The noise loggers were set to record A-weighted noise levels every 15 minutes and set to 'fast' response time. Calibration was checked before and after each measurement with no significant drift observed.

For the duration of monitoring, weather conditions were recorded at the Project's automatic weather station (AWS). Where weather conditions unsuitable for noise monitoring occurred, as defined in the INP, the monitoring data was filtered accordingly. Data was also excluded for identified extraneous noise events.

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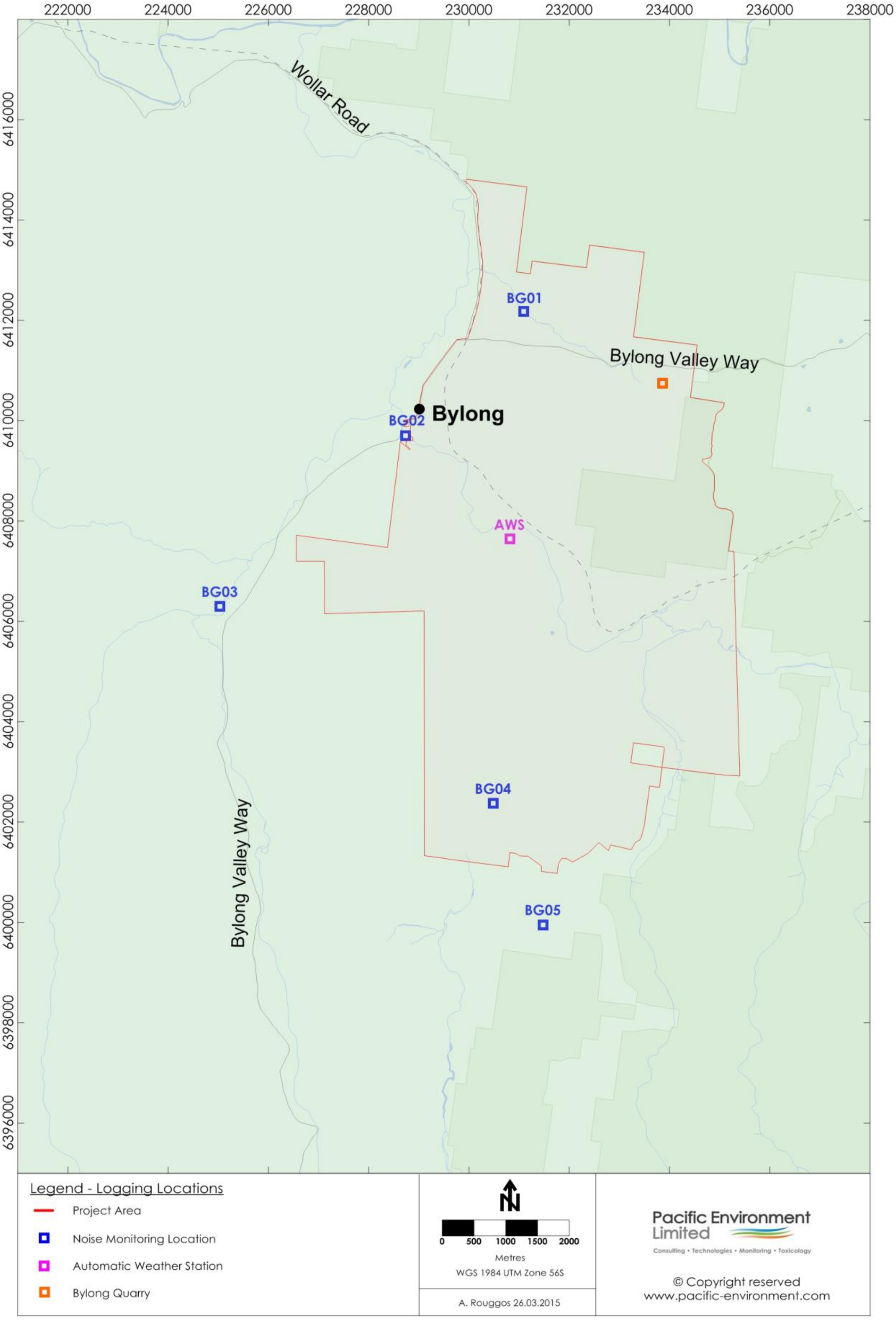

Figure 3.1: Noise Monitoring Locations

A review of the noise monitoring results revealed that where the Rating Background Levels (RBL's) were not affected by fauna (frog or insect) noise, the minimum and median measured RBL's at all locations were 30 dB(A) or less. As stated in Section 3.1.2 of the INP:

"Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A)."

A review of the unattended noise measurements revealed background noise levels typical of a rural environment Project area. Measured noise levels were generally controlled by non-anthropogenic sources.

During site visits for unattended noise measurements, no significant industrial noise sources were observed. On one occurrence, industrial noise from mobile plant was observed to be just audible at BG01, assumed to be from Bylong Quarry, however this was not observed on subsequent visits and is assumed to be a temporary occurrence and not a significant contributor to ambient noise profiles at this location.

Table 3-2 presents a summary of the Project's RBL's. Based on site observations, no significant industrial noise was apparent during the noise monitoring. Detailed results of the seasonal noise monitoring are contained within **Appendix B**.

Table 3-2: Project Rating Background Level

Location	Rating Background Level, dB(A)		
	Day	Evening	Night
All Monitoring Locations (BG01-BG05)	30	30	30

3.2 Meteorological Analysis

Meteorology data recorded at the Project's AWS has been referenced in determining the likelihood of noise enhancing weather conditions.

Meteorological features were determined in accordance with the INP to identify the likelihood of weather conditions which may increase noise levels at sensitive receivers in the project area.

A noise enhancing wind is considered to be a feature of the site if winds 3 m/s or below occur for more than 30% of the time in any assessment period in any season.

Table 3-3 presents statistical analysis of wind speeds and directions.

Table 3-3: Wind Frequency by Assessment Period under 3 m/s

Wind Direction	Wind Frequencies, % of Season and Time Period (< 3 m/s)											
	Summer			Autumn			Winter			Spring		
	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night
N	2%	0%	0%	1%	0%	0%	1%	1%	0%	3%	2%	1%
NNE	1%	0%	0%	1%	0%	0%	1%	1%	0%	3%	2%	0%
NE	3%	1%	0%	3%	1%	0%	1%	0%	0%	5%	1%	0%
ENE	**3%**	0%	0%	**5%**	0%	0%	1%	1%	0%	5%	2%	0%
E	**13%**	**9%**	0%	**7%**	**2%**	0%	3%	2%	0%	6%	**4%**	1%
ESE	**15%**	**40%**	**16%**	**11%**	**10%**	**2%**	5%	1%	2%	6%	**20%**	**6%**
SE	**8%**	**25%**	**38%**	**8%**	**23%**	**17%**	**8%**	**9%**	**6%**	5%	**13%**	**19%**
SSE	**3%**	**7%**	**19%**	**7%**	**18%**	**25%**	**8%**	**14%**	**15%**	3%	**9%**	**23%**
S	5%	**2%**	**10%**	**7%**	**18%**	**24%**	**6%**	**10%**	**19%**	4%	**8%**	**15%**
SSW	2%	2%	**5%**	**8%**	**6%**	**12%**	**4%**	**16%**	**14%**	2%	8%	**8%**
SW	2%	2%	3%	**6%**	7%	**9%**	**7%**	**17%**	**20%**	5%	8%	**14%**
WSW	2%	2%	1%	4%	6%	6%	**8%**	**13%**	**13%**	4%	6%	3%
W	3%	1%	0%	4%	4%	1%	**6%**	**9%**	**4%**	4%	2%	3%
WNW	1%	1%	0%	2%	0%	0%	4%	1%	1%	3%	2%	0%
NW	3%	1%	0%	2%	0%	0%	2%	2%	2%	3%	1%	1%
NNW	2%	1%	0%	3%	0%	0%	2%	1%	0%	3%	1%	1%

Note: Bolded text indicates a dominant wind direction where the sum of components occur for 30 percent of the time.

Wind directions were identified as dominant considering adjacent wind directions and summing the total percentage occurrence.

Dominant winds were identified during the daytime from east south east to the south. During the evening dominant winds were identified between east southeast and west southwest. Dominant winds were identified during the night between south east and west southwest.

The potential for drainage flows is considered likely due to the location of the sources and receivers within the valley. Based on the local topography, a drainage flow has been considered flowing down the valley from the south southeast towards Bylong Village.

Long term averages of annual rainfall at the nearby Bureau of Meteorology weather station sites have identified that rainfall in the region is typically greater than 500 mm per year. Therefore, in accordance with Table C2 in Appendix C of the INP, the potential for temperature inversions was considered, where they occur for 30% or more of the time during the night time period (6.00pm to 7.00am) in the winter months (June, July and August).

Analysis of temperature gradient data has been performed using TAPM/CALMET data prepared for the Project. Temperature inversions were identified to occur for more than 30% of the time during winter nights.

Table 3-4 presents the meteorological conditions included in the assessment.

Table 3-4: Meteorological Modelling Conditions

ID	Period	Meteorological Conditions	Modelling Parameters Wind	Pasquil-Gifford Stability Class	Relative Humidity	Air Temperature
1	Day	Neutral	No Wind	D	70%	20°C
2	Day	Gradient Wind	3 m/s ESE	D	70%	20°C
3	Day	Gradient Wind	3 m/s S	D	70%	20°C
4	Day	Gradient Wind	3 m/s WSW	D	70%	20°C
5	Evening/Night	Neutral	No Wind	D	90%	10°C
6	Evening/Night	Gradient Wind	3 m/s S	D	90%	10°C
7	Evening/Night	Gradient Wind	3 m/s SE	D	90%	10°C
8	Evening/Night	Gradient Wind	3 m/s WSW	D	90%	10°C
9	Evening/Night	Temperature Inversion	No Wind	F	90%	10°C
10	Evening/Night	Temperature Inversion and Drainage Flow	2 m/s SSE	F	90%	10°C

4 ASSESSMENT CRITERIA

4.1 Operational Noise

4.1.1 Industrial Noise Policy

Operational noise is assessed according to the INP (**EPA, 2000**). Two criteria are considered for intrusive and amenity noise impacts from industrial noise. The criteria set in the INP are non-mandatory, however it is emphasised that all reasonable and feasible measures should be implemented in an attempt to achieve the criteria. Where the criteria are not met, additional considerations may apply.

Intrusiveness Noise Criterion – $L_{Aeq,15min}$ noise level within the day (7.00am to 6.00pm, 8.00am to 6.00pm Sundays and Public Holidays), evening (6.00pm to 10.00pm) or night time (10.00pm to 7.00am, 10.00pm to 8.00am Sundays and Public Holidays) assessment periods should not exceed the RBL within that period by more than 5 dB(A).

Amenity Noise Criterion – maximum ambient L_{Aeq} noise level from industrial sources within the day, evening and night assessment period should not exceed the "acceptable noise levels" (ANL) published in the INP and reproduced in **Table 4-1**.

The ANL is dependent on the relevant receiver type and area category for residential receivers. The purpose of this noise goal is to provide an upper limit to industry related noise emission and prevent industrial noise from increasing above acceptable limits with successive new industrial development. The amenity noise criteria are determined by adjusting the ANL depending on the level of existing industrial noise.

For the purposes of this assessment, all residential receivers were considered rural receiver types as the noise environment identified during noise monitoring was dominated by natural sounds and is generally characterised by having low background noise levels.

Table 4-1: Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Places of Worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: This table is a reproduction of Table 2.1 of the INP. It should be read in conjunction with the notes from Section 2.2.1 of the INP.

The INP includes provisions for noise that contains certain characteristics including tonality, impulsiveness, intermittency or dominant low frequency content. Where these characteristics are identified, an adjustment is made to the measured or predicted noise level.

A comparison of the intrusive and amenity criteria shows that the intrusive criteria are the most stringent and therefore will be adopted as the project specific noise level (PSNL) for residential receivers. For other receiver types, the relevant amenity criteria applies.

The PSNL for the Project are presented in **Table 4-2**, for land uses and receiver types within the Project area. The intrusive noise criteria are based on the measured background levels in **Table 3-2**.

Table 4-2: Project Specific Noise Levels

Receiver/Land Use	Descriptor	Operational Noise Criteria, dB(A)		
		Day	Evening	Night
Residential	$L_{Aeq,15min}$	35	35	35
Places of Worship (external) (when in use)	$L_{Aeq,period}$	50 (when in use)	50 (when in use)	50 (when in use)
Area specifically reserved for passive recreation[2] (when in use)	$L_{Aeq,period}$	50	50	50
Active recreation area (when in use)	$L_{Aeq,period}$	55 (when in use)	55 (when in use)	55 (when in use)
Commercial premises	$L_{Aeq,period}$	65	65	65
Industrial premises	$L_{Aeq,period}$	70	70	70

Notes:
1. Day (7.00am-6.00pm Monday to Saturday and 8.00am-6.00pm Sundays and Public Holidays), Evening (6.00pm-10.00pm), Night (10.00pm-7.00am, unless preceding a Sunday or Public Holiday).
2. Noise criteria specified in the INP as internal limits are assessed using an external limit based on an outside to inside correction of 10 dB as specified in Section 2.2.1 of the INP.

4.1.2 Voluntary Land Acquisition and Mitigation Policy

The DP&E *Voluntary Land Acquisition and Mitigation Policy* (DP&E VLAM Policy) (**DP&E, 2014**) provides guidance on the assessment of impacts for state significant mining and extractive industry developments. The policy provides a process under which mitigation or voluntary acquisition rights are applied.

The policy includes the NSW government's interpretation of the significance of potential exceedances, presented in **Table 4-3**.

Table 4-3: Characterisation of Noise Impacts and Potential Treatments

Residual noise exceeds INP criteria by	Characterisation of impacts	Potential treatment
0-2 dB(A) above the PSNL	Impacts are considered to be negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3-5 dB(A) above the PSNL in the INP but the development would contribute less than 1dB to the total industrial noise level	Impacts are considered to be marginal	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.
3-5 dB(A) above the PSNL in the INP and the development would contribute more than 1dB to the total industrial noise level	Impacts are considered to be moderate	As for marginal impacts but also upgraded façade elements like windows, doors, roof insulation etc. to further increase the ability of the building façade to reduce noise levels.
>5 dB(A) above the PSNL in the INP	Impacts are considered to be significant	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions below.

Note: Reproduction of Table 1 of the DP&E VLAM Policy.

It states that a consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management:

- The noise generated by the development would be equal to or greater than 3 dB(A) above the INP project specific noise level at any residence on privately owned land; or
- The development would increase the total industrial noise level at any residence on privately owned land by more than 1 dB(A) and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; or
- 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 of the policy) by greater than or equal to 3 dB(A) at any residence on privately owned land.

The policy also states that voluntary acquisition rights should only be applied in the following circumstances:

- The noise generated by the development would be more than 5 dB(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 by 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; or

- 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.

The INP noise goals for residential receivers are shown in **Table 4-1** and the PSNLs in **Table 4-2**. Where the PSNLs are exceeded, the proponent should seek either a negotiated agreement with the landholder or apply for voluntary land acquisition rights. This process should be conducted on a case by case basis and noise levels confirmed by noise monitoring, where required.

Table 4-4 summarises the criteria related to voluntary land acquisition rights.

Table 4-4: Voluntary Land Acquisition and Mitigation Rights Criteria

Type	Period	Residence Mitigation Criteria $L_{Aeq,15min}$ dB(A)	Residence Acquisition Criteria $L_{Aeq,15min}$ dB(A)	Land Acquisition Criteria $L_{Aeq,period}$ Noise Level dB(A)
Rural Residence	Day	38	40	55
	Evening	38	40	50
	Night	38	40	45

Note: Where noise levels exceed 40 dB(A), that is at 41 dB(A) the residence acquisition criteria apply.

4.1.3 Low Frequency Noise

The characteristics of a noise source can increase annoyance for sensitive receivers. Examples of annoying characteristics are: prominent tones, impulsiveness, intermittent sources and low frequency noise. The INP provides guidance on 'modifying factors' which should be applied to predicted or measured noise levels when a dominant low frequency noise characteristic is present. Table 4.1 of the INP states that low frequency noise is considered dominant where the difference between the A-weighted and C-weighted noise levels is 15 dB or greater. Where this difference occurs the INP recommends a modifying factor of 5 dB is added to the predicted noise level.

The C-weighting network was designed to account for the ear's response to low frequency noise at high noise levels and is typically used to assess short peaks of high noise levels to ensure protection against hearing damage.

Recent research into annoyance from low frequency noise when assessed at lower noise levels is suggesting that the approach of applying subtracting C and A weighted noise levels is not representative of annoyance potential and in many situations would results in the 5 dB penalty being applied to sources which are very low risk of causing annoyance.

It is recognised that the difference between A-weighted and C-weighted noise levels can provide an indication of how much low frequency noise is present in a sound. Broner (*Acoustics Australia Vol. 39, 2011*) states that the predictive ability of the C-A difference is of limited value for the following reasons:

- Averaging the sound pressure levels to obtain the difference can lead to loss of information in terms of fluctuations and spectral balance. Broner recommends to also consider modulation.
- Greater difference may be permissible at low A-weighted levels, as there is empirical evidence that the C-A difference for low levels of background noise may exceed 20-25 dB without causing annoyance. Broner recommends the implementation of an overall noise level criterion.

Based on the review of many case histories and the literature, Broner recommends the following criteria listed in **Table 4-5**, with a 5 dB(C) penalty if the sound pressure level is fluctuating at least +/- 5 dB(C).

Table 4-5: Low Frequency Noise Criteria

Sensitive Receiver		Range	Criteria L_{Ceq}, dB(C)
Residential	Night time or 24/7 operation	Desirable	60
		Maximum	65
	Daytime or Intermittent operation (1-2 hours)	Desirable	65
		Maximum	70
Commercial / Office / Industrial	Night time or 24/7 operation	Desirable	70
		Maximum	75
	Daytime or Intermittent operation (1-2 hours)	Desirable	75
		Maximum	80

A low frequency noise criteria of 60 dB(C) has been adopted for the operational noise assessment.

4.2 Sleep Disturbance

The EPA does not currently have an explicit policy regarding sleep disturbance caused by noise from construction or industrial activities. However, there is some guidance mentioned in the INP application notes, which states: "The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development."

Where research exists, such as that reported in the INP (**EPA, 2000**), RNP (**DECCW, 2011**) and Environmental Criteria for Road Traffic Noise (ECRTN) (**EPA, 1999**), the results are diverse and EPA has therefore not set a specific criterion. However, in lieu of further and more definitive research, a screening criterion of RBL + 15 dB $L_{A1,1min}$ dB(A) is adopted as suggested in the INP Application Notes. This screening criterion indicates that if the criterion is met, sleep disturbance is unlikely.

Based on the adopted RBLs in **Table 3-2**, the sleep disturbance screening criterion for all residential receivers is $L_{A1,1min}$ 45 dB(A).

4.3 Construction Noise

The ICNG provides noise management levels for the control of noise from construction. In general these criteria are that construction noise should not exceed the background noise level by more than 10 dB(A) during standard hours, and by more than 5 dB(A) outside of standard hours. The criteria for residential receivers for this Project are given in **Table 4-6.**

Table 4-6: Construction Noise Management Levels at Private Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dBA	▪ A strong justification would typically be required for works outside the recommended standard hours. ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

The ICNG is not appropriate for all construction scenarios. Section 1.2 of the ICNG details the application of the guideline to specific situations. The ICNG states the following:

> *Noise from industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining) – this is assessed under the NSW Industrial Noise Policy (EPA 2000)*

For mine establishment and infrastructure construction, the INP criteria have been applied. For the upgrade or realignment of public roads and other infrastructure not directly associated with the establishment or mining operations or of mine infrastructure within the Project Boundary, the ICNG criteria have been applied. This is applicable in two of the construction scenarios for the Project where upgrades and realignment will be completed on the Upper Bylong Road.

A summary of the Project specific construction noise management levels for residential receivers and other receiver types is presented in **Table 4-7**. The unattended measured background noise levels summarised in **Section 3.1** has been used for residential receivers.

Table 4-7: Project Specific Construction Noise Management Level, dB(A)

Land Use	Construction Noise Management Level, $L_{Aeq,15min}$ dB(A)			
	Standard Hours	Outside of Standard Hours		
	Monday to Friday 7am to 6pm Saturday 8am to 1pm	Day Saturday 7am-8am, 1pm to 6pm, Sunday 8am-4pm	Evening Monday to Sunday 6pm to 10pm	Night time Monday to Saturday 10pm to 7am Sunday & Public Holidays 10pm to 8am
Residential	40	35	35	35
Active Recreation Area	65	65	65	65
Passive Recreation Area	60	60	60	60
Places of Worship[1]	55	55	55	55
Commercial	65	65	65	65
Industrial	70	70	70	70

Notes: 1. External noise level based on an outside to inside correction of 10 dB(A), in accordance with the INP.

4.4 Vibration

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

4.4.1 Human Comfort

The EPA administered guideline entitled "*Assessing Vibration: A Technical Guideline,*" which provides acceptable values for continuous and impulsive vibration in the range 1-80 Hz.

Where vibration is intermittent, such as for construction sources, a vibration dose is calculated and acceptable values are shown in **Table 4-8** below.

Table 4-8: Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night Time[1]	
	Preferred Value	Maximum Values	Preferred Value	Maximum Value
Critical areas [2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1 Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.

4.4.2 Building Damage

German Standard *DIN 4150-3-1999 "Structural Vibration – Part 3 Effects of vibration on structures"* provides methods for evaluating the effects of vibration on structures in the absence of an Australian Standard.

The recommended limits (guide values) from DIN 4150 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table 4-9**.

Table 4-9: Guideline Vibration Values for Short Term Vibration on Structures (mm/s)

Type of Building	Guideline values for velocity (mm/s)			
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Commercial and Industrial Building	20	20-40	40-50	40
Dwellings and buildings of similar occupancy or design	5	5-15	15-20	15
Structures that, because of their particular sensitivity to vibration cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3-8	8-10	8

4.5 Rail Noise

4.5.1 ARTC Environmental Protection Licence

The Australian Rail Track Corporation (ARTC) operates activities on the Sandy Hollow to Gulgong Railway Line and other parts of the rail network under Environmental Protection Licence (EPL) No. 3142. The EPL contains general noise limits in section L2.2 as follows:

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)L_{eq}, (day time from 7am – 10pm), 60 dB(A)L_{eq}, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.

The pollution reduction programs are intended to be carried out to reduce noise levels from rail bound vehicles operating on ARTC managed tracks, such as the Sandy Hollow to Gulgong Railway Line.

4.5.2 Rail Infrastructure Noise Guideline

The RING (**EPA, 2013**) is used to assess rail noise impacts at sensitive receivers from rail bound vehicles on new, existing and redeveloped tracks and tracks where additional traffic is generated by land use developments.

RING provides specific guidance for the assessment of impacts associated with rail infrastructure projects. The Project is expected to consist of the following rail components:

- Rail loop from the main Sandy Hollow to Gulgong Railway Line to the rail load-out facility.
- Generation of additional rail traffic on the Sandy Hollow to Gulgong Railway Line.

The guidance within the RING states that rail noise associated with rail loops and other fixed, non-network rail infrastructure should be assessed under the INP. Therefore the rail loop to where it joins the main rail line will be assessed as part of the operational noise assessment using the criteria in **Table 4-2**.

Developments that have the potential to generate rail traffic on an existing line are assessed using guidance in Appendix 2 of the RING.

RING guidance states that the proponent must determine if the addition of rail traffic generated by the development, when combined with the existing rail noise, is in excess of the trigger levels. The trigger levels for traffic generating developments are $L_{Aeq,15hr}$ 65 dB(A) during the day, $L_{Aeq,9hr}$ 60 during the night and L_{AFmax} 85 dB(A) (95th percentile) for all periods. Analysis of feasible and reasonable mitigation measures is required where a project-related increase of 0.5 dB or greater is identified and the Project exceeds the trigger levels.

A summary of the rail noise assessment criteria is presented in **Table 4-10**. The RING and ARTC EPL noise limits are consistent.

Table 4-10: Rail Noise Assessment Criteria

Receiver	Rail Noise Assessment Criteria dB(A)			
	Day (7.00am-10.00pm)	Night (10.00pm-7.00am)	All Periods	
Residential Land Uses	$L_{Aeq,15hr}$ 65 dB(A	$L_{Aeq,9hr}$ 60	L_{AFmax} 85 dB(A) (95th percentile)	Increase of 0.5 dB in total rail noise

4.6 Road Traffic Noise

The RNP (**DECCW, 2011**) provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments. The assessment of road traffic noise impacts on public roads is assessed under the RNP.

The Project is a traffic generating development as it is expected that staff bus and car movements and delivery and construction vehicle movements will be generated on the surrounding public roads as a result of the Project.

The RNP details a number of noise assessment criteria for various road categories and land uses. Bylong Valley Way, Wollar Road and Upper Bylong Road would all be classed as collector or sub arterial roads due to their function of providing connections between local roads and carrying through traffic.

The assessment criteria for external noise levels apply at 1 m from the façade of the affected residential receiver.

The road traffic noise assessment criteria for residential land uses for each road category are presented in **Table 4-11** for traffic generating developments.

Table 4-11: Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project/land use	Assessment Criteria dB(A)	
		Day (7.00am-10.00pm)	Night (10.00pm-7.00am)
Freeway/arterial/sub-arterial	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hour}$ 60 (external)	$L_{Aeq,15hour}$ 55 (external)

The RNP also provides assessment criteria for existing land uses other than residential that are also sensitive to noise that are exposed to additional traffic from land use developments on local, sub-arterial and arterial roads. The criteria for potentially affected land uses are presented in **Table 4-12**.

Table 4-12: Road Traffic Noise Assessment Criteria for Non-Residential Sensitive Land Uses

Existing Sensitive Land Use	Assessment Criteria dB(A) Day (7.00am-10.00pm)	Night (10.00pm-7.00am)	Additional Considerations
Places of Worship	$L_{Aeq,1hour}$ 40 (internal)	$L_{Aeq,1hour}$ 40 (internal)	The criteria are internal, i.e. the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what in these areas may be affected by road traffic noise.
Open Space (active use)	$L_{Aeq,15hour}$ 60 (external) when in use	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion. Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion.
Open space (passive use)	$L_{Aeq,15hour}$ 55 (external) when in use	-	

The RNP also provides guideline criteria for rural residences affected by increases in road traffic noise. The relative increase criteria limit states that increases to road traffic noise should not be more than 12 dB above the existing traffic $L_{Aeq,15hr}$ or $L_{Aeq,9hr}$ noise level. The RNP states that for rural situations where the existing traffic noise level is less than 30 dB(A), it is to be set to 30 dB(A).

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, the RNP states that any increase in the total traffic level should be limited to 2 dB above the road traffic noise level without the development. The RNP application notes states that this limit should be applied wherever the noise level without the development is with 2 dB of or exceeds the noise assessment criterion.

Both of the relative increase criteria are applicable to the Project. Where existing noise levels are more than 2 dB below the absolute criteria, any increase due to the Project should be limited to 12 dB above the existing noise level with the absolute criteria as the upper limit. Where existing noise levels are either within 2 dB of or above the absolute criteria, any increase due to the Project should be limited to 2 dB above the existing noise level.

Private haul roads (i.e. those haul roads within the mining areas) are not assessed under the RNP and the noise associated with these roads is assessed under the INP as part of the operational noise assessment.

4.7 Blasting Overpressure and Vibration

4.7.1 ANZEC Guidelines

Blasting overpressure and ground vibration is assessed using the ANZEC guidelines (**ANZEC, 1990**). These guidelines set limits for overpressure and ground vibration levels. Where compliance is achieved, the risk of annoyance is minimised. The limits are presented in **Table 4-13**.

The guidelines recommend that blasting is carried out between 9.00am to 5.00pm Monday to Saturday and should not be carried out outside of these times, including on Sundays and Public Holidays.

The guideline levels contained within AS 2187:2006 Part 2 "*Explosives – Storage and Use – Part 2: Use of Explosives*" Appendix J are generally consistent with the human comfort levels described in the ANZEC guidelines.

Table 4-13: ANZEC Guideline Blasting Limits

	Overpressure dB (Linear Peak)	Ground Vibration PPV (mm/s)
Recommended Maximum (95% of all blasts)	115	5
Level not to be exceeded	120	10
Long term goal for ground vibration	-	2

Notes: Overpressure limits apply where measurement equipment has a cut-off frequency of 2 Hz or less. Where equipment has a high cut-off frequency, 5 dB should be added to all levels.

4.7.2 Building Damage

Building damage from transient vibration sources such as blasting can be evaluated using the guidance presented in **Section 4.4.2**.

4.7.3 Heritage Items

Heritage items include both European Structures and Aboriginal artefacts and rock features. The criteria for these items have been set based on the guideline values in BS 7385: Part 2 and AS 2817: Part 2, in lieu of any specific vibration limits for these items. The criteria have been set using the most stringent guideline values for risk of cosmetic damage for heritage structures such as buildings.

For rock shelters and significant structures, examples from other similar mining projects suggest that a limit of 50 mm/s is appropriate. For trees with heritage significance, no set criteria exist. Therefore a guideline limit of 50 mm/s has been used. Further blasting testing and surveying should be carried out to determine specific guideline levels.

The overpressure guideline limit is based on the value recommended in AS 2187: Part 2-2006 Appendix J for building damage, which recommends 133 dB(L) as the safe level to minimise the risk of structural or architectural damage from air blasts.

The criteria levels used in this assessment are intended to be guideline levels only and are not definitive levels below which damage is not guaranteed to occur.

A summary of the guideline vibration criteria for heritage items is provided in **Table 4-14**.

Table 4-14: Heritage Item Guideline Blasting Limits

Item	Overpressure dB (Linear Peak)	Ground Vibration PPV (mm/s)
Sensitive Heritage Buildings and Structures	133	15
Heritage Archaeological Sites	133	15
Rock structures, Shelters and Grooves	133	50
Aboriginal Heritage (Trees)	133	50

4.7.4 Infrastructure

The ground vibration limits for infrastructure are based on the guidance contained within German Standard DIN 4150 "Structural Vibration: Effects on Structures," In the absence of any Australian guidelines. The standard sets limits for buried pipe infrastructure. Limits are specified for different materials of pipework. The majority of the infrastructure, such as rail culverts and road bridges are assumed to be constructed using modern materials and methods. Therefore, the reinforced concrete and metal limits are applicable for these items.

For other infrastructure items, the most stringent limits of 50 mm/s has been applied to provide a conservative approach. This guideline level is consistent with other nearby mines blast management plans.

The ground vibration limit for the rail lines are based on the limit set out in the Wilpinjong Blast Management Plan (**Wilpinjong Coal, 2011**) which is located in proximity to the same rail line as the Project.

The overpressure guideline limit is based on the value recommended in AS 2187:2006 Part 2 Appendix J for building damage, which recommends 133 dB(L) as the safe level to minimise the risk of structural or architectural damage from air blasts.

A summary of the blasting criteria for infrastructure items is provided in **Table 4-15**.

Table 4-15: Infrastructure Guideline Blasting Limits

Item	Overpressure dB(Linear Peak)	Ground Vibration PPV (mm/s)[1]
Rail Infrastructure (Culverts, Tunnels)	133[2]	80[3]
Rail Lines	-	200[4]
Other Public Infrastructure	133[2]	50[4]

Note: 1. Measured as Peak Component Particle Velocity (PCPV)
2. Based on the safe air blast guideline limit within AS 2187 for structures
3. Based on the DIN 4150 limit for reinforced structures
4. Based on guideline limits from the Wilpinjong Blast Management Plan (**Wilpinjong Coal, 2011**)

4.7.5 Rock Escarpments

Blasting has the potential to affect rock escarpments and cliffs in the vicinity to the proposed open cut operations. At present there is no defined criteria in NSW. A literature review of the potential for rock falls to occur as a result of blasting revealed that a definitive limit cannot be established without site specific information. Therefore at this point, a conservative limit of 50 mm/s has been set.

Blast monitoring and field surveys during trial blasts would inform suitable blast limits for rock escarpments. However, blasting ground vibration levels are predicted to the nearest rock escarpments from blasting locations.

4.7.6 Livestock

There are currently no defined blasting limits for the protection of livestock from the effects of blasting overpressure and ground vibration.

A literature review undertaken as part of the Wilpinjong Modification Noise and Blasting Assessment (**SLR, 2013**) indicated that whilst there are no defined limits for blasting for livestock, some limited research indicated that ground vibration up to 200 mm/s and an air blast limit of 125 dB(L) was acceptable (**SLR, 2013**).

In the absence of specific guideline levels and consistent with other Hunter Valley mine blast management plans, no specific limit for livestock has been established.

5 OPERATIONAL NOISE

5.1 Modelling Methodology

Noise modelling has been undertaken using the *International Organization for Standardization 9613 Acoustics – Attenuation of sound during propagation* outdoors (**ISO, 1996**) and CONCAWE's *Special Task Forces in Noise Propagation* (**CONCAWE, 1981**) algorithms, as implemented within the CadnaA 4.3 acoustic modelling package. The noise modelling takes into consideration the sound power level of the proposed site operations, activities and equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography, ground effect, meteorological effects and atmospheric absorption.

5.2 Modelling Scenarios

The modelling has assumed a conservative 15 minute scenario representative of the mining year, operating 24 hours a day, seven days a week and has considered four representative operational scenarios as follows:

- Year 3 – Open cut mining in the Eastern and Western Open Cut Mining Areas only with CHPP activities and rail loop.
- Year 5 – Open cut mining in the Eastern and Western Open Cut Mining Areas only with CHPP activities and rail loop.
- Year 7 – Open cut mining in the Eastern Open Cut Mining Area and underground mining with CHPP activities and rail loop.
- Year 11 and beyond - Underground mining operations only with CHPP activities and rail loop.

For all scenarios coal is extracted via excavator or front end loader (FEL) and loaded into haul trucks. It is hauled from open cut mining areas to the ROM pad where it is crushed and screened at the open cut mine infrastructure area (MIA) and transported via overland conveyor to the CHPP for processing. From the CHPP it is stockpiled by the skyline stacker prior to being reclaimed via bulldozers and conveyor and sent to the rail loader for export off site.

Overburden is extracted via excavator and loaded into haul trucks. The overburden is placed in either the North West Overburden Emplacement Area, the South West Overburden Emplacement Area or in later years when mining progresses, in the Eastern or Western open cut mining areas.

When underground operations commence, the coal is hauled via conveyor out of the underground drift, screened and then stockpiled in the raw coal stockpile near the CHPP. It is then reclaimed and sent to the CHPP for processing and then stockpiled with the open cut product coal.

Rejects from the CHPP are sent via the overland conveyor to the rejects bin located at the open cut MIA. During open cut mining, rejects are loaded onto empty coal trucks on their return journey to the Eastern open cut mining area and emplaced with overburden material in the mining void. During underground only mining, trucks are loaded at the rejects bin and hauled to the void remaining within the southern portion of the Eastern Open Cut Mining Area.

The Year 3 scenario represents the start of operations where open cut mining is being carried out in the Eastern and Western Open Cut Mining Areas with initial overburden from both areas being sent to either the North West Overburden Emplacement Area or South West Overburden Emplacement Area until the area within the open cut mining areas is suitably developed. Coal is extracted and processed as described above. Concurrent to the mining activities, progressive clearing and drilling operations are carried out. This scenario represents the Project when operations are closest to the Bylong village.

The Year 7 scenario represents the most productive open cut mining years with the greatest amount of plant and equipment operating on site. Both open cut mining areas are active and overburden is generally placed in the South West Overburden Emplacement Area, and in the two open cut mining areas. Concurrent to the mining activities, progressive clearing, topsoil stripping and drilling operations are carried out.

The Year 9 scenario represents years with concurrent open cut and underground mining operations. It also represents operations when they are at their closest to receivers to the east of the Project. The Eastern Mining Area is active and the Western Open Cut Mining Area will have been rehabilitated. Overburden is removed from the Eastern Open Cut Mining Area and moved to emplacement areas within the mining area. Coal is extracted and processed from both the Eastern Open Cut Mining Area and underground operations. The underground MIA is operational and includes air compressors, ventilation fans, underground vehicles and personnel carriers operating at the MIA.

The underground scenario represents operations when open cut mining has ceased and only underground operations are present. The CHPP and associated stockpiling and rail loader facilities are operational. Rejects are transported via overland conveyor to the rejects bin at the open cut MIA where they are hauled to the Eastern Mining Area for emplacement.

Equipment numbers and source locations for each year are presented in **Appendix C**.

5.3 Meteorological Conditions

The meteorological conditions considered for the assessment are presented in **Table 3-4**.

5.4 Operational Noise Mitigation

Preliminary modelling results indicated significant impacts at the nearest noise sensitive receivers. Noise mitigation investigations and adopted mitigation levels are detailed in the following sections. The process followed in developing the noise mitigating is detailed in **Table 5-1**.

Table 5-1: Noise Mitigation Process

Step	Description
1	Develop source sound power levels, model mining activity based on feasibility study mine layout.
2	Assess impacts.
2	Revise sound power levels based on feasible best available noise control technology, model and assess impacts.
3	Mitigation modelling to Investigate noise path controls including noise berms/barriers, reassess impacts.
4	Mitigation modelling to investigate moving operations and reduced plant operation rates.
5	Assess noise mitigation controls for capital expense and impact on production.
6	Select mitigation which provides maximum noise reduction without impacting mine production.

5.4.1 Investigation of Noise Controls

Noise controls were investigated for predicted exceedances at sensitive receivers. Noise controls were applied according to the hierarchy of noise control shown as follows, in order of preference:

- Control at source.
- Control of path.
- Control at receiver.

Controls were considered for implementation where reasonable and feasible. The INP states that feasibility relates to engineering considerations and what is practical to build. Reasonableness relates to the application of judgement in arriving at a decision, taking into account noise mitigation benefits and noise level reductions, the cost of mitigation versus the benefit, community views and the noise levels for affected land uses.

The meteorological analysis indicated that adverse meteorological conditions such as gradient winds during the day, evening and night and temperature inversions would be expected to occur for more than 60% of the time. Therefore, mitigation measures have been investigated to account for the occurrence of adverse conditions and specific mitigation measures would apply under these conditions.

Controls at receivers were not investigated as preference was given to controlling the noise source and the propagation path.

Controls at the source typically involve engineering or administrative controls which reduce the noise level of the noise source. The source controls which were examined for the Project included:

- Consideration of alternative plant and equipment.
- Engineering controls for plant and equipment (sound suppression kits, mufflers, enclosures, upgraded acoustic performance of enclosures).
- Control of source operating conditions (slow speed dozer reversing in first gear only).
- Limiting the number of plant operating.

Preliminary noise modelling included initial level of mitigation on plant equipment with suppression kits on excavators, bulldozers and acoustic grade mufflers on the haul trucks fleet. To provide further source control mitigation of mobile and fixed plant were investigated for implementation. Consultation with equipment manufacturers and the Project's mining consultants resulted in the adoption of best practice equipment suppression as a feasible and reasonable mitigation option. **Table 5-2** provides the reductions considered for the Project.

Table 5-2: Noise Source Mitigation

Source	Mitigation Measure	Sound Power Level dB(A)	Reduction dB(A)	Mitigated Sound Power Level dB(A)
Haul trucks	Full suppression kit	115	-2	113
Water Cart	Full suppression kit	115	-2	113
Dozer	Slow Speed reversing rubber track insert and full suppression kit	119	-4	115
Excavators 5500	Full suppression kit	118	N/A already included	118
Excavators 3600	Full suppression kit	116	N/A already included	116
FEL	Full suppression kit	116	-2	114
CHPP	Upgraded facades e.g: double skin with insulation	116	-3	113
Transfer towers	Upgraded facades on enclosures	112	-8	104
Sizing and crushing stations	Upgraded facades on enclosures	113	-8	105
Vent Fans	Silencer and Orientation	104	N/A already included	104
LHD	Full suppression kit	116	-2	114
UG Compressors	Enclosure	113/111	-10	103/101 per unit (250/160kW)

Measures to control of the propagation path were also investigated. These included:

- Relocation of activities such as waste emplacement activities and haul routes.
- Noise bunds for haul routes, waste emplacement areas and ROM pad.

For the Year 3 scenario, up to 18 different mitigation scenarios were investigated to reduce significant impacts at sensitive receivers.

The primary sources contributing to noise exceedances were identified as operations on the NW OEA and haul trucks travelling between the east and west of the Project on the northern haul road under adverse weather conditions during the day and night. Modifications to move or shield these sources from the most impacted receivers in Bylong village were investigated.

Table 5-3 provides a summary of the mitigation investigations and their relative benefits. Figures of the source locations for the selected scenarios are presented in **Appendix C**.

The control of fixed and mobile noise sources (mitigation scenario M2) has been considered for implementation. The measures reduced the predicted noise levels and the number of significantly and moderately impacted receivers under all scenarios and meteorological conditions. However, additional measures were required for the Year 3 scenario under adverse meteorological conditions to reduce the number of significantly impacted receivers.

Table 5-3: Mitigation Measures Investigation and Benefits

ID	Period	Met. Conditions	Description	No. of Receivers Significantly Impacted in Year 3	Noise Level Reduction (dB) Average	Noise Level Reduction (dB) Maximum	Comments on whether Measures are Reasonable and Feasible
M0	All	All	Initial modelling with standard mitigation.	6	N/A	N/A	N/A
M1	All	All	Additional mitigation of haul trucks and dozers (**Table 5-2**).	6	1	2	Adopted
M2	All	All	Mitigation of all mobile and fixed plant (**Table 5-2**).	5	2	3	Adopted
M3	All	All	10 m bund on NW OEA, 20 m bund on northern haul route and M1 measures.	5	2	3	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds.
M4	All	All	10 m bund on NW OEA, 20 m bund on northern haul route and M2 measures.	5	2	4	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds
M5	All	All	15 m bund on NW OEA, 20 m bund on northern haul route and M1 measures.	5	2	3	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds
M6	All	All	15 m bund on NW OEA, 20 m bund on northern haul route and M2 measures.	5	2	4	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds
M7	All	All	20 m bund on NW OEA, 20 m bund on northern haul route and M1 measures.	5	2	3	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds
M8	All	All	20 m bund on NW OEA, 20 m bund on northern haul route and M2 measures.	5	2	4	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds
M9	All	All	20 m bund on NW OEA, and M2 measures.	5	2	3	Not reasonable due to limited noise reduction benefit and practical issues for the construction of bunds

ID	Period	Met. Conditions	Description	No. of Receivers Significantly Impacted in Year 3	Noise Level Reduction (dB) Average	Maximum	Comments on whether Measures are Reasonable and Feasible
M10	All	All	M6 measures and no operations on NW OEA.	1	4	5	Rejected as would require mining operations to cease, not feasible.
M11	Day	Adverse	M2 measures and Western Open Cut waste emplacement diverted to SW OEA under adverse conditions during the day. In absence of mine planning data, two additional trucks were modelled from the Western Open Cut to maintain initial production rates.	1	2	4	Considered feasible and reasonable, however further mine planning refinement required.
M12	Eve/Night	Adverse	M2 measures and Western and Eastern Open Cut waste emplacement diverted to SW OEA under adverse conditions during the Evening/Night. In absence of mine planning data, two additional trucks are required from the Western Open Cut and four from the Eastern Open Cut to maintain initial production rate.	4	2	5	Considered feasible and reasonable, however further mine planning refinement required.
M13	All	All	M2 measures and Eastern Open Cut waste emplacement operations suspended.	1	3	4	Rejected as would require mining operations to cease, not feasible.
M14	Day	Adverse	M11 measures with no additional haul trucks from the Western Open Cut.	1	2	4	Accepted as economically feasible.
M15	Eve/Night	Adverse	M2 measures and Eastern and Western open cut waste emplacement diverted to SW OEA under adverse conditions during the evening and night. One additional truck is required from the Eastern Open Cut to maintain production rate, no additional trucks from the Western Open Cut.	3	2	5	Accepted as economically feasible.
M16	Eve/Night	Adverse	M15 measures with no additional haul trucks.	3	2	5	Rejected, would reduce production rate, not feasible.
M17	Eve/Night	Adverse	M16 measures with northern haul route located further south.	2	3	5	Rejected as would require additional fleet to maintain haul route, not feasible.

ID	Period	Met. Conditions	Description	No. of Receivers Significantly Impacted in Year 3	Noise Level Reduction (dB) Average	Noise Level Reduction (dB) Maximum	Comments on whether Measures are Reasonable and Feasible
M18	Eve/Night	Adverse	M17 measures with Eastern Open Cut haul route exit moved from east to west of Eastern Open Cut.	1	3	5	Rejected as would impact mining production, not feasible.

A review of **Table 5-3** indicates that the implementation of noise bunds are not reasonable mitigation measures as they did not provide a significant noise benefit. This measure is also very difficult to construct without requiring increased footprints for the haul roads.

The effectiveness of a bund is dependent on its proximity to either the source or receiver and meteorological conditions. Where bunds are unable to be placed near the source, their benefit is diminished. Due to their size and the locations alongside haul routes and waste emplacement areas, they were unable to be placed close enough to the source to have a significant effect. Under temperature inversions and gradient winds, the bunds' effect was also reduced and did not show a significant benefit. Therefore, mitigation scenarios M3 to M9 were not considered for implementation.

The alteration of operations in mitigation scenarios M10 to M18 was considered with reference to the feasibility and reasonableness (operational impact and economic viability).

The suspension of operations on the NW OEA was investigated in scenarios M10 and M13 during adverse meteorological conditions. Adverse meteorological conditions (gradient winds and temperature inversions) are expected to occur for up to 38% of the time during the day and up to 76% during the night. The impact on the operational production rate due to the suspension being in place during adverse conditions would be such that the Project would be economically unviable and therefore is not considered reasonable for implementation.

Mitigation scenarios M11 and M14 considered emplacing waste generated in the Western Open Cut in the SW OEA instead of the NW OEA under adverse meteorological conditions during the day in the Year 3 scenario. The M14 scenario was preferred as it had similar noise benefits and did not require an additional haul truck for the Western Open Cut waste haulage fleet. Therefore, scenario M14 was considered for implementation.

For adverse conditions during the night, scenarios M12, M15 to M18 considered emplacing waste generated in the Eastern and Western Open Cut Areas in the SW OEA instead of the NW OEA. These scenarios produced significant reductions in the number of significantly affected receivers. In order to maintain a viable production rate, additional trucks were required to be added to the haulage fleets. M15 was preferred over M12 as it was supported by detailed mine planning and a viable production rate was possible with fewer additional trucks.

Scenario M16 was not considered reasonable as the production rate was adversely impacted to the point where the rate was economically unviable. Furthermore, M17 and M18 were not considered reasonable as the relocation of the main east-west haul route further south altered the production schedule such that additional haul routes and double handling of waste and topsoil would be needed and this made the production rate unviable.

As a result, scenarios M14 (for day time activities) and M15 (for night time activities) were selected as the most reasonable and feasible measures and were considered for implementation for the Year 3 scenario under adverse meteorological conditions.

To support the noise mitigation investigation, an economic analysis was also conducted which considered the implementation of mitigation scenarios M2, M14 and M15 as the base case. As haul trucks were identified as a major contributor to significant impacts, the economic analysis also considered the implications of not implementing additional noise controls on haul trucks as the alternative case. The analysis concluded that the difference in economic impact between the base case and alternative case was not sufficient to warrant limiting the haul trucks to a sound power level of 115 dB(A). Therefore, mitigation measures M2, M14 and M15 are considered reasonable for implementation.

5.4.2 Project Noise Mitigation

In consideration of the noise mitigation investigation above, the reasonable and feasible mitigation measures adopted for the Project are as follows:

- Noise mitigation for mobile and fixed plant as per **Table 5-2** for all years (mitigation scenario M2), including:
    - Full suppression kits on haul trucks, water cart, FEL's, LHD.
    - Mitigation of fixed plant including the CHPP, Transfer Towers, Sizers and Crushers, Vent Fans and Underground Compressors.
- For the Year 3 scenario:
    - Diversion of the Western Open Cut waste haul route and supporting plant to the SW OEA during daytime adverse weather conditions (mitigation scenario M14).
    - Diversion of Western and Eastern Open Cut waste haul routes and supporting equipment to the SW OEA during evening and night time adverse weather conditions (mitigation scenario M15).
- Dozer reversing limited to 1st gear to reduce noise emissions.

5.4.3 Sound Power Levels

Sound power levels including mitigation detailed in **Section 5.4.1** are presented in **Table 5-4**

Table 5-4: Modelled Sound Power Levels

Item	Type	Sound Power Level L_{Aeq} dB(A)
Excavator	EX5600 (or equivalent)	118
Excavator	EX2600 (or equivalent)	116
FEL	CAT993 (or equivalent)	114
Haul Truck on flat ground	HITACHI EH4000/3500AC-3 (or equivalent)	113
Haul Truck on incline	HITACHI EH4000/3500AC-3 (or equivalent)	116
Dozer	CAT D11 (or equivalent)	115
Grader	CAT 16M (or equivalent)	111
Water Cart	HITACHI EH3500AC-3 (or equivalent)	113
Drill Rig	CAT MD6240 (or equivalent)	114
Service/Lube Truck	Bell 50D (or equivalent)	108
Conveyor Belt (SWL per metre)	-	80
Conveyor Drive	-	98
Transfer Tower or Station	-	104
CHPP	-	113
Rail Loader	-	105
Coal Train and Wagons on Loop	-	105
ROM crusher	-	105
Open Cut Sizer	-	105
UG Sizer	-	113
Rejects Bin	-	96
Skyline Stacker SWL per metre	-	80
Stacker Chute	-	104
Ventilation Fan 700kW	-	104
UG Compressors 250 kW	-	103
UG Compressors 160 kW	-	101
LHD	Sandvik LS195 (or equivalent)	114
UG Personnel Carriers (Driftrunner)	Driftrunner (or equivalent)	108

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5.4.4 Operational Noise Modelling Results

Predicted noise levels for impacted receivers using the adopted mitigation measures are presented in **Table 5-5** for the Year 3, 5 and 9 scenarios and underground operations respectively. The complete noise modelling results are presented in **Appendix D**.

Table 5-5: Predicted Impacted Receivers

Period	Criteria $L_{Aeq,15min}$	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
		Day	Day	Day	Day	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night
Condition ID		1	2	3	4	5	6	7	8	9	10
Receiver ID											
Year 3											
56	35	30	35	35	25	31	37	37	26	37	36
58	35	31	37	37	26	33	38	38	27	38	37
60	35	35	40	40	32	37	41	41	33	41	40
65A	35	35	39	39	32	36	40	40	32	40	40
63	35	35	40	40	32	37	41	41	33	41	40
68	35	34	39	39	32	36	40	40	34	40	39
69	35	38	42	42	39	40	43	43	39	43	43
141	35	27	24	27	34	29	25	30	36	36	31
Year 5											
56	35	28	34	25	28	29	36	36	26	36	35
57A	35	27	33	23	27	28	36	35	24	36	34
57C	35	26	33	22	26	28	36	35	24	36	34
58	35	29	36	26	29	31	38	38	27	38	37
60	35	32	38	31	32	33	40	40	33	40	39
65A	35	31	38	32	31	33	39	39	33	39	39
63	35	31	38	32	31	33	40	40	33	40	39
68	35	31	37	33	31	32	39	39	35	39	38
69	35	34	40	36	34	36	42	42	38	42	42
141	35	29	25	36	29	31	27	35	38	38	36
151	35	31	30	27	31	33	29	29	29	39	33
158	35	30	26	27	30	31	27	27	28	38	31
Year 9											
60	35	31	36	36	27	32	38	38	29	38	38
65A	35	30	36	36	27	32	38	38	28	38	37
63	35	30	36	36	27	32	38	38	29	38	37
68	35	30	36	36	27	31	38	38	29	38	37
69	35	33	39	39	32	35	41	41	33	41	41
141	35	31	27	37	38	33	29	39	40	40	39
151	35	30	32	26	26	32	28	28	28	39	32
158	35	29	26	25	25	30	26	26	26	37	30
Underground Only											
60	35	29	34	34	26	30	36	36	30	36	36
65A	35	28	34	34	25	30	36	36	30	36	35
63	35	29	34	34	25	30	36	36	30	36	36

Period	Criteria $L_{Aeq,15min}$	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
		Day	Day	Day	Day	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night	Eve/ Night
Condition ID		1	2	3	4	5	6	7	8	9	10
Receiver ID											
69	35	32	37	37	30	33	39	39	33	39	39

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

The Year 3 scenario predicted the most receivers with significant impacts, with the number reducing to one (receiver 69) in Year 5 and Year 9. No receivers were predicted to be significantly impacted for the underground only scenario.

However, even with the implementation of reasonable and feasible mitigation measures, noise levels are predicted to be above the PSNLs at up to 12 receivers. Of the 12 residual receivers, three are predicted to be significantly impacted (receivers 60, 63 and 69), six moderately impacted (receivers 58, 65A, 68, 141, 151 and 158) and impacts were negligible at three (receivers 56, 57A and 57C).

All receivers not shown in the tables above were predicted to receive acceptable noise levels for all assessed meteorological conditions.

Where residual exceedances occur, a negotiated agreement should be implemented between the proponent and affected receivers as described in Section 8 of the INP.

Reasonable and feasible mitigation measures have been applied to the Project. The DP&E VLAM Policy states that where exceedances occur after the implementation of reasonable and feasible mitigation measures, at property mitigation rights should be applied for receivers which are moderately impacted and acquisition or mitigation rights should be applied to those significantly impacted. Where impacts at receivers are negligible, the DP&E VLAM Policy states that treatments at the receiver are not warranted.

Table 5-6 presents a summary of the residually affected receivers using the greatest predicted noise level and the type of treatment for adverse impacts.

Table 5-6: Residually Affected Receivers and Treatment

Receiver ID	Impact Significance				Treatment
	Year 3	Year 5	Year 9	UG	
58	Moderate	Moderate	-	-	At property mitigation
60	Significant	Moderate	Moderate	Negligible	At property mitigation or acquisition
65A	Moderate	Moderate	Moderate	Negligible	At property mitigation
63	Significant	Moderate	Moderate	Negligible	At property mitigation or acquisition
68	Moderate	Moderate	Moderate	-	At property mitigation
69	Significant	Significant	Significant	Moderate	At property mitigation or acquisition
141	Negligible	Moderate	Moderate	-	At property mitigation
151	-	Moderate	Moderate	-	At property mitigation
158	-	Moderate	Negligible	-	At property mitigation

At property mitigation can include measures to increase the acoustic performance of residences, with the focus to protect the internal amenity of the property. Measures could include:

- Mechanical ventilation to allow windows to be closed.
- Upgrades to windows, roofs, doors and building facades.

Upgrades to facades should be implemented on a case by case basis and would depend on the existing condition of the building.

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Acquisition of properties should follow the process outlined in the DP&E VLAM Policy and the guidelines for negotiated agreements from Chapter 8 of the INP.

5.5 Voluntary Land Acquisition Rights Assessment

Operational noise has also been assessed for privately owned land. DP&E VLAM Policy states that where more than 25% of adjacent continuous blocks owned by the same freehold is predicted to experience noise levels of more than the recommended maximum amenity noise levels as defined in Table 2.1 of the INP, voluntary land acquisition rights should be applied. The maximum recommended amenity noise levels for rural type receivers are:

- $L_{Aeq,period}$ 55 dB(A) during the day.
- $L_{Aeq,period}$ 50 dB(A) during the evening.
- $L_{Aeq,period}$ 45 dB(A) at night.

Land affected by operational noise was assessed using the contours predicted for mitigated noise levels, presented in **Appendix E**. As the operations are expected 24 hours a day, the predicted 15 minute noise levels have conservatively been assumed to represent the 11 hour day, 4 hour evening and 9 hour night noise levels. Based on the predicted noise levels, voluntary acquisition rights should be applied for Property number 69.

Table 5-7 presents a summary of potentially affected privately owned land for the operational scenarios assessed under worst-case meteorological conditions.

Table 5-7: Affected Land Parcels

Operational Scenario	Criteria $L_{Aeq,9hr}$ dB(A)	Private Freehold	Percentage of Area Affected
Year 3	45	69	35%
Year 5	45	69	24%
Year 9	45	69	20%

5.6 Low Frequency Noise

5.6.1 Methodology

An assessment for potential impacts relating to low frequency noise has been conducted using both guidance from the INP and current acoustic assessment practice relating to contemporary research into the impacts of noise where low frequency is a dominant factor.

Noise levels using the mitigation measures outlined in **Section 5.4** were predicted as C-weighted noise levels. The difference between the A and C weighted noise levels in addition to the absolute C-weighted level have been used to predict whether impacts are likely to occur. Where the predicted noise level exceeds both criteria, adverse impacts are likely and should be considered as part of noise management measures.

The C-weighted noise levels were calculated using the mitigated noise model as described in **Section 5.4** for privately owned receivers for modelled Years 3, 5, 9 and underground only scenario.

5.6.2 Low Frequency Noise Modelling Results and Assessment

The predicted C-weighted noise levels for privately owned receivers are presented in **Appendix D**.

The predicted C-weighted noise levels are below the 60 dB(C) criterion at all receivers. At some receivers, the difference between the A and C weighted noise levels was found to be greater than 15 dB. As discussed in **Section 5.6** adverse impacts were considered to occur where both the absolute criterion and C-A criterion are exceeded.

In this case, as both criteria have not been exceeded at any privately owned receiver, the predicted impacts are considered acceptable.

5.7 Sleep Disturbance

5.7.1 Methodology

Sleep disturbance events have the potential to be caused by short high level noise events from operations. These can be caused by a number of activities and equipment items including tracking from dozers reversing, haul trucks being loaded, materials being loaded into bins, sizers and crushers, engine start ups and revving, tonal reversing alarms, warning and system alarms.

The mitigation measures described in **Section 5.4** were included in the noise modelling predictions. This included no activity on the NW OEA during adverse weather conditions at night and dozers have been mitigated to reduce tracking noise. A conservative noise level of L_{Amax} 129 dB(A) has been assumed to represent typical maximum noise level events from the operation of dozers and mobile plant.

5.7.2 Sleep Disturbance Noise Modelling Results and Assessment

The predicted maximum noise levels indicated impacts above the criteria for receiver 69 during the Year 3 scenario and the predicted results are presented in **Table 5-8**. All other receivers were predicted to receive acceptable maximum noise levels. Results were below the sleep disturbance criteria for all receivers for all other modelled scenarios. Complete noise modelling results are presented in **Appendix D.**

Table 5-8: Predicted L_{Amax} Noise Levels for Year 3 Scenario

Receiver	Screening Criteria $L_{A1,1min}$ dB(A)	Predicted Noise Level L_{max} dB(A)	
		Neutral Conditions	Adverse Conditions
69	45	40	46

Note: Cells are highlighted were levels are above the screening criteria

5.8 Cumulative Noise

The sensitive receivers in the Bylong Valley are currently not exposed to significant industrial noise sources. The campaign of noise monitoring, described in **Section 3.1**, confirms that there are no significant industrial noise sources in the vicinity of the Project. Apart from the Bylong Quarry and the agricultural practices which occur within the valley, there are no other proposed mines or industrial facilities in the area. Bylong Quarry is located in the northeast of the Project Boundary and is distant from the proposed surface activities associated with the Project. Therefore cumulative noise impacts from other industrial sources are not expected.

6 OPERATIONAL VIBRATION

Operational vibration has been considered as part of the assessment for activities other than blasting. Vibration from blasting is assessed in **Section 10**.

Vibration sources from the Project include dozers, waste or coal emplacement on stockpiles and movement of large mobile plant and underground extraction. The most significant vibration source associated with the Project has been identified as a dozer.

A dozer is assumed to have a peak particle velocity (PPV) of 4 mm/s at a distance of 10 m. The closest privately owned receiver (receiver 69) is approximately 1400 m from the closest point to the operation of the dozer. At this distance the predicted PPV level is less than 0.01 mm/s and is not expected to be perceptible.

Vibration predictions may vary depending on the local geology, however human comfort or building damage impacts would not be expected from use of dozers at the receivers. Other vibration sources associated with operations are expected to produce a lower vibration level.

7 CONSTRUCTION NOISE AND VIBRATION

7.1 Construction Activity

Construction of the Project is expected to occur in stages over approximately two years with one year for establishment of the open cut mining areas. The most significant construction stages are:

- Scenario 1 - Bulk earthworks for the establishment of the rail loop and mine infrastructure areas over 12 months.
- Scenario 2 - Installation and construction of the mine infrastructure, CHPP and rail loop over 10 months.
- Scenario 3 - Upgrade of Upper Bylong Road between the mine entrance and Bylong Valley Way.
- Scenario 4 - Realignment of Upper Bylong Road from the mine entrance to Wooleys Road.
- Scenario 5 - Establishment of Open Cut Mining Areas, Clearing and Stockpiling.

Bulk earthworks for the rail loop and mine infrastructure are expected to include cut and fill for the establishment of the infrastructure areas and rail loop with waste being transported to the NW OEA using excavators, articulated dump trucks, compactors, D10 dozers and supporting equipment.

The installation and construction of the mine infrastructure is expected to include piling for foundations for the CHPP and other structures, concreting and formwork, delivery of equipment and assembly of site structures, buildings and plant.

The road upgrade for Upper Bylong Road is expected to include minor widening and resurfacing to make the road suitable for accessing the mine. The realignment will establish a new road from the mine entrance to Wooleys Road. The works are expected to include typical road work equipment including rollers, pavers, road trucks and excavators.

The mine clearing and establishment is expected to utilise the mining fleet including D11 sized Dozers, haul trucks and excavators.

As required by the INP and ICNG, certain construction activities associated with extractive developments are assessable under the INP. In this case scenarios 1, 2 and 5 are assessable under the INP and scenarios 3 and 4 are assessable under the ICNG.

The road upgrades are not taking place wholly within the mine area and are not associated with the mine infrastructure or establishment of mining areas. In this case it is considered appropriate that they are assessed under the ICNG.

Establishment of Open Cut Mining Areas, Clearing and Stockpiling can also be considered as a mining activity and can be compared against the operational noise criteria.

Table 7-1 presents a summary of the construction noise scenarios.

Table 7-1: Construction Noise Scenarios

Scenario	Description	Assessment Method	Criteria $L_{Aeq,15min}$ dB(A)	Expected Duration
1	CHPP/Rail Loop Earthworks	INP	35	12 months
2	CHPP/Rail Loop Structures	INP	35	10 months
3	Upper Bylong Road Upgrade	ICNG	40	6 months
4	Upper Bylong Road Realignment	ICNG	40	6 months
5	Clearing and Stockpiling	INP	35	12 months

7.2 Construction Noise Assessment

7.2.1 Noise Modelling Methodology

Construction noise levels were predicted for each scenario using the noise model approach described in **Section 5.1**.

Construction scenarios 1, 2 and 5 were assessed for the meteorological conditions in **Table 3-4** to satisfy requirements of the INP. Construction scenarios 2 and 3 were assessed for daytime conditions as the key construction works are expected to only occur during standard hours.

7.2.2 Modelling Scenarios

Table 7-2 presents a summary of the indicative equipment fleet which has been used in each modelling scenario. **Appendix C.3** presents the source locations for each construction scenario.

For road upgrades (scenarios 3 and 4), noise sources were modelled at the closest and furthest point from the receivers along the road alignment. Predicted noise levels are presented as a range to show noise levels when the works are closer and further away from receivers.

Table 7-2: Indicative Construction Fleet

Construction Fleet	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
90t Excavator	2	-	-	-	-
30t Excavator	6	-	-	-	-
20t Excavator		-	3	3	-
D10 Dozer	2	-	-	-	-
Compactor	2	-	-	-	-
Vibratory Roller	2	-	1	1	-
Drum Roller	2	-	-	-	-
Articulated Off Road Tipper Truck	4	-	-	-	-
Road Truck and Dog	1	1	1	1	-
Mini Piling Rig	-	1	-	-	-
Mobile Crane	-	3	-	-	-
Concrete Batch Plant	-	1	-	-	-
Concrete Pump	-	2	-	-	-
Smooth Drum Roller	-	-	1	1	-
Spray Seal Truck	-	-	1	1	-
Static Roller	-	-	1	1	-
Mining Fleet					
Excavator	-	-	-	-	2
Dozer	-	-	-	-	4
Scraper	2	-	-	-	-
Grader	1	-	1	1	-
Water Carts	2	-	1	1	-
Haul Truck	2	-	-	-	5

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7.2.3 Construction Sound Power Levels

Sound power levels for plant used in construction are taken from the European Commission (EC) noise database, Pacific Environment measurements, the UK DEFRA construction noise database and the British Standard 5228-1 2014 Code of practice for noise and vibration control on construction and open sites - noise. Sound power levels for mining equipment used in scenario 5 are taken from the mitigated mining fleet in **Table 5-4**.

The sound power levels for construction equipment are presented in **Table 7-3.**

Table 7-3: Construction Equipment Sound Power Levels, dB(A)

Construction Fleet	Sound Power Level
90t Excavator	108
30t Excavator	106
20t Excavator	103
Dozer (CAT D10)	115
Compactor	108
Vibratory Roller[1]	105/108
Drum Roller	108
Articulated Off Road Tipper Truck	107
Road Truck and Dog	109
Mini Piling Rig	104
Mobile Crane	100
Concrete Batch Plant	106
Concrete Pump	108
Smooth Drum Roller	104
Spray Seal Truck	108
Static Roller	104
Haul Truck	109
Mining Fleet[2]	
Excavator (EX2600)	116
Dozer (CAT D11)	115
Scraper	116
Grader	111
Water Carts	113
Haul Truck	113

Notes: 1. Different size rollers used across construction scenarios
2. Mining Fleet uses mitigation as described in **Section 5**.

7.2.4 Construction Noise Modelling Results and Assessment

Noise levels were predicted under the 10 meteorological conditions identified in **Table 3-4**. The following tables show the predicted noise level at receivers predicted to experience noise levels above the criteria.

There were no predicted exceedances of the criteria for scenario 2 and 4. Complete noise modelling results at all receivers are presented in **Appendix D.4**.

Table 7-4, Table 7-5, Table 7-6 show the noise modelling results for receivers in scenarios 1, 3 and 5 where the criteria are predicted to be exceeded.

Table 7-4: Construction Scenario 1

Receiver	Criteria $L_{Aeq,15min}$ dB(A)	Predicted Noise Level $L_{Aeq,15min}$ dB(A)			
		Day Neutral	Day Adverse	Eve/Night Neutral	Eve/Night Adverse
60	35	31	35	32	36
65A	35	31	34	32	36
63	35	31	35	32	36
69	35	32	37	33	39

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table 7-5: Construction Scenario 3

Receiver	Criteria $L_{Aeq, 15min}$ dB(A)	Predicted Noise Level $L_{Aeq,15min}$ dB(A)	
		Day Neutral	Day Adverse
60	40	25 – 41	25 – 45
65A	40	26 – 46	25 – 50
63	40	26 – 45	26 – 49
68	40	26 – 61	26 – 62
69	40	32 – 44	32 – 48

Note: Cells are shaded light blue for predicted levels in excess of the criteria.

Table 7-6: Construction Scenario 5

Receiver	Criteria $L_{Aeq,15min}$ dB(A)	Predicted Noise Level $L_{Aeq,15min}$ dB(A)			
		Day Neutral	Day Adverse	Eve/Night Neutral	Eve/Night Adverse
58	35	27	34	29	36
60	35	31	38	31	38
65A	35	30	37	32	38
63	35	31	37	32	39
68	35	30	36	31	38
69	35	34	40	35	42
141	35	27	34	29	36

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

The results show that for scenario 1, one receiver (receiver 69) is predicted to be moderately impacted and negligible impacts are predicted at three receivers (receivers 60, 53 and 65A).

For scenario 3, predicted exceedances of the construction noise management level are expected at up to five receivers (receivers 60, 63, 65A, 68 and 69) when works are at their closest to Bylong village. When works are at their furthest, compliance with the noise management levels is predicted.

For scenario 5, the predicted noise levels indicate that compliance with the INP goals would be achieved under neutral conditions during the day and night. Under adverse conditions during the day, moderate impacts are predicted at receiver 69 and 60. During the night, significant impacts are predicted at receiver 69 and moderate impacts at receivers 60, 65A, 63 and 68. These results are similar to operational Year 3 model results.

Similar to operational Year 3, the primary contributor to noise exceedances in scenario 5 is the operation of bulldozers on the North West Overburden Emplacement Area and the haul route to the North West Overburden Emplacement Area.

No receivers are predicted to be highly noise affected (noise levels of 75 dB(A) or above) for any of the construction scenarios.

The noise exceedances resulting from scenario 1, 3 and 5 indicate that noise mitigation and management measures should be implemented for the affected receivers.

During construction, a generator may be present at the workers accommodation facility. Provided that the generator meets 83 dB(A) at 1 m, no adverse impacts for private receivers would be expected and has not been assessed further.

7.3 Construction Noise Mitigation

Scenarios 1 and 5 are assessed under the INP and therefore feasible and reasonable mitigation should be applied. For scenario 1, restrictions of operations during adverse conditions during the night should be applied for scenario 1. Alternative measures could include reducing the number of plant operating simultaneously during these periods. The major contributors to this scenario are the road truck and dog, off road articulated dump truck and dozers. Noise levels from these sources will primarily impact upon the sensitive receivers at Bylong Village.

For scenario 5, the mining fleet is subject to the mitigation measures detailed in **Table 5-4**. The primary contributor to the exceedances is the operation of dozers and haul trucks on the NW OEA during the night under adverse meteorological conditions.

Operations on the NW OEA would be expected to continue until the SW OEA is opened as part of the Project mitigation measures. When the SW OEA is established, hauling to the NW OEA would be restricted under adverse meteorological conditions during the night as described in **Section 5.4.2**.

Prior to the opening of the SW OEA during initial operations, restriction of activities on the NW OEA is not considered reasonable as the construction schedule will be materially affected.

The receivers identified as being moderately or significantly impacted in scenario 5 would qualify for at-property mitigation or acquisition rights as identified in the operational assessment. This mitigation is considered sufficient for predicted impacts from construction scenario 5 and no further mitigation is considered reasonable.

For receivers which are predicted to experience negligible impacts, no further treatment is deemed necessary in line with DP&E VLAM Policy.

For receivers affected by construction scenario 3, noise management measures are recommended. Further details are provided in **Section 11.3**.

7.4 Construction Vibration Assessment

The methodology contained in the USA's Federal Transit Administration *Noise and Vibration Impact Assessment Manual*, (FTA Manual) as recommended in *Assessing Vibration a Technical Guideline*, was used to predict vibration levels of plant at a range of distances. Vibration source levels were taken from the *Environmental Noise Management Manual* and the FTA Manual. **Table 7-7** presents a summary of the predicted levels.

Table 7-7: Predicted Vibration Levels

Item[1,2]	Guideline Levels (mm/s)[3]			Predicted Vibration Level PPV mm/s at Distance (m)					
	Commercial	Residential	Sensitive	5	10	20	30	40	50
Compactor	20	5	3	22.6	7.0	3.8	2.5	1.3	0.9
Dozer				19.8	4.0	2.2	1.4	0.8	0.5
Pile boring/drilling				4.25	1.5	0.8	0.5	0.3	0.2
Vibratory Roller (15t)				22.6	8	2.8	1.5	1.0	0.7

Note: 1. Vibration source levels taken from Section 9 of the Environmental Noise Management Manual. Predictions are indicative only and will vary depending on specific type of plant and geotechnical conditions
2. Pile boring source level sourced from the FTA Manual
3. Criteria presented are the most stringent criteria from DIN 4150-3

The guideline levels represent a vibration level below which damage to buildings is not expected to occur. Exceedance of the guideline levels does not necessarily lead to damage, however further investigation would be required.

Table 7-7 indicates that vibratory rollers (of similar size), bored piling and a dozer could operate at 20 m or greater from residential receivers without exceeding the guideline limit.

For sensitive locations, the safe working distance would be 20 m for dozers, vibratory rollers and pile boring and 30 m for compactors.

Where work occurs within 20 m of a residence or other sensitive structures, trial vibration measurements should be considered to establish safe working distances.

In order to reduce the potential impact of any vibration, it is recommended that construction vibration be considered as part of the construction noise and vibration management plan.

7.5 Construction Vibration Mitigation

Where activities using significant sources of vibration occur within close proximity to structures and identified receivers, potential impacts are likely to be increased. In this case, the following mitigation measures are recommended for consideration:

- Increase separation distance between vibration source and sensitive receiver where feasible and reasonable.
- Substitution of methods of high vibration emission to lower vibration methods.
- Preparation and implementation of a Construction Noise and Vibration Management Plan (CNVMP) for the Project to identify detailed assessment methods for high risk works, identify receivers, complaints handling and consultation protocols.
- Where piling or compaction is proposed within 20 metres of any residential or commercial structure, utility, service or other infrastructure, a condition survey should be conducted and preliminary vibration monitoring undertaken by a qualified practitioner.
- Vibration monitoring as required, to establish vibration levels and as part of vibration impact management including:
  - Undertaking trial measurements to establish the site specific vibration propagation from high risk activities to establish site specific offset distances required for compliance with the cosmetic building damage criteria.
  - Alternatives to high vibration source plant and equipment should be used where reasonable and feasible.
  - Vibration monitoring as required, as part of vibration impact management.
  - Where vibration monitoring is undertaken and criteria exceedances are identified, management measures should be implemented immediately to ensure vibration compliance is achieved.

8 RAIL NOISE

8.1 Methodology

Rail noise and vibration has been assessed considering the potential for Project generated rail movements to increase noise and vibration impacts on the existing Sandy Hollow to Gulgong Railway Line.

As outlined in **Section 4.5**, the assessment is concerned with the section of the rail from where the Project's rail loop joins that main line until the junction with the Main Northern Railway line in Muswellbrook.

Rail noise was assessed as a relative increase from the existing level of rail noise at receivers adjacent to the line as a result of additional rail traffic generated by the Project. A desktop based review of receivers located along the rail line was undertaken to determine the separation distance between receivers to the rail line.

The assessment considers existing rail movements, Project generated movements and future movements from projects with approval to generate rail traffic but are not currently operating to approved levels.

Trains from the Project will travel east from the rail loop towards Muswellbrook. Trains arriving at the Project will travel west from Muswellbrook. Currently, the Sandy Hollow to Gulgong Railway Line serves Ulan, Moolarben and Wilpinjong mines located to the west of the Project. Ulan, Moolarben and Wilpinjong mines currently have approvals to generate additional train movements than they are currently undertaking.

The Cobbora Coal Mine, which lies west of the Project, has recently been approved but is not yet operating. In additional to coal trains, a limited number of ore and grain trains use this line, which originate from west of Gulgong.

Rail traffic is also generated to the east of the Project, travelling towards Muswellbrook from the Mangoola and Bengalla mines. The Mount Pleasant Mine, which lies east of the Project, was first approved in 1999 and has yet to commence operations.

The approved rail quantities have been considered in this assessment.

The RING also considers the potential for L_{max} events to occur as a result of rail movements. In this case, the line is already served by coal trains that operate on a 24 hour basis. The coal trains proposed to be used by the Project would be similar to existing trains. As the L_{max} is a measure of a single noise event, it is considered that as the trains will be similar, the maximum noise levels with and without the Project would also be similar. Therefore the L_{max} component of the RING has not been discussed further.

8.2 Rail Movements

The Project is expected to generate on average up to 500 trains per year with a maximum of 720 trains per year. This equates to a daily average of two trains and a maximum of eight trains. The capacity of the trains is expected to be 8,600 tonnes. With potential for larger trains in the future, this may reduce the number of train movements.

Given that the trains travel in one direction to the mine then in the opposite direction from the mine on the same line, the average number of rail movements per year is therefore 1000, and the maximum would be 1440 movements.

The existing number of train movements was determined based on information from publically available sources including Project approvals, Australian Rail Track Corporation (ARTC) reports, environmental impact statements and noise and vibration assessments of existing mines west of the Project. The existing train movements are presented in **Table 8-1**.

Table 8-1: Existing Contracted Rail Movements

Line Section	Existing Movements	Existing Movements Day (7.00am to 10.00pm)	Existing Movements Eve/Night (10.00pm to 7.00am)
Bylong-Mangoola[1]	29	18	11
Bengalla-Muswellbrook[1]	47	29	18

Note: 1. Contracted movements from Hunter Valley Corridor Rail Strategy 2012 -2021(**ARTC, 2012**)

There are currently two mining projects that have been approved and intend on using the rail line: Cobbora and Mount Pleasant coal mines. Published data relating to the intended rail movements from these projects are presented in **Table 8-2**.

Table 8-2: Approved Projects Rail Movements

Mining Project	Approved/Planned Movements	Approved/Planned Movements Day (7.00am to 10.00pm)	Approved/Planned Movements Night (10.00pm to 7.00am)
Cobbora[1]	10	7	3
Mount Pleasant[2]	6	4	2

Note: 1. Based on the stated planned rail movements Cobbora NIA (**EMM, 2012**)
2. As stated in the Mount Pleasant Noise Impact Assessment (**ERM, 1997**)

A summary of the assessed rail movements is presented in **Table 8-3**.

Table 8-3: Assessed Rail Movements

Section	Existing Contracted without Project		Existing Contracted & approved without Project		Existing Contracted with Project[1]		Existing Contracted & approved with Project[1]	
	Day	Night	Day	Night	Day	Night	Day	Night
Bylong-Mangoola	18	11	25	14	23	14	30	17
Bengalla-Muswellbrook	29	18	40	23	34	21	45	26

Note: 1. Assumes the Project's contribution of five movements during the day and three movements during the night

8.3 Rail Noise Predictions and Assessment

Rail noise levels were predicted at offset distances from the track. The calculations assumed a sound exposure level (SEL) of 101 dB(A) at 15 m per coal train passby event. The SEL is based on previous measurement data and assumes two Class 90 locomotives and wagons to a total train length of 1,050 m. The posted speed on the line has been taken to be 60 km/h.

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Table 8-4: Predicted Rail Noise Levels on Bylong-Mangoola Section

Distance (m)	Predicted Rail Noise Level dB(A)							
	Existing – Contracted without Project		Existing Contracted & Approved without Project		Existing – Contracted with Project		Existing Contracted & Approved with Project	
	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$
15	67	65	68	66	68	66	69	66
20	65	63	66	64	66	64	67	64
25	63	61	65	62	64	62	66	63
30	62	60	64	61	63	61	64	62
35	61	59	63	60	62	60	63	61
40	60	58	62	59	61	59	62	60
45	60	57	61	58	61	58	62	59
50	59	57	60	58	60	58	61	59
55	58	56	60	57	59	57	60	58
60	58	55	59	56	59	56	60	57
75	56	54	58	55	57	55	58	56
80	56	54	57	55	57	55	58	55
100	54	52	56	53	55	53	57	54
Criteria	**65**	**60**	**65**	**60**	**65**	**60**	**65**	**60**

Table 8-5: Predicted Rail Noise Levels on Bengalla-Muswellbrook Section

Distance (m)	Predicted Rail Noise Level dB(A)							
	Existing – Contracted without Project		Existing Contracted & Planned without Project		Existing – Contracted with Project		Existing Contracted & Planned with Project	
	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$	Day $L_{eq,15hr}$	Night $L_{eq,9hr}$
15	69	67	70	68	69	67	71	68
20	67	65	68	66	68	65	69	66
25	65	63	67	64	66	64	67	65
30	64	62	66	63	65	63	66	64
35	63	61	65	62	64	62	65	63
40	62	60	64	61	63	61	64	62
45	62	60	63	61	62	60	64	61
50	61	59	62	60	62	60	63	60
55	60	58	62	59	61	59	62	60
60	60	58	61	59	60	58	62	59
75	58	56	60	57	59	57	60	58
80	58	56	59	57	59	56	60	57
100	56	54	58	55	57	55	58	56
Criteria	**65**	**60**	**65**	**60**	**65**	**60**	**65**	**60**

The rail noise levels in **Table 8-4** indicate that existing levels of noise from contracted rail movements exceed the criteria at distances up to 30 m from the rail line on the Bylong to Mangoola section. There are currently four receivers located within 30 m of the track:

- 26 Kenilworth Street Denman.
- Mill Street Caravan Park Muswellbrook.
- 1 Turner Street Denman.
- 10 Fontana Way Denman.

The addition of the Project related volumes is expected to increase the noise levels by up to 1.1 dB during the day and 1 dB during the night. This means that the distance from the line where rail noise levels comply is extended up to approximately 35 m. This has the potential to affect three additional receivers as follows:

- 11 Fontana Way Denman.
- 12 Fontana Way Denman.
- 66 Craigend Access Mangoola.

The rail noise levels from existing contracted and approved movements on the Bylong to Mangoola section indicate the rail noise criteria are expected to be exceeded at up to 40 m from the track. There are currently 11 receivers located within 40 m of the track:

- 26 Kenilworth Street Denman.
- Mill Street Caravan Park Muswellbrook.
- 1 Turner Street Denman.
- 10 Fontana Way Denman.
- 11 Fontana Way Denman.
- 12 Fontana Way Denman.
- 66 Craigend Access Mangoola.
- 1242 Bylong Valley Way Kerrabee.
- 31 Honey Lane Sandy Hollow.
- 13 Fontana Way Denman.
- 179 Merriwa Road Denman.

The addition of Project related volumes to the existing contracted and approved volumes is expected to increase noise levels on the Bylong to Mangoola Section by up to 0.8 dB during the day and the night. This has the potential to affect up to four additional receivers:

- 35 Kenilworth Street Denman.
- 15 Fontana Way Denman.
- 8 Fontana Way Denman.
- 154 Louges Lane Muswellbrook.

On the Bengalla to Muswellbrook section of the line, the rail noise from existing and contracted movements in **Table 8-5** exceeds the criteria up to 40 m from the track. With the addition of Project related movements, the noise level is expected to increase by up to 0.7 dB and affect up to four addition receivers experiencing rail noise level above the criteria.

- 35 Kenilworth Street Denman.
- 8 Fontana Way Denman.
- 15 Fontana Way Denman.
- 154 Louges Lane Muswellbrook.

The rail noise for existing contracted and approved movements is expected to exceed the criteria at distances of up to 50 m from the track. The addition of the Project related movements is not expected to cause a noticeable increase in the day or night rail noise levels and no addition receivers are expected to be affected.

As a result of the predicted increases expected to exceed 65 $L_{Aeq,15hr}$ 65 and $L_{Aeq,9hr}$ 60 dB(A) and increase rail noise levels by more than 0.5 dB from rail operations as a result of additional rail traffic from the Project, noise management measures are recommended. These are discussed further in **Section 11.5**. However, the requirement and provision to provide mitigation is not generally borne from one user of the track and would be subject to further investigation and consideration by ARTC.

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9 ROAD TRAFFIC NOISE

9.1 Introduction

The Project is expected to generate additional vehicles on the existing roads in the area. As part of the development, roads are expected to be upgraded or realigned. These include:

- Upgrade to Upper Bylong Road from the mine entrance to Bylong Valley Way
- Realignment of Upper Bylong Road from the mine entrance to Wooleys Road to provide access to properties to the east of the Project.

No privately owned sensitive receiver lies within 600 m of the realigned Upper Bylong Road and therefore this has not been assessed.

Based on the Bylong Coal Project Traffic and Transport Impact Assessment (**Parsons Brinckerhoff, 2015**), the Project related roads are:

- Wollar Road.
- Bylong Valley Way.
- Upper Bylong Road.

Project related traffic is expected to primarily travel to and from the Project along Wollar Road, accessing the Project from Wollar Road on to Bylong Valley Way and then Upper Bylong Road. Other access routes are expected to be from the east and south along Bylong Valley Way.

The posted speeds on Wollar Road within the vicinity of the Project are 100 km/h. On Bylong Valley Way the posted speed is 50 km/h through Bylong village and 80 km/h and 100 km/h elsewhere. Upper Bylong Road's posted speed limit is 50 km/h in the vicinity of the village and 80 km/h elsewhere.

During the construction phase, a workers accommodation facility is to be located on the Bylong Station property owned by KEPCO, with access off Bylong Valley Way, east of the Wollar Road intersection and crossing with Sandy Hollow to Gulgong Railway line as indicated in **Figure 2.2**.

Based on the traffic assessment, three scenarios have been considered for construction, peak production and underground only operations as follows:

- Construction traffic in Year 2.
- Operational traffic in Year 9 and Year 13.

9.2 Project Generated Traffic

The Project is expected to generate traffic from staff and contractor light vehicles going to and from the Project, heavy vehicle deliveries and contractors, and during construction, a shuttle bus to and from the worker accommodation facility. **Table 9-1** present the Project generated traffic.

Table 9-1: Project Daily Generated Traffic

Year	Year 2	Year 9	Year 13
Light Vehicles	410	614	494
Buses (WAF)	24	0	0
Heavy Vehicles	104	26	26
Total	**538**	**640**	**520**

Light vehicle movements for employees are expected to be generated during the shift change over time. Shift change over time is 7.00 am and 7.00 pm. Therefore, vehicles can be expected to be travelling prior to 7.00 am to arrive before the shift starts and that those coming off shift would be travelling after 7.00 am. The evening shift change over time is at 7.00 pm and all of the employee vehicle movements are expected prior to 10.00 pm. Heavy vehicle deliveries during construction and operation and contractors are expected during the daytime.

Based on the Project's traffic assessment, the Project related roads are expected to be utilised by Project generated traffic as shown in **Table 9-2**.

Table 9-2: Percentage of Project Generated Traffic on Roads

Road	Section	Year 2		Year 9		Year 13	
		LV*	HV**	LV	HV	LV	HV
Bylong Valley Way	East of Wollar Road	6%	0%	6%	0%	5%	0%
Bylong Valley Way	West of Wollar Road	94%	100%	94%	100%	95%	100%
Wollar Road	-	88%	100%	88%	100%	90%	100%
Bylong Valley Way	North of Upper Bylong Road	94%	100%	94%	100%	95%	100%
Bylong Valley Way	South of Upper Bylong Road	6%	0%	6%	0%	5%	0%
Upper Bylong Road	-	100%	100%	100%	100%	100%	100%

*Light vehicle; **Heavy vehicle.

9.3 Traffic Volumes

Existing road traffic movements have been taken from intersection counts conducted in 2014 by the Project's traffic consultant and traffic counts conducted in 2011 for the Bylong Quarry Traffic Assessment (**Barnson, 2012**).

Existing traffic flows are characterised by low volumes during the night period (10.00pm to 7.00am). The 2014 intersection counts were conducted between 5.00am and 8.00pm. The 2014 night time traffic flows were estimated using the traffic flows from the 2011 traffic (**Barnson, 2012**) and applying the ratio of daytime to night time traffic to the 2014 counts.

The existing traffic flows were then estimated from the 2014 counts (**PB, 2015**) using a 2% per annum increase based on the assumptions listed in Project's traffic assessment (**PB, 2015**).

Table 9-3 to **Table 9-8** show the assessed years' traffic volumes both without and with the Project for each modelled year.

Table 9-3: Year 2 Traffic Volumes (Without Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	313	295	21%	18	6%
Bylong Valley Way	West of Wollar Road	299	282	13%	17	0%
Wollar Road	-	154	132	60%	22	5%
Bylong Valley Way	North of Upper Bylong Road	306	288	14%	18	6%
Bylong Valley Way	South of Upper Bylong Road	318	300	13%	19	6%
Upper Bylong Road	-	186	176	12%	10	0%

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Table 9-4: Year 2 Traffic Volumes (With Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	360	333	24%	27	26%
Bylong Valley Way	West of Wollar Road	815	738	21%	77	13%
Wollar Road	-	623	550	33%	73	7%
Bylong Valley Way	North of Upper Bylong Road	815	744	21%	78	14%
Bylong Valley Way	South of Upper Bylong Road	341	320	12%	22	5%
Upper Bylong Road	-	725	652	21%	73	14%

Table 9-5: Year 9 Traffic Volumes (Without Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	367	346	21%	21	6%
Bylong Valley Way	West of Wollar Road	350	330	13%	20	0%
Wollar Road	-	180	155	60%	26	5%
Bylong Valley Way	North of Upper Bylong Road	358	338	14%	21	6%
Bylong Valley Way	South of Upper Bylong Road	373	351	13%	22	6%
Upper Bylong Road	-	218	206	12%	12	0%

Table 9-6: Year 9 Traffic Volumes (With Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	402	375	19%	27	5%
Bylong Valley Way	West of Wollar Road	955	836	8%	119	1%
Wollar Road	-	751	633	19%	119	2%
Bylong Valley Way	North of Upper Bylong Road	955	836	9%	120	2%
Bylong Valley Way	South of Upper Bylong Road	408	380	12%	28	4%
Upper Bylong Road	-	858	741	7%	117	1%

Table 9-7: Year 13 Traffic Volumes (Without Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	389	367	21%	22	6%
Bylong Valley Way	West of Wollar Road	372	351	13%	21	0%
Wollar Road	-	191	164	60%	27	5%
Bylong Valley Way	North of Upper Bylong Road	380	358	14%	22	6%
Bylong Valley Way	South of Upper Bylong Road	395	373	13%	24	6%
Upper Bylong Road	-	231	219	12%	12	0%

Table 9-8: Year 13 Traffic Volumes (With Project)

Road	Section	Total traffic (24hrs)	Daytime 7.00am to 10.00pm (15 hrs)		Night 10.00pm to 7.00am (9 hrs)	
			Total traffic	% heavy vehicles	Total traffic	% heavy vehicles
Bylong Valley Way	East of Wollar Road	416	390	20%	26	5%
Bylong Valley Way	West of Wollar Road	868	776	9%	92	1%
Wollar Road	-	659	565	22%	94	2%
Bylong Valley Way	North of Upper Bylong Road	868	783	10%	93	2%
Bylong Valley Way	South of Upper Bylong Road	419	393	12%	28	5%
Upper Bylong Road	-	751	664	8%	87	1%

9.4 Methodology

Road traffic noise levels were predicted using the US Federal Highway Administration's Traffic Noise Model 2.5 (TNM) (**FHWA, 2004**). This method of prediction was preferred over the UK's Department of Transport's Calculation of Road Traffic Noise (CRTN) (**DoT, 1988**) as it is considered in the RNP as having more validity for intermittent and low traffic volumes. The model considered soft ground between the road and receivers with no barriers or topographical shielding.

The section of Bylong Valley Way between Upper Bylong Road and Wollar Road does not contain any private sensitive receivers. As a result it has not been considered in the assessment. The sections of Bylong Valley Way south of the Upper Bylong Road intersection and east of the Wollar Road intersection and Wollar Road have been considered.

The potentially most affected receivers were identified in the vicinity of the Project related roads. Where compliance is achieved at these receivers, compliance would be expected at receivers further from the road. These receivers and their offset from the roads are:

- Receiver 44 Wollar Road (100 m).
- Receiver 65 – Bylong Valley Way and Upper Bylong Road (17 m and 420 m).
- Receiver 68 – Bylong Valley Way and Upper Bylong Road (23 m and 34 m).
- Receiver 69 – Upper Bylong Road (144 m).
- 5036 Bylong Valley Way, Growee Bylong Valley Way south (30 m).
- 2272 Bylong Valley Way, Widden Bylong Valley Way east (22 m).

9.5 Predicted Road Traffic Noise Levels and Assessment

Table 9-9 to **Table 9-11** present the predicted road traffic noise levels for Year 2, Year 9 and Year 13.

Table 9-9: Year 2 Calculated Traffic Noise Levels

Receiver ID	Without Project		With Project		Increase (dB)	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day	Night
44	45	30	49	37	3.7	6.2
65	47	35	47	36	0.0	0.4
68	49	36	52	43	3.0	7.0
69	36	30	43	35	7.6	5.0
5036 Bylong Valley Way	50	39	50	39	0.0	0.2
2272 Bylong Valley Way	54	41	55	46	0.9	5.6

Note: 1. Where calculated traffic noise levels are less than 30 dB(A), they are set to 30 dB(A)

Table 9-10: Year 9 Calculated Traffic Noise Levels

Receiver ID	Without Project		With Project		Increase (dB)	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day	Night
44	45	31	47	36	1.8	4.5
65	49	36	49	37	0.3	1.1
68	49	35	50	39	1.4	4.2
69	36	30	40	30	3.7	0.0
5036 Bylong Valley Way	51	39	51	40	0.1	1.0
2272 Bylong Valley Way	54	40	54	42	0.0	1.4

Note: 1. Where calculated traffic noise levels are less than 30 dB(A), they are set to 30 dB(A)

Table 9-11: Year 13 Calculated Traffic Noise Levels

Receiver ID	Without Project		With Project		Increase (dB)	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$	Day	Night
44	46	31	47	35	1.5	3.4
65	49	37	49	37	0.1	0.5
68	49	36	50	39	1.1	2.9
69	36	30	40	30	3.4	0.0
5036 Bylong Valley Way	51	40	51	40	0.0	0.0
2272 Bylong Valley Way	54	40	54	42	0.2	1.4

Note: 1. Where calculated traffic noise levels are less than 30 dB(A), they are set to 30 dB(A)

The largest predicted noise increases are expected at receiver 44 on Wollar Road, receiver 68 at the intersection of Upper Bylong Road and Bylong Valley Way and receiver 69 on Upper Bylong Road. These receivers are located on the roads where the largest traffic increases are expected. During Year 2, the largest increases in noise level are expected to be up to 8 dB at receiver 69 during the day and up to 6 dB at receiver 44 during the night. This represents the largest potential increase as a result of the Project in the Year 2 scenario since this year contains the most site generated traffic.

A review of traffic volumes and the offset distance from the road indicates that internal noise levels at St Stephens Anglican Church would not be expected to be above the RNP criteria. The majority of traffic does not travel past the church and comes from the north and turns off prior to entering the village. On this basis, it is expected that noise levels at the place of worship would be within acceptable limits.

Whilst traffic noise levels on Wollar Road, Bylong Valley Way and Upper Bylong Road are predicted to increase, the predicted increase is less than the 12 dB increase criteria. The levels are also expected to be within the $L_{Aeq,15hr}$ 60 dB(A) and $L_{Aeq,9hr}$ 55 dB(A) RNP criteria at the nearest sensitive receivers.

10 BLAST OVERPRESSURE AND VIBRATION ASSESSMENT

10.1 Methodology

Blasting overpressure and vibration have been calculated at the nearest sensitive receivers according to Australian Standard AS 2187: Part 2-2006 "*Explosives – Storage and Use – Part 2: Use of Explosives*" and the US Bureau of Mines.

The air blast overpressure levels (OP) are predicted from the equation below:

$$OP = 164.35 - 24\left(\log D - \frac{1}{3} logQ\right)$$

The PPV for average ground type are predicted from the equation below:

$$PPV = K * \left(\frac{D}{\sqrt{Q}}\right)^{-1.6}$$

For both equations, D is distance in meters from the blast to the assessment point, Q is the weight in kg of explosive per day or maximum instantaneous charge (MIC) and K is the site based factor.

Receivers which are within the open cut mining areas have not been assessed as they will be removed from the area prior to operations commencing.

10.2 Blast Calculations and Assessment

Overpressure and ground vibration levels were calculated based on a set of conservative site laws. The calculations are indicative only and predictions should be further developed as part of the blast design and development of specific site laws.

A detailed blasting design has not yet been completed. Therefore, a conservative approach was taken to predict overpressure and vibration levels using the MIC of 410 kg, 1000 kg and 3500 kg. The initial MIC of 410 kg was selected based on a typical hole depth of 15 m and hole diameter of 229 mm, taken from the preliminary blasting design in the Project's feasibility study (**RPM/QCC Resources/PB, 2014**).

The site based factor K is site specific and is usually defined empirically after a series of trial blasting. Based on a review of nearby coal mine assessments, the site based factor in the area ranges from 500 (hard rock) to 1700 (average ground type). In this instance, the factor K is 1140 which is used in AS 2187: Part 2 2006 to predict the 50% chance of exceedance in "average conditions."

Table 10-1 presents a summary of the predictions for private residential receivers. **Table 10-2** presents a summary of the predictions for heritage receivers and infrastructure.

The closest significant rock escarpment locations were selected for the blasting assessment to provide an indicative calculation of blasting overpressure and vibration levels. The calculated levels are presented in **Table 10-3.** Cells are shaded where predicted levels exceed the guideline limits.

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Table 10-1: Predicted Blasting Overpressure and Ground Vibration Levels for Residential Receivers

ID	Approx. Distance m	Vibration, mm/s				Overpressure, dB(L)			
		Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
4	11050	5	0.05	0.10	0.26	133	88	91	96
5	10936	5	0.05	0.10	0.27	133	88	91	96
17	7479	5	0.09	0.18	0.49	133	92	95	100
22	5436	5	0.15	0.30	0.82	133	96	99	103
41A	9960	5	0.06	0.11	0.31	133	89	92	97
41B	9889	5	0.06	0.12	0.32	133	89	92	97
42	8879	5	0.07	0.14	0.38	133	90	94	98
43	9670	5	0.06	0.12	0.33	133	90	93	97
44	8948	5	0.07	0.14	0.37	133	90	94	98
47	8862	5	0.07	0.14	0.38	133	91	94	98
49	8495	5	0.07	0.15	0.40	133	91	94	98
50	7906	5	0.08	0.17	0.45	133	92	95	99
53	4764	5	0.18	0.37	1.02	133	97	100	104
56	4080	5	0.23	0.48	1.30	133	99	102	106
57A	4346	5	0.21	0.43	1.18	133	98	101	105
57B	4409	5	0.21	0.42	1.15	133	98	101	105
57C	4324	5	0.21	0.44	1.19	133	98	101	105
58	3331	5	0.32	0.66	1.80	133	101	104	108
60	3004	5	0.38	0.78	2.13	115	102	105	109
61A	3273	5	0.33	0.68	1.85	115	101	104	108
61B	3261	5	0.34	0.68	1.87	115	101	104	108
65A	3230	5	0.34	0.70	1.89	115	101	104	108
63	3117	5	0.36	0.74	2.01	115	101	105	109
68	3427	5	0.31	0.63	1.72	115	100	104	108
69	2724	5	0.45	0.91	2.49	115	103	106	110
141	2667	5	0.46	0.94	2.57	115	103	106	110
146	2298	5	0.59	1.20	3.27	115	105	108	112
151	3138	5	0.36	0.73	1.98	115	101	104	109
158	3141	5	0.36	0.73	1.98	115	101	104	109
161	3684	5	0.28	0.56	1.53	115	100	103	107
162	3734	5	0.27	0.55	1.50	115	100	103	107
165	4271	5	0.22	0.44	1.21	115	98	101	106
168	5277	5	0.16	0.32	0.86	115	96	99	103
181A	4950	5	0.17	0.35	0.96	115	97	100	104
181B	4909	5	0.17	0.36	0.97	115	97	100	104
181C	4937	5	0.17	0.35	0.96	115	97	100	104
181D	4771	5	0.18	0.37	1.01	115	97	100	104
225	4971	5	0.17	0.35	0.95	115	97	100	104

ID	Approx. Distance m	Vibration, mm/s				Overpressure, dB(L)			
		Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
226	5699	5	0.14	0.28	0.76	115	95	98	103
242	7601	5	0.09	0.18	0.48	115	92	95	100
292	5879	5	0.13	0.27	0.73	115	95	98	102
317	8500	5	0.07	0.15	0.40	115	91	94	98
349	7550	5	0.09	0.18	0.49	115	92	95	100
348	7009	5	0.10	0.20	0.55	115	93	96	100
Bylong Oval	3198	5	0.35	0.71	1.92	115	101	104	109
Bylong Community Hall	3291	5	0.33	0.67	1.84	115	101	104	108

Table 10-2: Blast Overpressure and Ground Vibration Prediction for Heritage and Infrastructure Receivers

ID	Description	Approx. Distance (m)	Vibration (mm/s)				Overpressure dB(L)			
			Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
CUL001	Sandstone Cavity	3528	50	0.3	0.6	1.6	133	100	103	108
CUL002	Sandstone Cavity	3593	50	0.3	0.6	1.6	133	100	103	107
CUL003	Sandstone Cavity	2922	50	0.4	0.8	2.2	133	102	105	110
CUL004	Sandstone Formation	2924	50	0.4	0.8	2.2	133	102	105	110
CUL005	Sandstone Cavity	2923	50	0.4	0.8	2.2	133	102	105	110
CUL006	Sandstone Cavity	2577	50	0.5	1.0	2.7	133	103	106	111
CUL007	Sandstone Formation	2718	50	0.4	0.9	2.5	133	103	106	110
CUL008	Sandstone Cavity	1988	50	0.7	1.5	4.1	133	106	109	114
CUL009	Sandstone Cavity	2019	50	0.7	1.5	4.0	133	106	109	113
CUL012	Sandstone Formation	2651	50	0.5	1.0	2.6	133	103	106	111
CUL013	Sandstone Cavity	3714	50	0.3	0.6	1.5	133	100	103	107
CUL015	Sandstone Cavity	2699	50	0.5	0.9	2.5	133	103	106	110
CUL016	Sandstone Cavity	2495	50	0.5	1.1	2.9	133	104	107	111
CUL017	Sandstone Cavity	3894	50	0.3	0.5	1.4	133	99	102	107
CUL018	Sandstone Cavity	4697	50	0.2	0.4	1.0	133	97	100	105
CUL019	Sandstone Cavity	3896	50	0.3	0.5	1.4	133	99	102	107
CUL020	Sandstone Cavity	3562	50	0.3	0.6	1.6	133	100	103	107
CUL021	Sandstone Cavity	3565	50	0.3	0.6	1.6	133	100	103	107
CUL022	Sandstone Cavity	3620	50	0.3	0.6	1.6	133	100	103	107
CUL023	Sandstone Cavity	2398	50	0.5	1.1	3.1	133	104	107	112
CUL024	Sandstone Cavity	1920	50	0.8	1.6	4.4	133	106	110	114
CUL025	Sandstone Cavity	2606	50	0.5	1.0	2.7	133	103	106	111
CUL026	Sandstone Cavity	2570	50	0.5	1.0	2.7	133	103	107	111
CUL027	Sandstone Cavity	2475	50	0.5	1.1	2.9	133	104	107	111
CUL028	Sandstone Cavity	2720	50	0.4	0.9	2.5	133	103	106	110
CUL029	Sandstone Cavity	2396	50	0.5	1.1	3.1	133	104	107	112
CUL030	Sandstone Cavity	2013	50	0.7	1.5	4.0	133	106	109	113
CUL031	Sandstone Cavity	3874	50	0.3	0.5	1.4	133	99	102	107
CUL032	Sandstone Cavity	3884	50	0.3	0.5	1.4	133	99	102	107
CUL033	Sandstone Cavity	3892	50	0.3	0.5	1.4	133	99	102	107

ID	Description	Approx. Distance (m)	Vibration (mm/s)				Overpressure dB(L)			
			Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
INF001	Rail Culvert	6016	80	0.1	0.3	0.7	133	95	98	102
INF002	Rail retaining wall	2297	80	0.6	1.2	3.3	133	105	108	112
INF003	Road Bridge	864	80	2.8	5.7	15.6	133	115	118	122
INF004	Rail Culvert	988	80	2.3	4.6	12.6	133	113	116	121
INF005	Rail Tunnel Entrance	4039	80	0.2	0.5	1.3	133	99	102	106
INF006	Rail Line	850	200	2.9	5.9	16.0	133	115	118	122
GG01	Grinding Groove	2904	50	0.4	0.8	2.2	133	102	105	110
GG02	Grinding Groove	2893	50	0.4	0.8	2.3	133	102	105	110
GG03	Grinding Groove	2858	50	0.4	0.8	2.3	133	102	105	110
GG04	Grinding Groove	3077	50	0.4	0.8	2.0	133	102	105	109
MT04	Modified Tree	3939	50	0.2	0.5	1.4	133	99	102	106
OQ01	Ochre Quarry	2484	50	0.5	1.1	2.9	133	104	107	111
RS01	Rockshelter	3590	50	0.3	0.6	1.6	133	100	103	107
RS02	Rockshelter	4712	50	0.2	0.4	1.0	133	97	100	105
RS03	Boulder	85	50	114.8	243.3	638.4	133	139	142	146
RS04	Rockshelter	5989	50	0.1	0.3	0.7	133	95	98	102
RS05	Rockshelter	5975	50	0.1	0.3	0.7	133	95	98	102
RS06	Rockshelter	1937	50	0.8	1.6	4.3	133	106	109	114
RS07	Rockshelter	2297	50	0.6	1.2	3.3	133	105	108	112
RS08	Rockshelter	2473	50	0.5	1.1	2.9	133	104	107	111
RS09	Rockshelter	2626	50	0.5	1.0	2.6	133	103	106	111
RS10	Rockshelter	2279	50	0.6	1.2	3.3	133	105	108	112
RS11	Rockshelter	21702	50	0.0	0.0	0.1	133	81	84	89
RS12	Rockshelter	5915	50	0.1	0.3	0.7	133	95	98	102
RS13	Rockshelter	2473	50	0.5	1.1	2.9	133	104	107	111
EH001	Bylong Anglican Church & Cemetery	3273	15	0.3	0.7	1.9	133	101	104	108
EH003	Bylong Station House	5455	15	0.1	0.3	0.8	133	96	99	103
EH004	Sunnyside Homestead	2986	15	0.4	0.8	2.1	133	102	105	109
EH005	Tarwyn Park	190	15	31.7	64.7	176.3	133	131	134	138
EH008	Brigdelo School	7479	15	0.1	0.2	0.5	133	92	95	100
EH010	Homestation	3539	15	0.3	0.6	1.6	133	100	103	108

ID	Description	Approx. Distance (m)	Vibration (mm/s)				Overpressure dB(L)			
			Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
EH011	Cheese Factory Remains	508	15	6.6	13.4	36.5	133	120	123	128
EH012	Harley Hill Farm Complex	1590	15	1.1	2.2	5.9	133	108	112	116
EH013	Harley Hill Cottage Remains	180	15	34.6	70.5	192	133	131	134	139
EH014	Tarwyn Park Potential Archaeological Deposit	248	15	20.7	42.2	115.1	133	128	131	135
EH015	Potential Archaeological Deposit 1	1043	15	2.1	4.2	11.6	133	113	116	120
EH016	Swiss Cottage	133	15	56.1	114.5	311.9	133	134	137	142
EH017	Bylong Hall	3316	15	0.3	0.7	1.8	133	101	104	108
EH019	Tarwyn Park Stables	107	15	79.5	162.1	441.7	133	137	140	144
EH020	Potential Archaeological Deposit 3 (Cottage Chimney Remains)	350	15	12.5	25.5	69.5	133	124	128	132
EH022	Bylong Station Stables	5490	15	0.1	0.3	0.8	133	96	99	103
EH023	Bylong Trig Station	1288	15	1	3	8	133	111	114	118

Note: Cells are shaded blue where guideline levels are exceeded.

Table 10-3: Blast Overpressure and Ground Vibration Prediction for Rock Escarpments

ID	Description	Approx. Distance (m)	Vibration (mm/s)				Overpressure dB(L)			
			Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg	Criteria	MIC-410kg	MIC-1000kg	MIC-3500kg
CLI01	Escarpment	4998	50	0.2	0.3	0.9	133	96	100	104
CLI02	Escarpment	1368	50	1.3	2.7	7.5	133	110	113	117
CLI03	Escarpment	263	50	18.8	15.2	104.8	133	127	130	135
CLI04	Escarpment	301	50	15.2	11.0	84.4	133	126	129	133
CLI05	Escarpment	1500	50	1.2	2.4	6.5	133	109	112	116
CLI06	Escarpment	1171	50	1.7	3.5	9.6	133	112	115	119

Note: Cells are shaded blue where guideline levels are exceeded

The blasting predictions in **Table 10-1** indicate that no private receiver is predicted to experience blasting overpressure or ground vibration levels in excess of the ANZEC guideline limits.

For heritage and infrastructure features presented in **Table 10-2**, vibration levels at boulder RS03 are predicted to exceed the guideline limits with an MIC of 3500kg. Management for this feature would include managing MIC amounts to meet the criteria. As the criteria are guideline levels only, additional condition inspection, monitoring and trial blasts should be undertaken to establish safe blasting limits.

Blast calculations indicate the heritage receptors including Tarwyn Park, Harley Hill Cottage, Swiss Cottage and Cottage Chimney Remains were predicted to potentially exceed the vibration and overpressure limits due to proximity to the eastern open cut. A Blast Management Plan would need to consider specific heritage receiver mitigation measures at these locations including trial blasts to develop suitable MIC to meet vibration limits, blast monitoring, and ongoing condition surveys.

For rock escarpments, the predicted levels in **Table 10-3** indicate overpressure levels of up to 129 dB(L) and ground vibration levels of up to 42 mm/s using an MIC of 3500 kg. As there are no defined guideline limits to prevent rock falls from escarpments as a result of blasting, it is recommended that the escarpments are considered as part of the Blast Management Plan.

11 NOISE AND BLAST MANAGEMENT

11.1 Operational Noise Management

11.1.1 Introduction

Noise management is required to ensure that the Project operates within the criteria and to reduce the potential for increased noise emissions to occur. A Noise Management Plan should be developed for the site. The management plan should include the following:

- Limiting criteria.
- Identification of noise sensitive receivers.
- Description of the measures to be implemented to ensure compliance with the criteria.
- Description of the management system, roles and responsibilities, reporting requirements, actions and triggers for actions.
- Description of pro-active and reactive measures for noise management.
- Description of a monitoring program which should include:
    - Meteorological monitoring.
    - Noise monitoring for compliance.
    - Noise monitoring for day to day noise management.
    - Noise monitoring in response to complaints or incidents.
- Definitions for noise incidents and non-compliance events.
- Protocols for handling complaints or incidents relating to noise.
- Indicators for performance.
- Requirement for the education of staff and contractors with regard to noise management as part of training and induction programs.
- Reporting requirements.
- Periods for review and updates to the management plan.

An outline of the items to be included in the noise management plan is provided in the following sections. The noise management plan should be developed in detail as further operational planning is undertaken.

11.1.2 Operational Noise Management

Mitigation measures were developed in **Section 5.4**. The measures to be included for the Project include:

- Mitigation of fixed and mobile plant as outlined in **Table 5-2**. Including:
  - Sound power level limits for stationary plant outlined in **Table 5-4**.
  - Sound power level limits for mobile plant outlined in **Table 5-4**.
  - Management of dozers for slow speed reversing in first gear only.
  - Inserts for dozer tracks to minimise tracking noise.
- Alteration of operations during adverse weather conditions in the daytime when the North West Overburden Emplacement Area is in use, as outlined in **Section 5.4.1**.
- Alteration of operations during adverse weather conditions at night when the North West Overburden Emplacement Area is in use, as outlined in **Section 5.4.1.**
- At property mitigation for moderately impacted receivers (receivers 58, 65A, 68, 141, 151 and 158).
- At property mitigation or acquisition for significantly impacted receivers (receivers 63, 60 and 69).
- Use of broadband or smart reversing alarms instead of traditional tonal alarms.

As identified in the operational noise assessment, careful management of operations under certain meteorological conditions is required to minimise potential impacts at receivers. To facilitate this, operational protocols or 'Site Rules' would be established, which determine when operational activities would be altered based on predictive meteorological and real-time noise and meteorological monitoring. Monitoring systems are outlined further in **Section 11.1.3** and **11.2**. Further to this, management measures should also include:

- Ensuring mobile plant operates to the appropriate sound power levels by periodic noise testing.
- Maintaining and operating machinery in accordance with manufacturer's specifications.
- Operational planning to take into account adverse meteorology for receivers.
- Education of staff and contractors with regard to noise management as part of training and induction programs.
- Identify good practice protocols for the operation of machinery to minimise potential noise events including:
  - Haul trucks.
  - Extraction of waste and coal from open cut mining areas.
  - Overburden emplacement areas.
  - Operation of the CHPP, conveyors, rail loader, stockpiles, ROM pad and crusher.
  - Operation of trains on the rail loop.

11.1.3 Noise Monitoring

As part of the noise management plan, a noise monitoring program should be developed. Noise monitoring using a combination of real-time continuous unattended monitoring and periodic attended noise monitoring should be implemented to provide both real-time noise management and continual management and improvement of noise emission from the Project.

Periodic attended noise monitoring should be conducted to determine compliance with the criteria.

An indicative noise monitoring program is described below. The program should be developed and refined as the Project develops and is reflective of stakeholder consultation. **Table 11-1** presents in principle monitoring methods.

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Table 11-1: Indicative Monitoring Programs

Item	Frequency	Location	Purpose
Sound Power Level Testing	Initial testing, then periodically	For selected plant and equipment and at a number of points surrounding operations	To confirm equipment sound power levels
Real-time continuous unattended noise monitoring	Continuous	At selected locations where noise management is required such as at a location representative of potentially affected receivers to the north, south, east and west of the project. For example, receivers in Bylong village, receiver 181 or 57, receiver 141 and receiver 151	To provide inputs into real-time noise management and enable operational modifications to be made as required (not to determine compliance)
Periodic attended noise monitoring	Periodic - Quarterly	At locations where compliance with noise conditions are required to be determined	To determine compliance with construction and operational noise goals
Attended noise monitoring	As required	At locations where a complaint has been received or where potential noise management issues occur	To determine the level of noise from the mine and identify significant noise sources from the Project. Results of the monitoring would then inform rectification actions
Real-time continuous meteorological monitoring	Continuous	At a location representative of the Project and receivers	To determine meteorological conditions that may affect or have affected noise emission from the site and to determine appropriate conditions for noise monitoring

It is recommended that noise monitoring of specific plant items is carried out at the start of operations or during commissioning to confirm noise emission levels. The measurement of equipment sound power levels at the start of the Project would inform management of specific plant and provide a benchmark for performance should it be required as part of any subsequent noise management.

Attended noise monitoring as described in **Table 11-1** should be periodically carried out to determine compliance with the Project's noise limits. The monitoring should be carried out in accordance with the requirements in Chapter 11 of the INP and AS 1055-1997. Compliance monitoring should be carried out by independent, suitably qualified acoustic practitioners.

Noise measurements should consider the operating and meteorological conditions presented in this assessment and those implemented on site at the time of measurement.

Attended compliance monitoring should include locations where limits are specified and compliance is required to be achieved. This includes potentially affected private residential receivers and other sensitive locations. Representative locations of sensitive receivers would be determined where direct measurement at receivers is not practical.

Where noise levels from the Project cannot be directly measured or estimated at the receiver from the attended noise monitoring, the protocols within Chapter 11 of the INP should be implemented. These include alternative methods such as measuring closer to the source and calculating levels at receivers, alternative noise monitoring locations or noise modelling to calculate levels at receivers.

Real-time continuous noise monitoring should be implemented as a real-time management tool. This type of noise monitoring system is currently available and used within NSW for mining projects. The monitoring locations should be selected based on the potential for noise impacts to occur.

Real-time unattended noise monitoring cannot be used to determine compliance with the criteria. However, it can include a number of techniques to estimate the Project's contribution to the measured noise level for management purposes. These techniques could include directional noise monitoring, use of multiple monitoring sites close in and further away from operations, using alternatives descriptors to L_{eq}, and use of noise level, frequency and time based filtering.

Currently available technology enables real-time noise management based on continuous noise monitoring in the form of alerts when limits are either being approached or exceeded. Noise level limits should be developed as part of the noise management plan which would trigger noise management actions.

All noise monitoring data should be subject to data quality control protocols which would include protocols for the items to be recorded during noise monitoring, the measured noise indicators, data handling and storage and reporting.

Noise monitoring locations for unattended and attended noise monitoring should be determined during the development of the noise management plan. The locations should be chosen based on the predicted impacts at receivers, consent or licence conditions and on site considerations including suitability to measure representative noise levels, avoiding adverse influence from extraneous noise sources, security and access.

All meteorological monitoring from an on-site meteorological station should conform to the requirements of *Australian Standard AS 2923-1987 Ambient Air – Guide for Measurement of Horizontal Wind for Air Quality Applications*. Meteorological conditions to determine appropriate conditions whilst attended monitoring is conducted should include inputs from the on-site meteorological station, operator observations or monitoring based on the requirements of AS 1055.

Meteorological monitoring should include a method of determining atmospheric stability for the purpose of determining temperature inversion conditions. This could include the measurement of wind speed, wind direction for calculation of sigma theta stability data or temperature measurement at multiple heights.

11.2 Noise and Meteorological Forecasting

In order to manage Project noise and blast emissions, a site specific predictive noise and meteorological forecasting system should be used as part of operational planning and implementation of noise management measures.

The meteorological forecasting system should be capable of providing forecasts specific to the Project area, sufficient for prior operational planning. The forecast should at a minimum include wind speed, wind direction, temperature, humidity, barometric pressure and a means to determine atmospheric stability class, atmospheric temperature gradient or the presence of temperature inversions and their strength.

A noise prediction system utilising meteorological forecasts should provide a noise forecast for the project area identify potential noise compliance issues before they occur and inform operations planning to minimise noise impacts.

11.3 Construction Noise Management

Construction noise for the road upgrade of Upper Bylong Road should be effectively managed to minimise potential impacts. This would include development of a CNVMP prior to commencement of works onsite. This would utilise more detailed information in relation to the proposed construction methodology, activities, durations and equipment type and numbers. It is envisaged that the management plan would consider the following:

- The nearby residences and other sensitive land uses.
- The noise management levels identified in this assessment.
- Address the potential impact from the proposed construction methods.
- Where management levels are exceeded, examine feasible and reasonable noise mitigation.
- Develop reactive and proactive strategies for dealing with any noise complaints.
- Identify a site contact person to follow up complaints.
- Noise monitoring.

Source controls:

- Mitigation of specific noise sources using portable temporary screens, where this is possible.
- Maximising the offset distance between noisy plant items and sensitive receivers.
- Orienting equipment away from sensitive receivers.
- Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including cranes, excavators and trucks.
- Using lower powered or reduced size equipment, where practical.
- Using spotters, smart or broadband reversing alarms in place of traditional tonal reversing alarms.
- Using items to screen mobile plant and equipment.
- Operating machinery in a manner which reduces maximum noise level events, including excavators and dozers.
- Turning off machinery when not in use.

Administration controls:

- Respite and/or restricted construction hours may be considered for extended periods of noise intensive works.
- Selecting plant and equipment based on output noise levels.
- Using alternative construction methods to minimise noise levels.
- Avoiding the use of horns and alarms.
- Education and training of site staff is necessary for satisfactory implementation of noise mitigation measures.
- Site awareness training / environmental inductions that include a section on noise mitigation techniques / measures to be implemented throughout the project.
- Ensuring work occurs within approved hours relevant to the construction activity.
- Ensuring plant and equipment is well maintained and not generating excessive noise.
- Avoid dropping materials and tools or dragging materials across hard surfaces.

Community management measures, consistent with the Project's community management plan, including:

- Notifying receivers potentially affected by the works.
- Keeping the community informed in relation to noise intensive activities in the immediate area.
- Providing consultation to identify particularly sensitive times and avoiding carrying out noise intensive activities during these times where possible.

Site controls:

- Limiting the number of plant and equipment on site.
- Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.

- Arrange site accesses to minimise impacts on sensitive receivers.
- Carrying out loading and unloading away from sensitive receivers.
- Selecting site access points and roads as far as possible away from sensitive receivers.

11.4 Rail Noise Management

The assessment identified in **Section 8** that under the existing rail traffic volumes, the addition of the Project would affect an additional three receivers on the Bylong to Mangoola section and four receivers on the Bengalla to Muswellbrook section of the rail line.

The assessment also indicated that with the existing contracted and approved rail traffic volumes, the addition of the Project would potentially affect an additional four receivers on the Bylong to Mangoola section and no additional receivers on the Bengalla to Muswellbrook section.

As stated previously, ARTC is responsible for the activities on its rail line and subsequently has a requirement under their EPL to undertake pollution reduction programs in relation to noise. Furthermore, the EPL also contains limits for the noise emission from individual trains. Therefore it would be expected that the rail freight contractors would utilise locomotives and other rail bound vehicles that comply with the requirements of ARTC's EPL.

Further noise management can be achieved by scheduling trains during the less sensitive day time period, where reasonable and feasible.

Where noise criteria at individual properties are exceeded, noise mitigation in the form of acoustic barriers or architectural treatments, such as façade and/or glazing upgrades and the provision of mechanical ventilation, could be considered for implementation. Due to the rural nature of the area surrounding the rail line, dwellings are sparse and the provision of an acoustic barrier may not be feasible due to the length and potential benefits.

The provision of architectural treatments should be determined on a case by case basis and would take into consideration receiver specific details, including the distance from the track, topography, orientation of sensitive internal areas and any intervening structures. The requirement and provision to provide architectural treatments is not generally borne from one user of the track and would be subject to further investigation and consideration by ARTC. The investigation, management and mitigation of rail noise is the responsibility of ARTC.

11.5 Road Traffic Noise Management

The road traffic assessment did not identify any exceedance of the criteria. However, road traffic noise management should be included as part of the noise management plan. The management plan would identify the related routes associated with the Project, including Wollar Road, Bylong Valley Way south and east and Upper Bylong Road.

Measures to assist in the management of road traffic noise should include staff and contractor education and training of road traffic noise impacts. The education should include educating drivers on appropriate driving behaviours to minimise the risk of annoyance from light vehicles. This would include adhering to posted speed limits and avoiding aggressive acceleration and driving styles.

Heavy vehicle operators driving to and from the site should also be subject to education and training through inductions and tool-box talks. The education of heavy vehicle drivers would focus on appropriate driving behaviours to minimise the risk of annoyance, including limiting compression braking in residential areas or at night, avoiding aggressive driving styles and limiting the use of air brake releases in the vicinity of sensitive receivers.

Once the mine is operational and residential accommodation arrangements of employees is known, KEPCO will investigate the feasibility of bussing its employees between Mudgee and the site.

11.6 Blast Management

It is recommended that a blast management plan is developed. The blast management plan should include:

- Limiting criteria.
- Identified blast sensitive receivers.
- Performance indicators.
- Monitoring protocols.
- Roles and responsibilities.
- Blasting controls.
- Protocols for community consultation, incidents and complaints.
- Contingency protocols.
- Reporting requirements.

The blast management plan should also consider the following with regard to overpressure and ground vibration:

- Consideration of blast timing:
    - Restriction of blasting to between the hours of 9.00am to 5.00pm Monday to Saturday with no blasting outside of these times, including on Sundays and Public Holidays.
    - Restriction of blasting during adverse meteorological conditions.
- Blast monitoring and inspection including:
    - Blast monitoring at key sensitive sites.
    - Trial blasts to assist in the development of "site laws" based on monitoring data.
    - Regular condition surveys and blast monitoring at heritage structures and modification of blast design to meet blast limits at these sites where required.
    - Monitoring and field surveys of rock escarpments during trial blasts to develop appropriate blasting limits to minimise the potential for rock displacement or falls.
    - Condition monitoring, as required, for blast sensitive sites, including protocols for property inspections and investigations.
    - Inspection of rock escarpment conditions, as required.
    - A record of the inspections and condition monitoring to track conditions over time.
- Predictive meteorological forecast systems, outlined in **Section 11.2,** to inform the blast design and timing.
- Protocols for receivers including:
    - Implementing a temporary exclusion zone of at least 500 m for public places.
    - Specific blasting protocols developed for blasting close to heritage items, rail infrastructure, residential receivers, roads and escarpments.
- Operational measures including:
    - Modification of blasting parameters including MIC, delay interval, burden and spacing, stemming, direction of initiation, charge depth and confinement to reduce blasting overpressure and ground vibration.
    - Ensure that the stemming depth is maintained using well compacted crushed rock or other material that will not blow out easily.
    - Where feasible, orientate the blast face away from any sensitive areas.
    - Controls to minimise fly rock.
- Performance indicators and review including:
    - A review of blasting operations after they are carried out to confirm performance against the blast management plan.
    - Periodic review of the blast management plan to evaluate performance and identify actions, if required.

11.7 Blast Monitoring

A blast monitoring program should be developed as a component of the blast management plan. The monitoring program should include details of monitoring locations, protocols and requirements. Monitoring locations should be representative of potentially affected (whilst privately owned) receivers and significant features including:

- Bylong village to the north of the Project.
- Receivers to the east of the Project.
- Receiver to the south of the Project.
- Adjacent heritage buildings.
- Locations to the east of the project representative of rock escarpment features.
- Locations to the south and west of the eastern pit representative of escarpment features.

Other sites should also be considered, where required during revision and review of the management plan, or in response to blasting incidents and complaints.

Monitoring should occur when the blasting location is approaching sensitive receivers and infrastructure and predicted levels indicate that impacts may occur. The distance at which blast monitoring would occur should be defined by the size of the blast and the specific site laws developed during trial blasts and should be detailed in the management plan.

It is recommended, however, that blast monitoring is carried out for all blasts at locations representative of closest privately owned receivers and heritage structures, to provide assurance that criteria are being met.

Blast overpressure and ground vibration monitoring should be carried out in accordance with AS 2187.2-2006 *Explosives - Storage and use - Use of explosives* and the ANZEC guidelines.

11.8 Community Consultation and Communication

The Project should, as part of its environmental management procedures, provide information regarding noise and blasting issues to the community. It should provide information on any aspect of noise and blasting where requested from the community. A program of proactive communication and the dissemination of information should be developed.

Information regarding blasting times and dates should be made available to the community within a reasonable period of time prior to any planned blasting.

A means of communication (such as a telephone number, email address or website) for the Project should be provided to the community where information can be obtained.

11.9 Noise and Blast Incident and Complaints Handling

Response procedures will be activated either by an adverse noise or blasting impact at sensitive receivers or by the identification of risks of impacts as identified by staff, contractors or management. The knowledge of noise or blasting problems would typically come from three sources:

- Community complaints from neighbouring landholders who contact the mine regarding noise or blasting.
- Results of noise and blast monitoring.
- Observations or risks identified from mine operators, staff, contractors and management.

In situations where emission levels are perceived by neighbouring landholders or site personnel to be a problem, or the noise or blasting monitoring system results demonstrate noise levels approaching or exceeding relevant criteria, a procedure should be developed to effectively manage these incidents.

A noise or blast incident may be identified by the Project's monitoring systems. Where this occurs, a protocol should be developed for managing these incidents and confirming if a non-compliance event has occurred.

A phone line would be maintained during the Project (Community Liaison Officer on 1800 295664). All complaints would be logged, the nature of the complaint and the time and date recorded. The Project's response to the complaint would also be recorded, detailing the Project's response, measures taken and any follow up with the complainant.

The Project's environmental management system should develop a detailed complaints and incidents management protocol.

11.10 Performance Indicators

The noise management plan and blast management plan should also develop performance indicators to assist in determining the plan's performance. Key performance indicators could include:

- Results of compliance noise and blast monitoring and sound power level testing.
- Community responses and feedback.
- Trends or incidents identified in continuous monitoring results.
- Management and actions taken in response to complaints and noise incidents.
- Observations or risks identified by staff, contractors and management.

12 CONCLUSION

An assessment of noise, vibration and blasting impacts from the Project has been conducted. The assessment was conducted with reference to the SEARs and other relevant agency requirements according to current guidelines, standards and assessment methods.

In relation to operational noise, the assessment indicated the following:

- Initial noise predictions indicated significant noise impacts and the need to investigate noise mitigation options.
- Feasible and reasonable mitigation measures were investigated to reduce noise impacts at receivers. The adopted mitigation measures include:
    - Mitigation for selected fixed and mobile plant.
    - Alteration of operations during day and night under adverse meteorological conditions whilst the NW OEA is in operation in the Year 3 scenario.
- The implementation of the mitigation measures reduced noise levels by up 3 dB(A) at the most affected receivers.
- With the mitigation measures, three receivers were predicted to be significantly impacted, including receiver 60, 63 and 69 to the north of the project. An additional six receivers were predicted to be moderately impacted, including receivers 56, 58, 65A, 68 to the north and receiver 141 to the south east. As open cut mining progresses south, noise levels reduce at receivers to the north and moderately impact an additional two receivers to the south, namely receivers 151 and 158.
- At-property mitigation measures or acquisition rights applied under the DP&E VLAM Policy is recommended for the residual significantly and moderately impacted receivers.
- Low frequency noise levels were predicted to be within acceptable levels.
- Sleep disturbance impacts were predicted at one receiver (receiver 69). This receiver is significantly impacted by operational noise and the measures implemented for operational noise would be sufficient to control sleep disturbance impacts.

With respect to construction noise and vibration, the assessment considered five construction scenarios, including mine infrastructure construction, road upgrades and realignments and the start of mining operations.

The installation of structures (scenario 2) and the realignment of Upper Bylong Road (scenario 4), did not predict exceedances of the INP or ICNG criteria and therefore impacts are considered negligible. During earthworks for mine infrastructure (scenario 1), one receiver (receiver 69) was predicted to be moderately impacted and at all other receivers, the impacts were negligible.

During the upgrade of Upper Bylong Road (scenario 3), exceedances of the ICNG construction noise management levels were predicted at up to five receivers (receivers 60, 63, 65A, 68 and 69) when works were at their closest to Bylong Village. When works were at their furthest, compliance with the noise management levels was predicted.

During mine establishment and stripping activities (scenario 5) compliance with the INP goals was predicted under neutral conditions during the day and night. Under adverse conditions during the day, moderate impacts were predicted at receiver 69 and 60. During the night, significant impacts were predicted at receiver 69 and moderate impacts at receivers 60, 65A, 63 and 68 similar to the Year 3 operational noise impacts.

No receivers are predicted to be highly noise affected (noise levels of 75 dB(A) or above) for any of the construction scenarios.

The receivers predicted to be impacted by construction noise are also predicted to be impacted by operational noise. In this case the measures applied for operational noise would be suitable to mitigate impacts at these receivers.

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The rail noise assessment indicated that rail movements caused by the project would increase noise levels at receivers along the Bylong to Mangoola and Bengalla to Muswellbrook sections of the track. The assessment considered the impact of Project generated movements with both existing movements and existing and approved movements. The assessment concluded the following:

- On the Bylong to Mangoola section, up to three additional receivers would be impacted as a result of the Project compared with existing movements and up to four additional receivers compared with the existing and approved movements.
- On the Bengalla to Muswellbrook section, up to four additional receivers would be impacted as a result of the Project compared with existing movements and no additional receivers compared with the existing and approved movements.

The requirement and provision to provide mitigation is not generally borne from one user of the track and would be subject to further investigation and consideration by ARTC.

The road traffic noise assessment indicated that project related traffic is expected on Wollar Road, Upper Bylong Road and Bylong Valley Way, with the majority of traffic expected to travel on Wollar Road to access the Project. The assessment indicated that increases in traffic noise would be within acceptable limits for construction and operational stages of the Project.

The blasting assessment indicated that no privately owned receivers were predicted to be impacted by blast vibration or overpressure levels in excess of the guideline limits.

Predicted vibration and overpressure levels for heritage items indicated exceedance at Tarwyn Park Harley Hill Cottage, Swiss Cottage and Cottage Chimney Remains where blasting occurs in the adjacent Eastern Open Cut. A Blast Management Plan would be required to detail suitable blast management to meet blast limits at the heritage receivers.

Predicted vibration and overpressure levels also indicated that the guideline levels would not be exceeded for rock escarpments.

The assessment identified a number of blast sensitive features and receivers where no specific criteria exist to assess impacts from blasting vibration and overpressure. Where this occurs, the most stringent criteria from AS 2187:2006 for structural damage was used in consideration that further monitoring, condition inspection and trial blasts would be carried out to determine appropriate guideline limits.

Noise and blasting management measures were recommended which included the development of a noise management plan and a blast management plan. As part of these plans, measures were recommended which included:

- Specific mitigation for fixed and mobile plant as indicated in this report.
- Specific operational alterations under adverse meteorological conditions during the day and night.
- Meteorological forecasting to assist in identification of adverse conditions and operational planning.
- Noise monitoring program for compliance determination, sound power level measurement for plant and equipment, continuous noise monitoring for noise management, monitoring in response to complaints and meteorological monitoring.
- Road and rail traffic management measures.
- Blast monitoring program for compliance and blast management.
- Community consultation and communication.
- Noise and blast incident and complaint handling.
- Performance indicators for the management plan.

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Appendix A SENSITIVE RECEIVERS AND FEATURES

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The following tables present the noise sensitive receivers and blast sensitive receivers located within the Project area.

Table A-1: Noise Sensitive Receiver Locations

ID	Owner	Receiver Type	MGA Coordinates Zone 56 E	N
	Privately-Owned Receivers			
4	Justin Kennedy Lewis Pty Limited	Residential	225751	6416995
5	Justin Kennedy Lewis Pty Limited	Residential	225667	6416840
17	Bridgelo School 1914	Residential	230178	6414455
41A	NA Fieldsend	Residential	226801	6416207
41B	NA Fieldsend	Residential	226796	6416131
42	PJ & LJ Kelleher	Residential	227687	6415328
43	W Zappa	Residential	227777	6416196
44	WD & PAS Evans	Residential	228833	6415736
47	Suntala Pty Ltd	Residential	228445	6415552
49	Suntala Pty Ltd	Residential	229126	6415335
50	Suntala Pty Ltd	Residential	229421	6414790
53	RF & BW Murdoch	Residential	233708	6410993
56	Locaway Pty Ltd	Residential	226800	6409519
57A	Locaway Pty Ltd	Residential	225827	6408583
57B	Locaway Pty Ltd	Residential	225736	6408534
57C	Locaway Pty Ltd	Residential	225826	6408529
58	J Mead	Residential	226848	6408342
60	Jarvet Pty Limited	Residential	228482	6409419
61A	St Stephens Church - Anglican Church Property Trust Diocese of Bathurst	Place of Worship	228454	6409700
61B	St Stephens Church - Anglican Church Property Trust Diocese of Bathurst	Passive Recreation Area	228480	6409697
65A	JB Watson (Bylong General Store)	Residential	228660	6409734
63	TA Rixon	Residential	228651	6409610
68	RNK Wright	Residential	228921	6410018
69	RNK Wright	Residential	229442	6409398
141	JD & VK & AJ & LF & MG & NJ & K Brown & AN Bonarius	Residential	235184	6406104
142A	Minister for Education and Training	School	231041	6405605
142B	Minister for Education and Training	School	231038	6405565
146	PA Frost & CD Shaw	Residential	234104	6403024
151	PR Grieve	Residential	229691	6401019
158	PR Grieve	Residential	230384	6400727
161	JB Watson & JA Nancarrow	Residential	230854	6400087
162	JB Watson & JA Nancarrow	Residential	231496	6400026
165	J Garling & D & P & R Loneragan	Residential	229919	6399688
168	J Garling & D & P & R Loneragan	Residential	229542	6398753
181A	Icelink Pty Ltd	Residential	224814	6407172
181B	Icelink Pty Ltd	Residential	224845	6407060
181C	Icelink Pty Ltd	Residential	224812	6406984
181D	Icelink Pty Ltd	Residential	224978	6406981
225	Timnath Pty Ltd	Residential	226224	6402091

ID	Owner	Receiver Type	MGA Coordinates Zone 56 E	N
Privately-Owned Receivers				
226	Timnath Pty Ltd	Residential	225909	6401119
242	Ian Ross & Kay Carol Tindale	Residential	226263	6397961
292	Iwi Cattle Co Pty Ltd	Residential	225257	6402067
317	LL Braithwaite	Residential	226709	6396556
349	J Garling & D & P & R Loneragan	Residential	229379	6396433
348	J Garling & D & P & R Loneragan	Residential	229574	6396942
Bylong Oval	Bylong Council	Active Recreation Area	228585	6409672
Bylong Community Hall	Bylong Council	Commercial	228609	6409781
Goulburn River National Park	NPWS NSW	Passive Recreation Area	-	-
Wollemi National Park	NPWS NSW	Passive Recreation Area	-	-
Bylong Quarry		Industrial	234626	6410802
KEPCO Owned Receivers				
K1	KEPCO Bylong Australia Pty Ltd	Residential	230269	6414258
K2	KEPCO Bylong Australia Pty Ltd	Residential	230044	6413815
K3	KEPCO Bylong Australia Pty Ltd	Residential	230530	6412524
K4	KEPCO Bylong Australia Pty Ltd	Residential	230582	6412451
K5	KEPCO Bylong Australia Pty Ltd	Residential	229931	6411232
K6	KEPCO Bylong Australia Pty Ltd	Residential	228956	6410183
K7	KEPCO Bylong Australia Pty Ltd	Residential	228903	6410218
K8	KEPCO Bylong Australia Pty Ltd	Residential	228834	6410246
K9	KEPCO Bylong Australia Pty Ltd	Residential	228650	6409688
K10	KEPCO Bylong Australia Pty Ltd	Residential	229347	6409099
K11	KEPCO Bylong Australia Pty Ltd	Residential	229224	6408942
K12	KEPCO Bylong Australia Pty Ltd	Residential	230880	6407498
K13	KEPCO Bylong Australia Pty Ltd	Residential	230966	6407295
K14	KEPCO Bylong Australia Pty Ltd	Residential	231545	6407033
K15	KEPCO Bylong Australia Pty Ltd	Residential	231776	6406549
K16	KEPCO Bylong Australia Pty Ltd	Residential	231195	6406387
K17	KEPCO Bylong Australia Pty Ltd	Residential	231101	6406579
K18	KEPCO Bylong Australia Pty Ltd	Residential	231130	6406563
K19	KEPCO Bylong Australia Pty Ltd	Residential	222936	6405820
K20	KEPCO Bylong Australia Pty Ltd	Residential	223212	6405757
K21	KEPCO Bylong Australia Pty Ltd	Residential	230978	6405482
K22	KEPCO Bylong Australia Pty Ltd	Residential	230368	6404500
K23	KEPCO Bylong Australia Pty Ltd	Residential	230513	6404341
K24	KEPCO Bylong Australia Pty Ltd	Residential	230483	6403594
K25	KEPCO Bylong Australia Pty Ltd	Residential	229922	6403263
K26	KEPCO Bylong Australia Pty Ltd	Residential	230460	6402369
K27	KEPCO Bylong Australia Pty Ltd	Residential	232976	6405173
K28	KEPCO Bylong Australia Pty Ltd	Residential	233862	6405511

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ID	Owner	Receiver Type	MGA Coordinates Zone 56 E	N
	Privately-Owned Receivers			
K29	KEPCO Bylong Australia Pty Ltd	Residential	235214	6405633
K144	KEPCO Bylong Australia Pty Ltd	Residential	229756	6403726
K130	KEPCO Bylong Australia Pty Ltd	Residential	231539	6406905
KTPHB	KEPCO Bylong Australia Pty Ltd	Commercial	231208	6406983

Table A-2: Residential, Heritage, Infrastructure and Rock Escarpment Locations

ID	Name	Receiver Type	MGA Coordinates (m) Zone 56	
			E	N
4	Justin Kennedy Lewis Pty Limited	Residential	225751	6416995
5	Justin Kennedy Lewis Pty Limited	Residential	225667	6416840
17	Brigdelo School 1914	Residential	230178	6414455
22	Bylong Station Stables	Residential	230726	6412434
41A	NA Fieldsend	Residential	226801	6416207
41B	NA Fieldsend	Residential	226796	6416131
42	PJ & LJ Kelleher	Residential	227687	6415328
43	W Zappa	Residential	227777	6416196
44	WD & PAS Evans	Residential	228833	6415736
47	Suntala Pty Ltd	Residential	228445	6415552
49	Suntala Pty Ltd	Residential	229126	6415335
50	Suntala Pty Ltd	Residential	229421	6414790
53	RF & BW Murdoch	Residential	233708	6410993
56	Locaway Pty Ltd	Residential	226800	6409519
57A	Locaway Pty Ltd	Residential	225827	6408583
57B	Locaway Pty Ltd	Residential	225736	6408534
57C	Locaway Pty Ltd	Residential	225826	6408529
58	J Mead	Residential	226848	6408342
60	Jarvet Pty Limited	Residential	228482	6409419
61A	Anglican Church Property Trust Diocese of Bathurst	Residential	228454	6409700
61B	Anglican Church Property Trust Diocese of Bathurst	Residential	228480	6409697
65A	JB Watson	Residential	228660	6409734
63	TA Rixon	Residential	228651	6409610
68	RNK Wright	Residential	228921	6410018
69	RNK Wright	Residential	229442	6409398
141	JD & VK & AJ & LF & MG & NJ & K Brown & AN Bonarius	Residential	235184	6406104
142A	Minister for Education and Training	Residential	231041	6405605
142B	Minister for Education and Training	Residential	231038	6405565
146	PA Frost & CD Shaw	Residential	234104	6403024
151	PR Grieve	Residential	229691	6401019
158	PR Grieve	Residential	230384	6400727
161	JB Watson & JA Nancarrow	Residential	230854	6400087

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ID	Name	Receiver Type	MGA Coordinates (m) Zone 56	
			E	N
162	JB Watson & JA Nancarrow	Residential	231496	6400026
165	J Garling & D & P & R Loneragan	Residential	229919	6399688
168	J Garling & D & P & R Loneragan	Residential	229542	6398753
181A	Icelink Pty Ltd	Residential	224814	6407172
181B	Icelink Pty Ltd	Residential	224845	6407060
181C	Icelink Pty Ltd	Residential	224812	6406984
181D	Icelink Pty Ltd	Residential	224978	6406981
225	Timnath Pty Ltd	Residential	226224	6402091
226	Timnath Pty Ltd	Residential	225909	6401119
242	Ian Ross & Kay Carol Tindale	Residential	226263	6397961
292	Iwi Cattle Co Pty Ltd	Residential	225257	6402067
317	LL Braithwaite	Residential	226709	6396556
349	J Garling & D & P & R Loneragan	Residential	229379	6396433
348	J Garling & D & P & R Loneragan	Residential	229574	6396942
Bylong Oval	Bylong Council	Residential	228585	6409672
Bylong Community Hall	Bylong Council	Residential	228609	6409781
K1	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230269	6414258
K2	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230044	6413815
K3	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230530	6412524
K4	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230582	6412451
K5	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	229931	6411232
K6	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	228956	6410183
K7	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	228903	6410218
K8	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	228834	6410246
K9	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	228650	6409688
K10	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	229347	6409099
K11	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	229224	6408942
K12	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230880	6407498
K13	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230966	6407295
K14	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231545	6407033
K15	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231776	6406549
K16	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231195	6406387
K17	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231101	6406579
K18	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231130	6406563
K19	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	222936	6405820
K20	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	223212	6405757
K21	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230978	6405482
K22	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230368	6404500

ID	Name	Receiver Type	MGA Coordinates (m) Zone 56	
			E	N
K23	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230513	6404341
K24	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230483	6403594
K25	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	229922	6403263
K26	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	230460	6402369
K27	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	232976	6405173
K28	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	233862	6405511
K29	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	235214	6405633
K144	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	229756	6403726
K130	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231539	6406905
KTPHB	KEPCO Bylong Australia Pty Ltd	Residential-KEPCO	231208	6406983
CUL001	Sandstone Cavity	Heritage Feature	234500	6408457
CUL002	Sandstone Cavity	Heritage Feature	234512	6408574
CUL003	Sandstone Cavity	Heritage Feature	234191	6407574
CUL004	Sandstone Formation	Heritage Feature	234192	6407574
CUL005	Sandstone Cavity	Heritage Feature	234197	6407551
CUL006	Sandstone Cavity	Heritage Feature	233651	6408027
CUL007	Sandstone Formation	Heritage Feature	233720	6408195
CUL008	Sandstone Cavity	Heritage Feature	233110	6407790
CUL009	Sandstone Cavity	Heritage Feature	233121	6407836
CUL010	Possible occupation area	Heritage Feature	231341	6403753
CUL011	Sandstone Platform	Heritage Feature	230737	6403735
CUL012	Sandstone Formation	Heritage Feature	231219	6409611
CUL013	Sandstone Cavity	Heritage Feature	234525	6408792
CUL015	Sandstone Cavity	Heritage Feature	233994	6407439
CUL016	Sandstone Cavity	Heritage Feature	233773	6407483
CUL017	Sandstone Cavity	Heritage Feature	234672	6408897
CUL018	Sandstone Cavity	Heritage Feature	234438	6410397
CUL019	Sandstone Cavity	Heritage Feature	234672	6408899
CUL020	Sandstone Cavity	Heritage Feature	234682	6408132
CUL021	Sandstone Cavity	Heritage Feature	234513	6408513
CUL022	Sandstone Cavity	Heritage Feature	234553	6408553
CUL023	Sandstone Cavity	Heritage Feature	233347	6408190
CUL024	Sandstone Cavity	Heritage Feature	232613	6408303
CUL025	Sandstone Cavity	Heritage Feature	233185	6408708
CUL026	Sandstone Cavity	Heritage Feature	233203	6408639
CUL027	Sandstone Cavity	Heritage Feature	233772	6407404
CUL028	Sandstone Cavity	Heritage Feature	233759	6408131
CUL029	Sandstone Cavity	Heritage Feature	233371	6408150
CUL030	Sandstone Cavity	Heritage Feature	232690	6408359
CUL031	Sandstone Cavity	Heritage Feature	234143	6409544
CUL032	Sandstone Cavity	Heritage Feature	234128	6409572

ID	Name	Receiver Type	MGA Coordinates (m) Zone 56	
			E	N
CUL033	Sandstone Cavity	Heritage Feature	234122	6409590
INF001	Rail Culvert	Infrastructure	230259	6412994
INF002	Rail retaining wall	Infrastructure	230009	6409168
INF003	Road Bridge	Infrastructure	230547	6407835
INF004	Rail Culvert	Infrastructure	232344	6406937
INF005	Rail Tunnel Entrance	Infrastructure	236001	6407373
INF006	Rail Line	Infrastructure	N/A	N/A
GG01	Grinding Groove	Heritage Feature	230539	6409895
GG02	Grinding Groove	Heritage Feature	230518	6409881
GG03	Grinding Groove	Heritage Feature	230485	6409844
GG04	Grinding Groove	Heritage Feature	230598	6410072
MT04	Modified Tree	Heritage Feature	233533	6410133
MT05	Modified Tree	Heritage Feature	232408	6404883
MT06	Modified Tree	Heritage Feature	232657	6404783
MT07	Modified Tree	Heritage Feature	232600	6404647
MT08	Modified Tree	Heritage Feature	232341	6404677
OQ01	Ochre Quarry	Heritage Feature	233770	6407449
RS01	Rockshelter	Heritage Feature	234741	6408053
RS02	Rockshelter	Heritage Feature	234369	6410474
RS03	Boulder	Heritage Feature	231691	6404074
RS04	Rockshelter	Heritage Feature	232228	6412806
RS05	Rockshelter	Heritage Feature	232223	6412794
RS06	Rockshelter	Heritage Feature	232635	6408306
RS07	Rockshelter	Heritage Feature	233218	6408199
RS08	Rockshelter	Heritage Feature	233769	6407404
RS09	Rockshelter	Heritage Feature	233902	6407508
RS10	Rockshelter	Heritage Feature	233428	6407806
RS11	Rockshelter	Heritage Feature	254216	6408406
RS12	Rockshelter	Heritage Feature	232717	6412605
RS13	Rockshelter	Heritage Feature	233234	6408462
CLI01	Rock Escarpment	Escarpment	227097	6410932
CLI02	Rock Escarpment	Escarpment	232464	6407656
CLI03	Rock Escarpment	Escarpment	231697	6403668
CLI04	Rock Escarpment	Escarpment	231187	6403178
CLI05	Rock Escarpment	Escarpment	234272	6405184
CLI06	Rock Escarpment	Escarpment	232848	6406084
EH001	Bylong Anglican Church & Cemetery (1876)	Heritage Feature	228460	6409702
EH002	Bylong Catholic Church & Cemetery (1915)	Heritage Feature	231133	6406571
EH003	Bylong Station House	Heritage Feature	230588	6412451
EH004	Sunnyside Homestead (1864)	Heritage Feature	228457	6409386

ID	Name	Receiver Type	MGA Coordinates (m) Zone 56	
			E	N
EH005	Tarwyn Park House	Heritage Feature	231545	6407033
EH006	Bylong Upper Hall (1920s)	Heritage Feature	230988	6405643
EH007	Bylong Upper Public School (1927)	Heritage Feature	231039	6405603
EH008	Brigdelo School (1914)	Heritage Feature	230178	6414455
EH009	Post Office & Store (1915)	Heritage Feature	230979	6405482
EH010	Homestation (1840s)	Heritage Feature	228936	6410136
EH011	Cheese Factory Remains	Heritage Feature	230895	6407490
EH012	Harley Hill Farm Complex (1900)	Heritage Feature	230453	6402367
EH013	Harley Hill Cottage (1930s)	Heritage Feature	230483	6403596
EH014	Tarwyn Park Potential Archaeological Deposit	Heritage Feature	231663	6406990
EH015	Potential Archaeological Deposit 1	Heritage Feature	231428	6407889
EH016	Swiss Cottage	Heritage Feature	232878	6405146
EH017	Bylong Hall	Heritage Feature	228614	6409809
EH018	Potential Archaeological Deposit 2	Heritage Feature	231531	6407883
EH019	Tarwyn Park Stables	Heritage Feature	231539	6406905
EH020	Potential Archaeological Deposit 3 (Cottage Chimney remains)	Heritage Feature	230362	6404503
EH021	Tarwyn Park Horse Burials	Heritage Feature	231208	6406983
EH022	Bylong Station Stables	Heritage Feature	230638	6412487
EH023	Bylong Trig Station	Heritage Feature	228556	6407196

Appendix B NOISE MONITORING

Pacific Environment Limited

B.1 INTRODUCTION

Noise monitoring was carried out between May 2012 and February 2014 at five sites in the Bylong Valley.

The five monitoring locations are situated in a rural setting with no appreciable industrial noise sources in the vicinity. BG01 and BG03 are located on farmland within the vicinity of residential buildings. BG02 is located within the backyard of a property within Bylong village, adjacent to Bylong General Store. BG04 and BG05 are located within the vicinity of residential properties.

The monitoring locations are intended to be representative of the surrounding sensitive receivers in the area.

The results of the unattended noise monitoring for each monitoring location by season are detailed in **Table B-1** to **Table B-5** respectively. The background noise level is described as the 'Rating Background Level' (RBL) as defined within the Industrial Noise Policy (INP). The results are presented in the time periods defined as follows:

- Day - 7.00am to 6.00pm;
- Evening - 6.00pm to 10.00pm; and
- Night - 10.00pm to 7.00am.

Full details of the seasonal background noise monitoring are presented in the following sections.

Table B-1: Noise Monitoring Results for BG01, dB(A)

	BG01	Day			Evening			Night		
		L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL
2012	Autumn	44	47	24	38	44	20	37	45	19
2012	Winter	48	53	27	44	48	34	42	49	23
2012	Spring[2]	42	45	27	46	50	31	37	44	22
2012/3	Summer[3]	50	53	27	53	58	37	46	50	34
2013	Autumn	50	52	32	39	46	23	44	50	23
2013	Winter	43	47	27	38	48	20	39	49	20
2013	Spring	40	42	24	42	44	21	39	43	20
2014	Summer	42	45	23	40	47	27	36	44	26
	Median	48	52	27	39	46	23	40	47	23
	Average	47	50	27	40	46	26	40	47	22
	Minimum	42	45	24	38	44	20	37	44	19

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Measurements affected by insect/frog noise.
3. Median and average exclude periods which are affected by insect/frog noise.

Table B-2: Noise Monitoring Results for BG02, dB(A)

	BG02	Day			Evening			Night		
		L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL
2012	Autumn	51	58	29	39	48	26	43	49	26
2012	Winter	49	53	30	42	50	25	41	50	22
2012	Spring[4]	-	-	-	-	-	-	-	-	-
2012/3	Summer[2]	52	58	30	54	60	34	46	53	27
2013	Autumn	49	51	29	38	46	22	40	48	22
2013	Winter	51	58	30	42	47	25	47	50	25
2013	Spring	44	48	29	44	49	26	43	49	25
2014	Summer	53	58	26	53	60	26	47	46	24
	Median[3]	49	53	30	39	48	25	41	49	24
	Average	49	54	30	40	48	24	40	47	24
	Minimum	45	48	29	38	46	22	36	40	22

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Observed to be affected by insect/frog noise.
3. Median and average exclude periods which are affected by insect/frog noise.
4. Excluded due to insufficient data.

Table B-3: Noise Monitoring Results for BG03, dB(A)

	BG03	Day			Evening			Night		
		L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL
2012	Autumn	42	45	26	34	41	23	35	40	22
2012	Winter	44	48	26	34	40	19	39	39	19
2012	Spring	44	48	30	48	54	29	40	46	20
2012/3	Summer[2]	47	50	28	54	60	35	42	47	26
2013	Autumn	46	49	29	36	41	24	36	40	24
2013	Winter	46	49	26	33	37	22	36	40	22
2013	Spring	43	48	29	34	41	23	41	47	23
2014	Summer	46	50	27	52	54	28	35	37	24
	Median[3]	45	49	27	34	41	23	38	40	23
	Average[3]	45	48	27	35	41	22	38	42	23
	Minimum	42	45	26	34	40	19	35	39	19

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Observed to be affected by insect/frog noise.
3. Median and average exclude periods which are affected by insect/frog noise.

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Table B-4: Noise Monitoring Results for BG04, dB(A)

	BG04	Day			Evening			Night		
		L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL
2012	Autumn	35	38	23	27	32	22	29	32	22
2012	Winter	41	46	22	36	43	22	29	34	19
2012	Spring[2]	43	48	26	43	49	25	41	48	20
2012/3	Summer[2]	45	49	25	51	56	30	40	44	31
2013	Autumn[3]	43	47	31	39	44	30	42	46	31
2013	Winter	43	43	29	33	34	28	36	38	28
2013	Spring	44	47	25	39	41	23	41	48	22
2014	Summer	43	48	26	62	67	27	35	38	27
	Median[4]	42	47	24	32	38	22	29	34	20
	Average[3]	41	45	24	38	44	26	33	38	20
	Minimum	35	38	22	27	32	22	29	32	19

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Observed to be affected by insect/frog noise.
3. Whole monitoring occurrence affected by extraneous noise.
4. Median and average exclude periods which are affected by insect/frog noise and extraneous noise.

Table B-5: Noise Monitoring Results for BG05, dB(A)

	BG05	Day			Evening			Night		
		L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL	L_{eq}	L_{10}	RBL
2012	Autumn	40	41	21	33	36	19	28	33	19
2012	Winter	40	43	23	39	44	28	33	37	25
2012	Spring[2]	44	48	27	41	45	28	38	46	20
2012/3	Summer[2]	51	51	27	47	51	34	43	47	35
2013	Autumn	47	55	23	39	40	22	35	40	21
2013	Winter	44	48	24	41	44	23	37	39	22
2013	Spring	43	48	27	41	41	26	39	45	22
2014	Summer	42	43	24	48	54	28	35	39	26
	Median	44	48	23	39	40	22	34	39	23
	Average	44	48	24	37	40	23	34	39	21
	Minimum	40	41	21	33	36	19	28	33	19

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Observed to be affected by insect/frog noise.
3. Logger Stopped after 3 days.
4. Median and average exclude periods which are affected by insect/frog noise.

B.2 AUTUMN 2012 MONITORING

Introduction

Noise measurements were carried out between Thursday 10 May and Thursday 17 May 2012 using three ARL 316 and two ARL Ngara Environmental noise loggers. The noise loggers were set to record A-weighted noise levels every 15 minutes and set to 'fast' response time. Calibration was checked before and after the measurements and no significant drift was noted

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the Project's automatic weather station (AWS). Data was also excluded for identified extraneous events. The following table, **Table B-6**, details excluded periods (day, evening and night) due to weather conditions unsuitable for noise monitoring.

Table B-6: Periods Excluded from Unattended Monitoring

Date	Period	Reason
12/5/12	Day	Inclement Weather – wind
13/5/12	Day	Inclement Weather – wind

Unattended Measurement Results

The calculated Assessment Background Level (ABL) in **Table B-7** below.

The results are presented in the time periods defined in the INP as follows:

- Day - 7.00am to 6.00pm;
- Evening - 6.00pm to 10.00pm; and
- Night - 10.00pm to 7.00am.

Table B-7: ABLs for Autumn 2012 Monitoring

Location	Period	ABL by Date (May 2012)								RBL
		10	11	12	13	14	15	16	17	
BG01	Day	27	25	-	-	23	23	25	24	24
	Evening	20	22	20	20	19	19	19	19	20
	Night	20	20	20	19	18	18	19	19	19
BG02	Day	29	32	-	-	27	29	28	29	29
	Evening	26	27	26	26	24	26	27	26	26
	Night	25	26	26	26	24	26	27	26	26
BG03	Day	28	27	-	-	24	25	26	26	26
	Evening	23	23	25	23	23	23	23	23	23
	Night	22	23	23	23	22	22	22	22	22
BG04	Day	24	24	-	-	22	23	23	23	23
	Evening	22	22	24	23	22	22	22	22	22
	Night	21	22	24	22	21	22	22	22	22
BG05	Day	22	22	-	-	20	20	21	21	21
	Evening	19	20	23	19	19	19	19	19	19
	Night	19	19	21	19	19	19	19	19	19

Attended Measurement Results

Table B-8, presents the results of the operator attended measurements.

Table B-8: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	10/05/12 1.38 pm	35	40	37	29	Noise environment controlled by non-anthropogenic noise sources including birds, distant insects and vegetation rustle.
BG02	10/05/12 11.05 am	42	53	43	29	Noise environment includes bird calls (cockatoo), occasional distant car pass, distant vegetation rustle, and occasional noise from construction site (estimated L_{eq} 28). Ambient noise controlled by natural sources.
BG03	10/05/12 12.35 pm	34	43	37	28	Noise environment controlled by non-anthropogenic noise sources including birds, distant insects and vegetation rustle. Car pass on road just audible (estimated L_{eq} 20-21 for 30 seconds).
BG04	10/05/12 10.15 am	35	47	37	25	Noise environment includes animal sounds including birds, insects and occasional cattle. Other noise sources include distant engine noise (possibly drilling rig, estimated L_{eq} 24-26).
BG04	18/05/12 11.25 am	27	37	38	22	Noise environment controlled by natural (non-anthropogenic) sources including birds, insects and vegetation rustle.
BG05	10/05/12 8.55 am	38	52	34	23	Noise environment consists of animal calls including birds and occasional cattle call. Distant industrial noise audible on occasional towards end of measurement period.
BG05	18/05/12 10.45 am	31	41	30	23	Noise environment controlled by natural (non-anthropogenic) sources including birds, insects and vegetation rustle.

Discussion

A review of the unattended and attended noise measurements reveal that background noise levels are very low across the whole of the Project area. In addition it was identified during the attended measurements that no significant industrial noise sources were noted. It is assumed that the industrial noise noted at BG04 and BG05 was a temporary occurrence as it was not present when the measurements were repeated.

It should also be noted that the noise loggers typically have a noise floor of around 15-20 dB(A) which varies slightly between different monitors. Therefore it can be said that any result that are lower than 20 dB(A) cannot be verified as they are within range of the equipment's sensitivity. In any case where background noise levels are below 30 dB(A), the INP states that they shall be set at 30 dB(A).

Noise Monitoring Graphs

Figure B.1 to **Figure B.5** display the noise monitoring data at each location during the autumn 2012 monitoring occurrence. Weather data is presented in **Figure B.6**.

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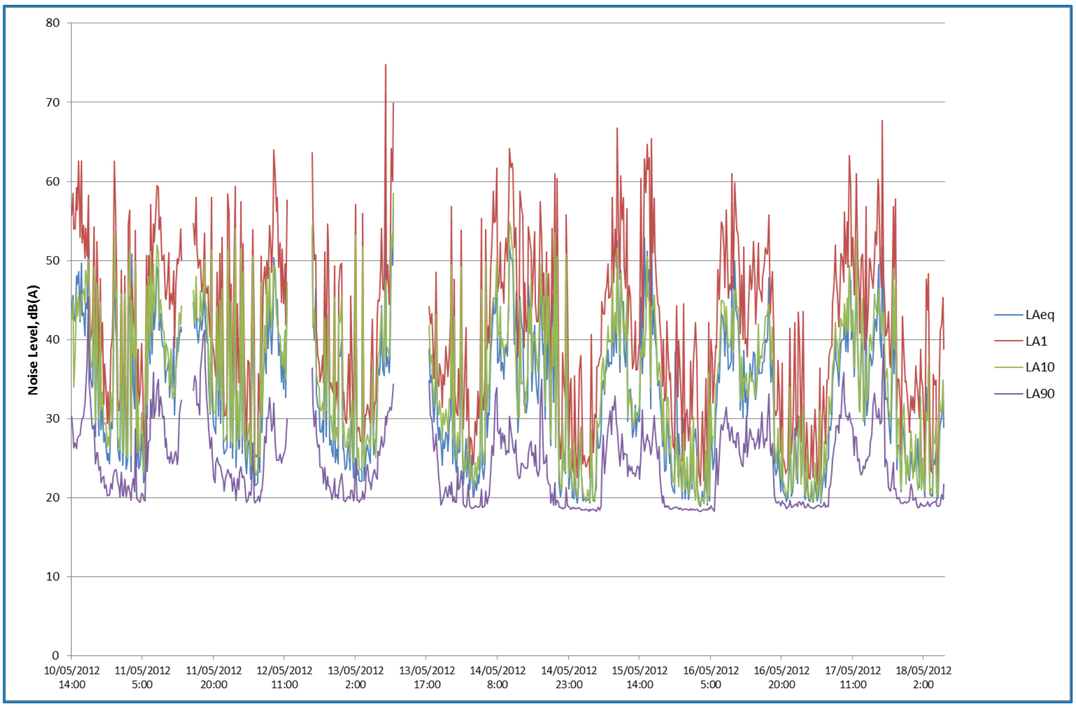

Figure B.1: BG01 Noise Monitoring Autumn 2012

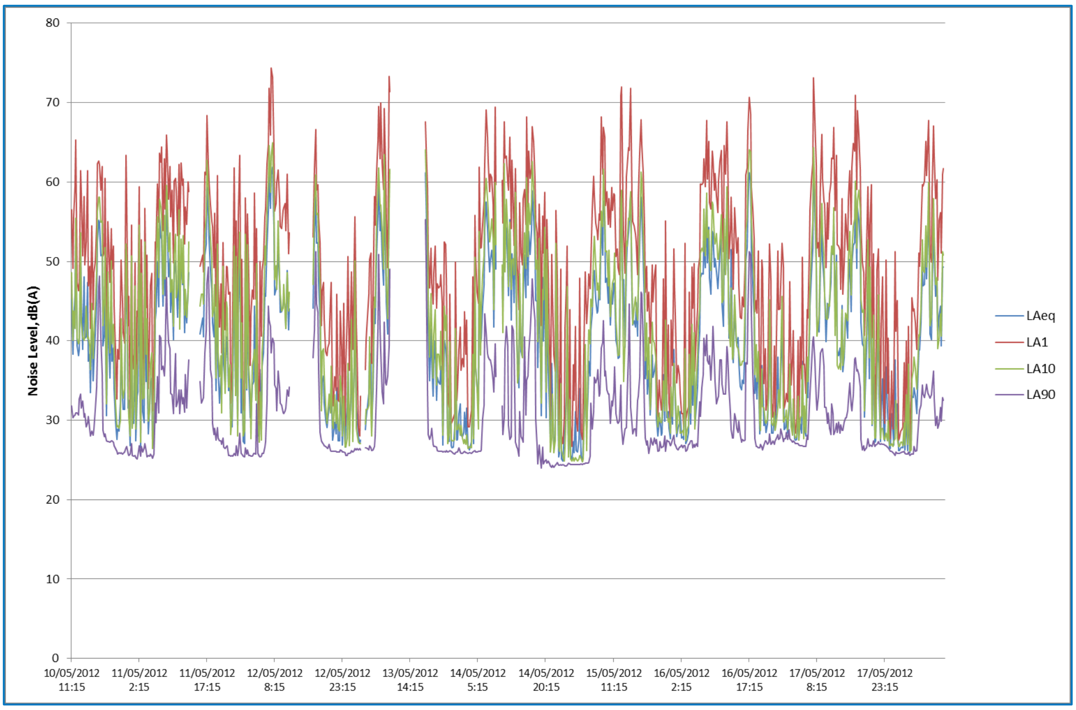

Figure B.2: BG02 Noise Monitoring Autumn 2012

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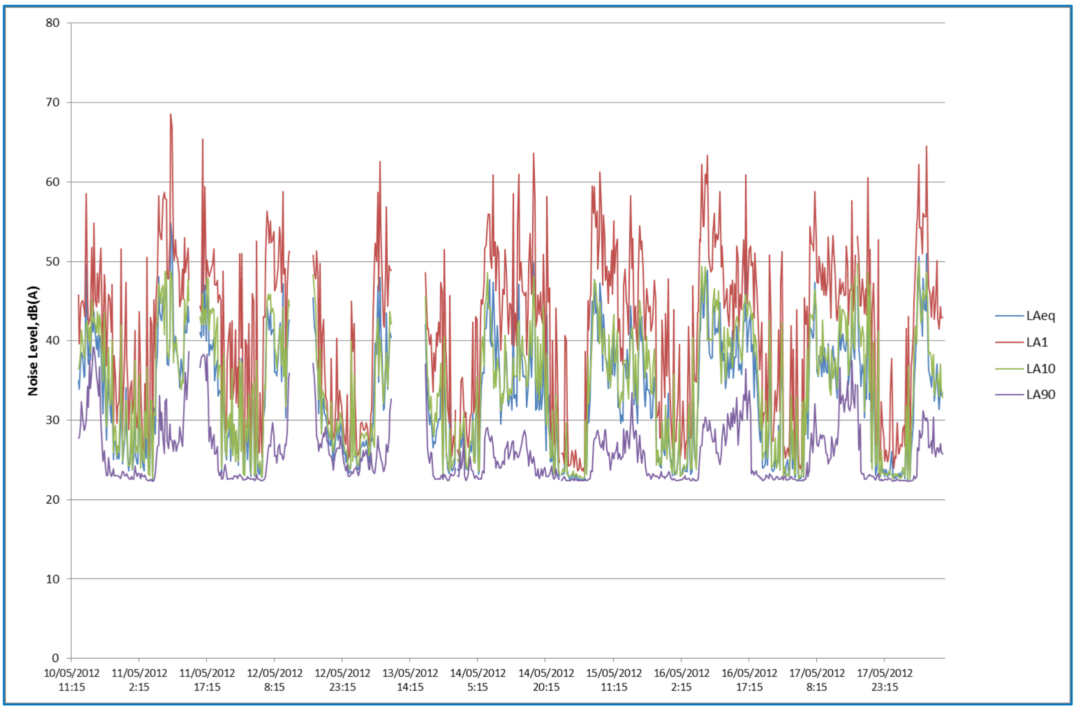

Figure B.3: BG03 Noise Monitoring Autumn 2012

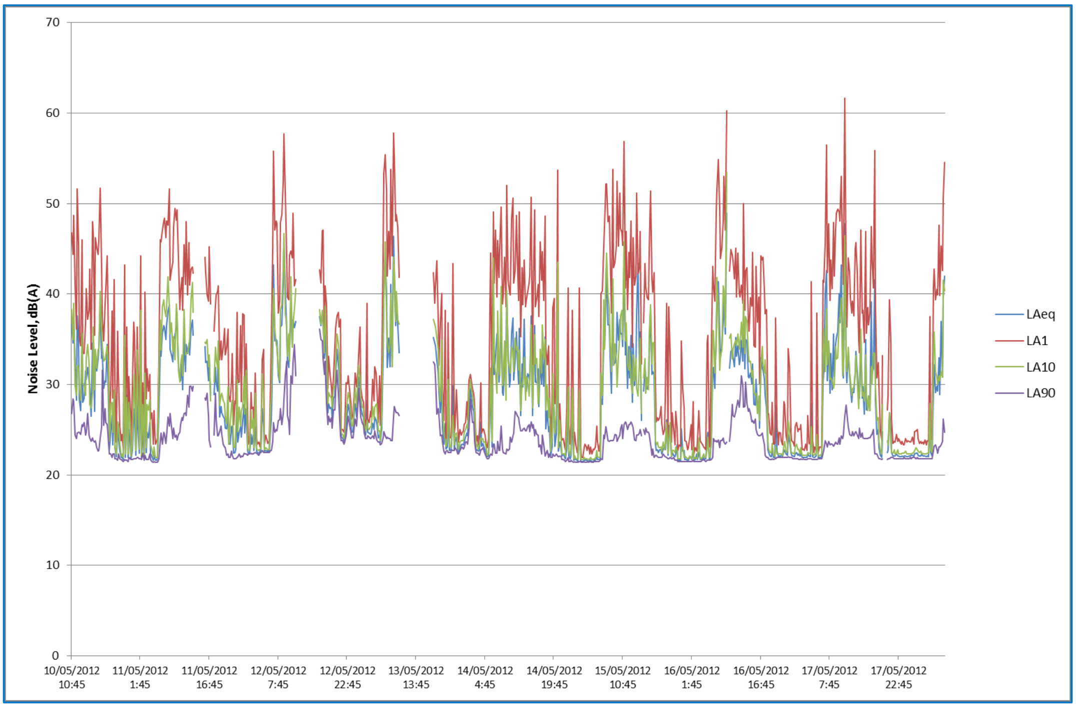

Figure B.4: BG04 Noise Monitoring Autumn 2012

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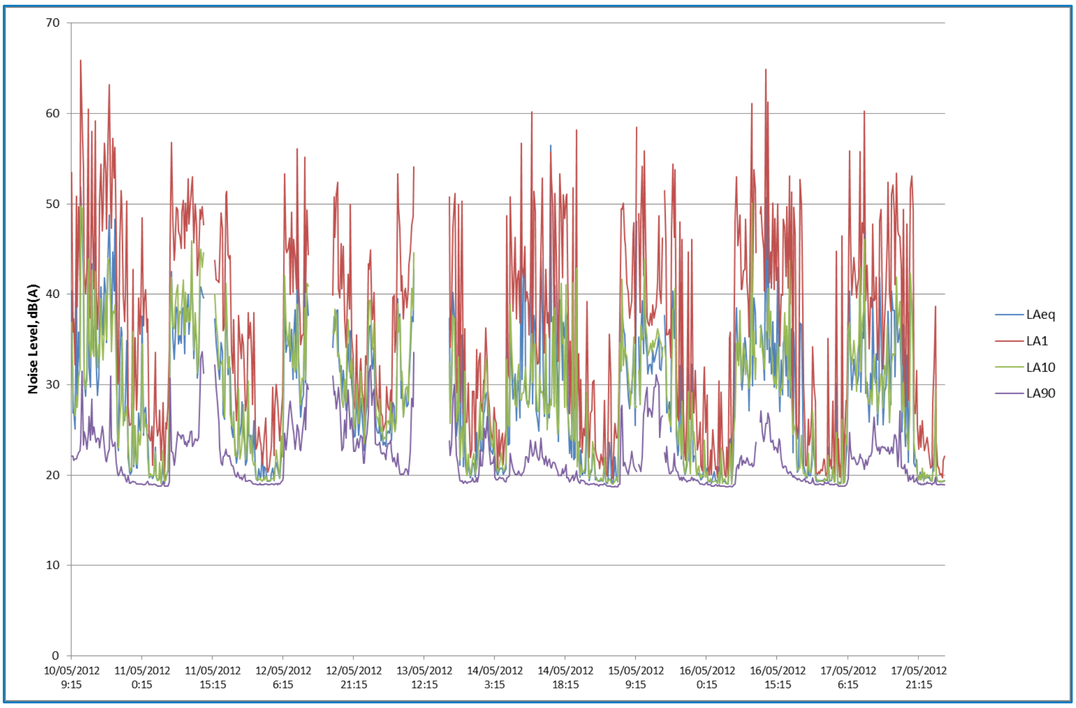

Figure B.5: BG05 Noise Monitoring Autumn 2012

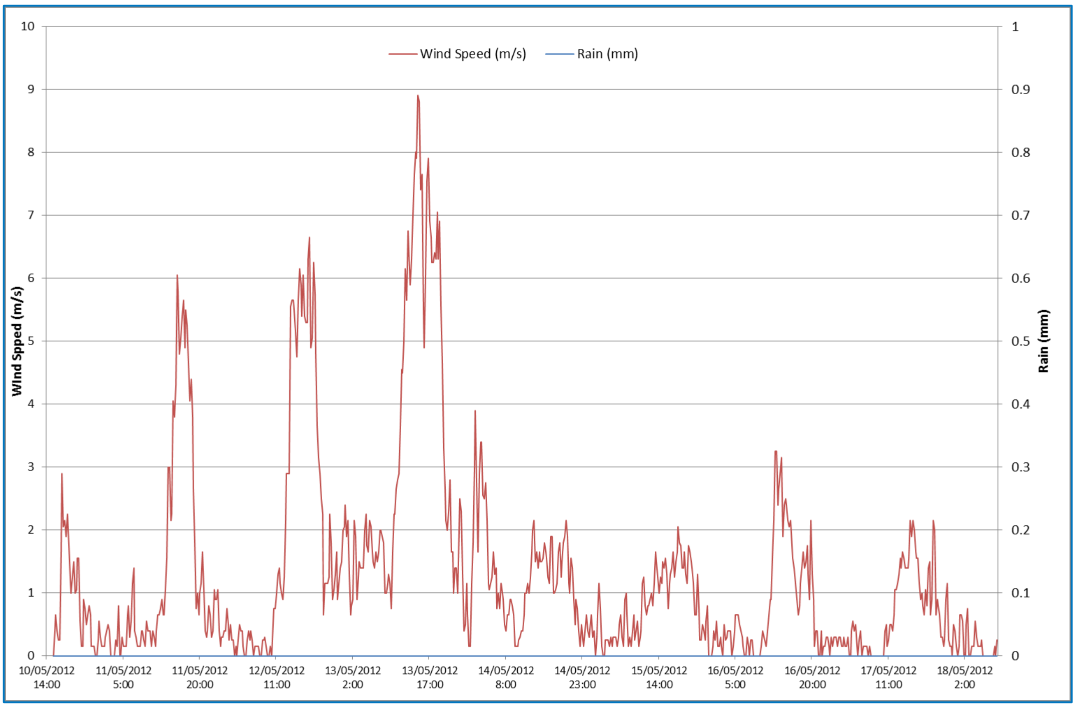

Figure B.6: Weather Data Autumn 2012

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B.3 WINTER 2012 MONITORING

Introduction

Noise measurements were carried out between Friday 20 July and Tuesday 31 July 2012 using five ARL Ngara Environmental noise loggers. The noise loggers were set to record A-weighted noise levels every 15 minutes and set to 'fast' response time. Calibration was checked before and after the measurements and no significant drift was noted. The noise logger at BG03 stopped after six days.

In addition, operator attended measurements were carried out for 15 minutes at the time of installation of the noise loggers. The purpose of these measurements was to describe the prevailing ambient noise environment at each noise logging location. Measurements were carried out using a Rion NA-21 Type 1 Sound Level Meter. Calibration was checked before and after measurements and no significant drift was noted. Attended measurements were carried out at all locations on 20 July 2012. During all measurements the weather was noted to be clear and fine with slight winds estimated to be from 0-1 on the Beaufort Scale.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the Project's AWS. Data was also excluded for identified extraneous events. **Table B-** details excluded periods (day, evening and night) due to weather conditions unsuitable for noise monitoring.

Table B-9: Periods Excluded from Unattended Monitoring

Date	Period	Reason
22/7/12	1.00pm to 1.45pm	Inclement Weather – wind
26/7/12	7.00pm to 7.15pm	Inclement Weather – rain
26/7/12	8.45pm to 9.15pm	Inclement Weather – rain
26/7/12	10.00pm to 10.15pm	Inclement Weather – rain
27/7/12	Day	Inclement Weather – wind

Unattended Measurement Results

The calculated ABL is shown in **Table B-10** below. The background noise level is described as the RBL as defined within the INP.

The results are presented in time periods as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-10: ABLs for Winter 2012 Monitoring

Loc.	Period	ABL by Date (July 2012)											RBL
		20	21	22	23	24	25	26	27	28	29	30	
BG01	Day	25	28	27	28	26	26	27	28	31	28	27	27
	Evening[1]	32	28	34	30	36	37	37	34	34	30	23	34
	Night	20	20	22	23	27	27	26	26	22	19	26	23
BG02	Day	28	31	30	31	29	27	28	30	30	27	28	30
	Evening	23	24	26	24	26	26	30	29	25	23	22	25
	Night	20	20	22	21	22	24	24	22	22	20	20	22
BG03[2]	Day	22	28	26	26	26	24	28	-	-	-	-	26
	Evening	19	19	19	19	19	19	-	-	-	-	-	19
	Night	19	19	19	19	19	19	-	-	-	-	-	19
BG04	Day	21	26	23	22	23	22	22	22	23	22	20	22
	Evening	22	21	20	21	23	23	23	22	24	23	22	22
	Night	19	19	19	19	19	21	20	19	27	19	19	19
BG05	Day	22	24	23	23	22	22	23	23	24	22	22	23
	Evening[1]	24	23	24	26	28	28	32	30	33	33	31	28
	Night	21	22	22	23	22	27	28	25	31	29	26	25

Notes:
1. Frog/insect affected period.
2. Logger stopped after 6 days.

Attended Measurement Results

Table B-11 presents the results of the operator attended measurements.

Table B-11: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	20/07/12 1.50 pm	45	59	45	24	Noise environment controlled by non-anthropogenic noise sources including birds, distant insects and vegetation rustle. Some distant industrial noise (steady-state engine noise) noted and audible at measurement location (estimated L_{eq} 18 dB(A)). Noise location from direction of Quarry which was observed to be in operation at the time of measurement.
BG02	20/07/12 12.10 am	39	49	39	28	Noise environment includes bird calls (cockatoo), occasional distant car pass, distant vegetation rustle, and occasional intermittent distant noise from construction site (estimated L_{eq} 28). Ambient noise controlled by non-anthropogenic sources.
BG03	20/07/12	33	42	36	27	Noise environment controlled by non-

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Location	Date and Time	Noise Level dB(A) L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	Comments
	1.05 pm					anthropogenic noise sources including intermittent bird calls, distant insects and vegetation rustle. Occasional vehicle pass on road just audible (estimated L_{eq} 25-30 for 30 seconds).
BG04	20/07/12 11.25 am	39	52	42	25	Noise environment includes animal sounds including intermittent bird calls, insects. Drilling rig was observed approximately 300m away and was inaudible during measurement, assumed not to be operational. Background noise controlled by non-anthropogenic sources.
BG05	20/07/12 10.25 am	38	50	41	23	Noise environment consists of animal calls including birds and occasional slight vegetation rustle. Background noise controlled by non-anthropogenic sources.

Discussion

A review of the unattended and attended noise measurements reveal that background noise levels are generally low across the whole of the Project area. In general, non-anthropogenic noise sources control the background noise environment. It was noted at BG01 that distant industrial noise was observed. The direction of the noise was observed to emanate from approximately southeast of the measurement location. It was noted and observed that Bylong Quarry was operational, with trucks entering and leaving the site in addition to mobile plant operating on site. The nature of the noise was observed to be largely steady state and characteristic of distant noise from mobile plant, however reversing alarms were not observed. It is therefore assumed that as the Bylong Quarry lies southeast of the measurement position and no other significant industrial noise sources are present in the valley, that the Bylong Quarry was the source of the noise. When decommissioning the noise logger, the industrial noise was subjectively observed at a lower level than before.

It is also noted that previous measurements carried out during the autumn occurrence of noise logging, industrial noise was not observed at this location.

From a review of the measurements, it is evident that noise from frogs affected the measurements at location BG01 and BG05. The result of this is that during the evening when the frog calls are most prominent, a rise in background noise level is observed above the daytime level and what would typically be expected in the absence of frog noise. With reference to the autumn occurrence of noise monitoring, the frog noise appears to increase the background noise level (L_{A90}) by 14 dB(A) at BG01 and 9 dB(A) at BG05 during the evening period.

With the exception of the BG01 and BG05 evening periods, the winter occurrence of noise monitoring in general is in good agreement with the autumn occurrence and is typical of a rural environment.

It should also be noted that the noise loggers typically have a noise floor of around 15-20 dB(A) which varies slightly between different monitors. Therefore it can be said that any result that are lower than 20 dB(A) cannot be verified as they are within range of the equipment's noise floor. In any case where background noise levels are below 30 dB(A), the INP states that they shall be set at 30 dB(A).

Noise Monitoring Graphs

FigureB.7 to **FigureB.11** display the noise monitoring data at each location during the winter 2012 monitoring occurrence. Weather data is presented in **FigureB.12**.

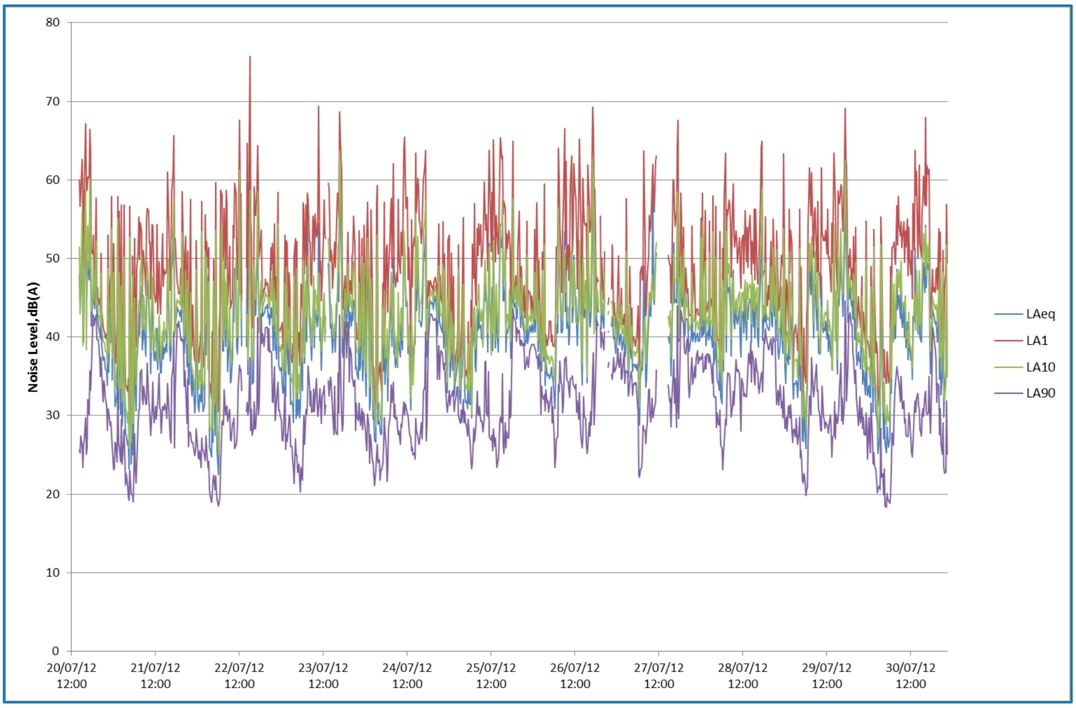

Figure B.7: BG01 Noise Monitoring Winter 2012

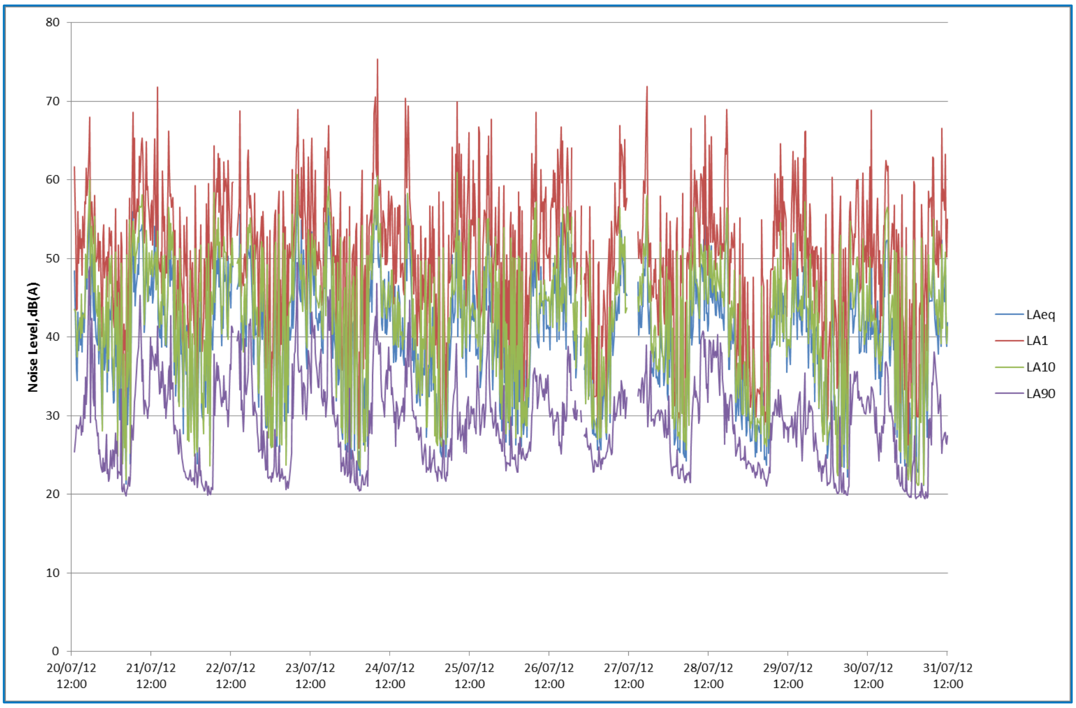

Figure B.8: BG02 Noise Monitoring Winter 2012

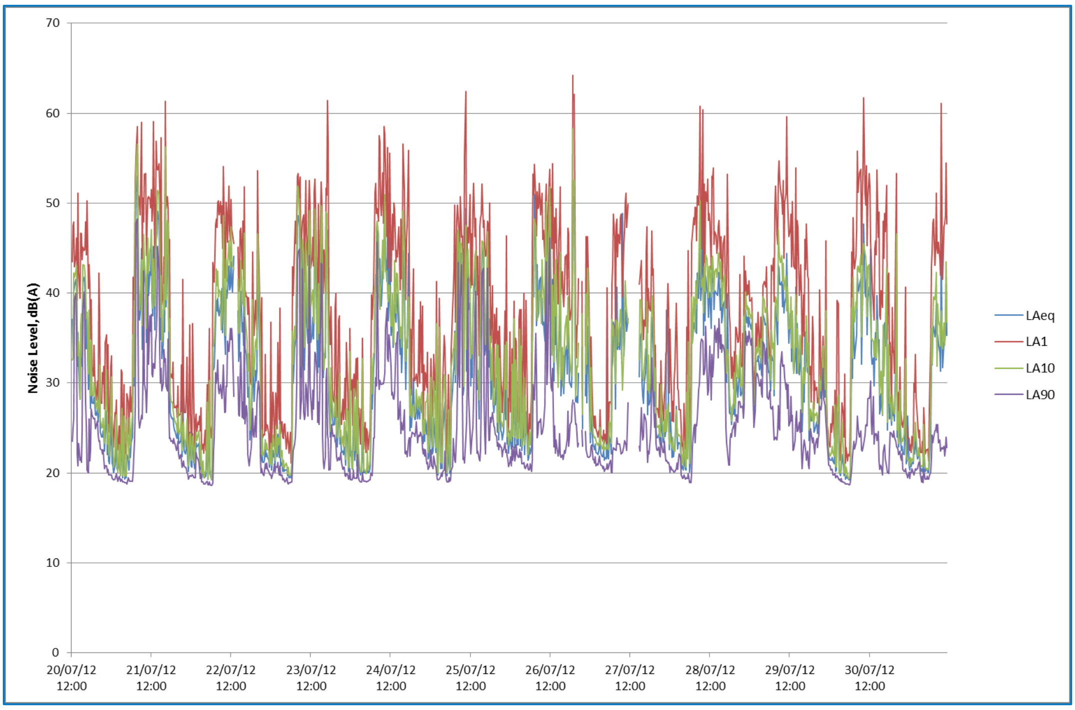

Figure B.9: BG03 Noise Monitoring Winter 2012

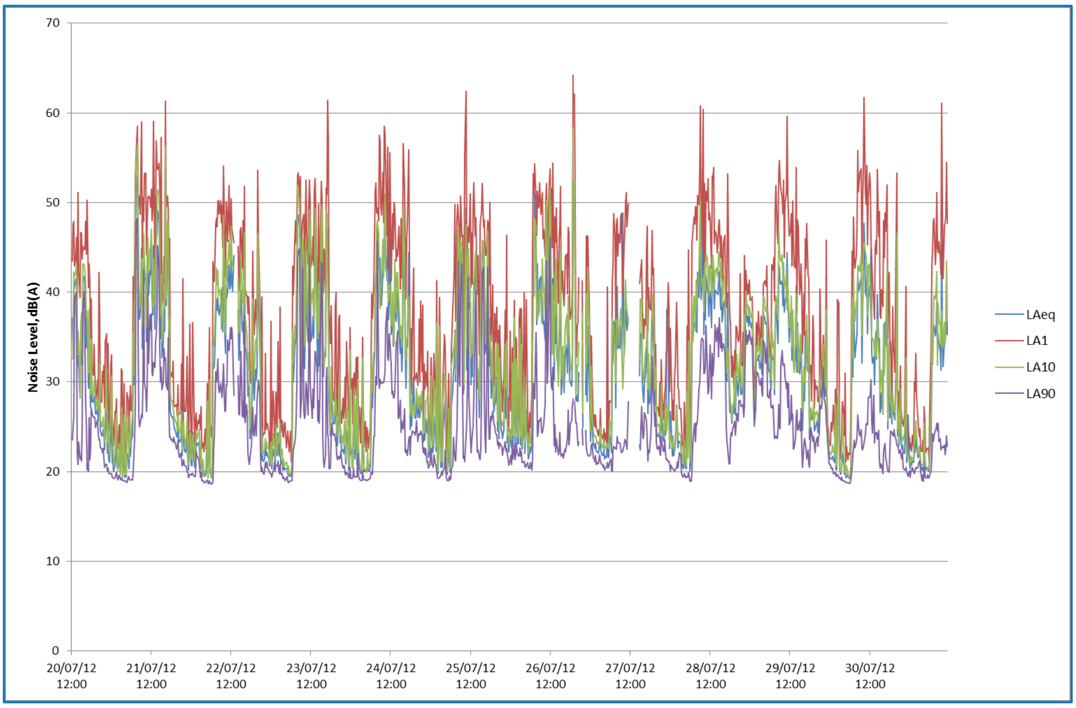

Figure B.10: BG04 Noise Monitoring Winter 2012

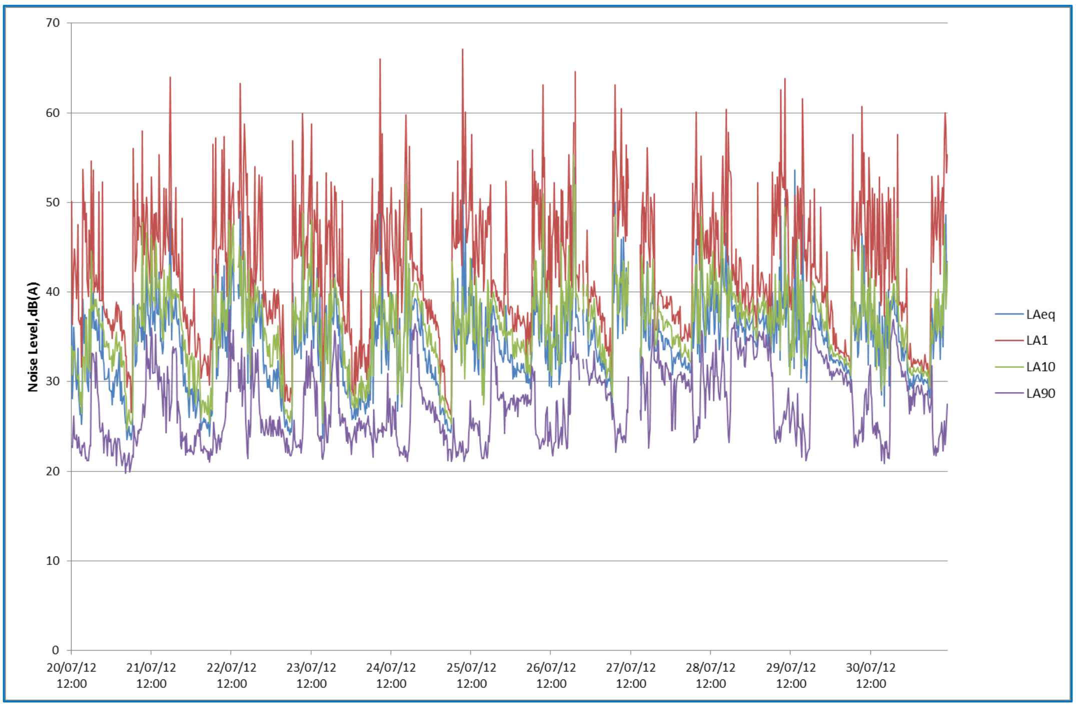

Figure B.11: BG05 Noise Monitoring Winter 2012

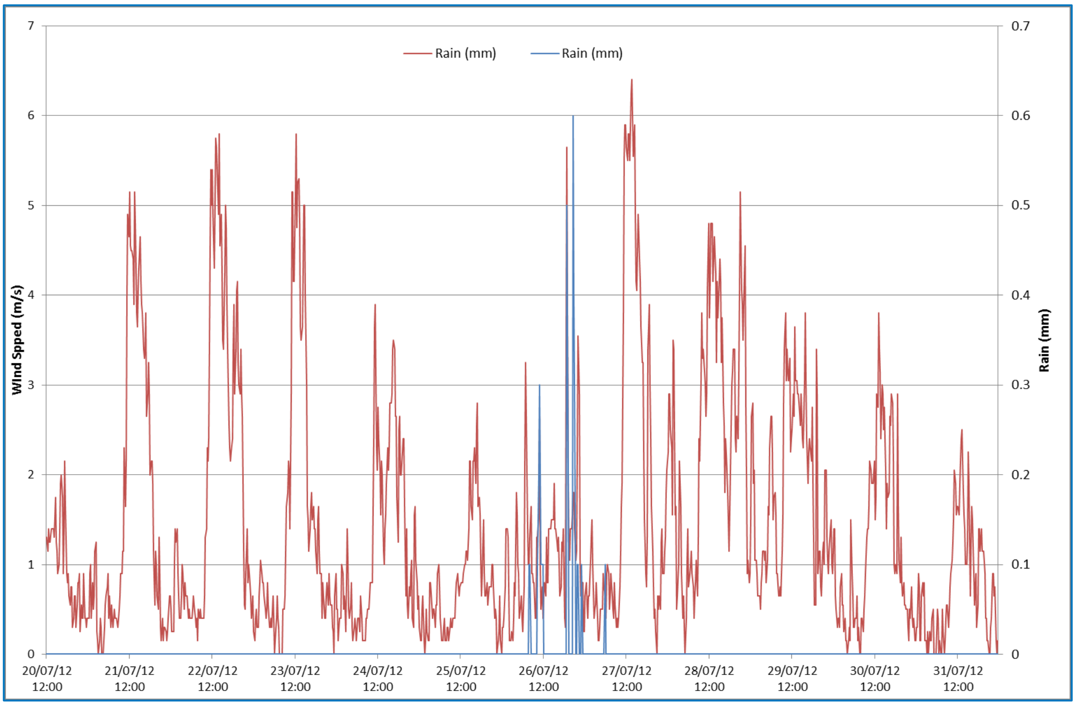

Figure B.12: Weather Data Winter 2012

B.4 SPRING 2012 MONITORING

Introduction

Noise measurements were carried out between Thursday 1 November and Wednesday 14 November 2012 using five ARL Ngara Environmental noise loggers. The noise loggers were set to record A-weighted noise levels every 15 minutes and set to 'fast' response time. Calibration was checked before and after the measurements and no significant drift was noted. The noise logger at BG03 stopped after six days.

Attended measurements were carried out on 1 November and 14 November. Measurements were carried out at BG01 on 1 November only as high winds prevented other measurements from being carried out. Measurements were carried out at the remaining locations on 14 November. During all measurements the weather was noted to be fine to four oktas cloud with slight winds estimated to be from 0-2 on the Beaufort Scale.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the Project's AWS. Data was also excluded for identified extraneous events. **Table B-12** details excluded periods (day, evening and night) due to weather conditions unsuitable for noise monitoring.

Table B-12: Periods Excluded from Unattended Monitoring

Date	Period	Reason
1/11/12	Day	Inclement Weather – Wind
2/11/12	Day	Inclement Weather – Wind
6/11/12	Day	Inclement Weather – Wind
7/11/12	Evening	Inclement Weather – Rain
8/11/12	Evening	Inclement Weather – Rain
9/11/12	Day	Inclement Weather – Wind
13/11/12	Day	Inclement Weather – Wind
13/11/12	Possibly Evening	Inclement Weather – Wind
8/11/12-14/11/12 at BG04 only	All	Windshield removed

Unattended Measurement Results

The calculated ABL is shown in **Table B-13** below. The background noise level is described as the RBL as defined within the INP.

The results are presented in time periods as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-13: ABLs for Spring 2012 Monitoring

Loc.		ABL by Date (November 2012)														RBL
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
BG01[2]	D	37	27	28	26	20	-	-	-	-	-	-	-	-	-	27
	E	35	31	31	30	19	-	-	-	-	-	-	-	-	-	31
	N	20	22	22	26	20	-	-	-	-	-	-	-	-	-	22
BG02[4]	D	Data Excluded														
	E															
	N															
BG03[3]	D	-	-	32	29	29	-	30	30	-	-	-	-	-	-	30
	E	36	32	27	29	29	29	-	-	-	-	-	-	-	-	29
	N	19	19	20	20	24	28	24	-	-	-	-	-	-	-	20
BG04[5]	D	-	-	26	24	26	-	26	28	-	-	-	-	-	-	26
	E	29	28	26	24	24	24	-	-	-	-	-	-	-	-	25
	N	20	20	19	20	23	23	22	-	-	-	-	-	-	-	20
BG05	D	-	-	26	24	26	-	26	29	-	31	30	27	-	28	27
	E	30	28	29	26	26	27	28		34	29	28	26	-	-	28
	N	19	21	19	19	21	22	20	26	20	19	19	19	21	-	20

Notes:
1. Evening measurements were observed to be affected by insect noise at all locations.
2. Logger stopped after 5 days at this location.
3. Logger stopped after 8 days at this location.
4. Logger malfunction at this location leading to reduced data recording. Data recorded Day 26%, Evening 20% and Night 3%. Therefore results may not be representative of a full weeks logging, given reduced data recovery.
5. Logger was found with windshield removed. Interrogation of the monitoring data indicates that windshield was removed on 8/11/12. Therefore 7 days of the monitoring has been used.

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Attended Measurement Results

Table B-**Table B**-**14** presents the results of the operator attended measurements.

Table B-14: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	14/11/2012 1.10pm	37	49	39	28	Noise environment consisted of distant bird calls, low level insect noise and occasional car passby audible from Bylong Valley Way. Noise environment dominated by non-anthropogenic noise sources.
BG02	14/11/2012 11.35am	41	50	43	33	Noise sources include distant bird calls (30-38 dB(A), LAmax 52 dB(A)), distant ride on lawn mower, occasional car passby on road. Occasional reversing alarm audible from ARTC compound (estimated level LAmax 38 dB(A) and tonal). Background noise environment generally controlled by non-anthropogenic sources.
BG03	14/11/2012 12.20pm	40	52	42	32	Noise sources included distant bird calls, vegetation rustle, and occasional cars just audible on Bylong Valley Way (estimated level 27 dB (A), LAmax 30 dB(A). Background noise environment generally controlled by non-anthropogenic sources.
BG04	14/11/2012 11.15am	39	50	42	29	Noise sources include, distant vegetation rustle and birds calls and insects. Ambient and background noise environment controlled by non-anthropogenic sources.
BG05	1/11/2012 10.20am	39	52	38	27	Noise sources include bird calls and insects. Cockatoo calls LAmax 55 dB(A) infrequent. Ambient and background noise environment controlled by non-anthropogenic sources.

Discussion

A review of the measurements both attended and unattended reveal that the background noise environment is generally made up of non-anthropogenic noise sources. No significant sources of industrial noise were noted at any of the locations. At BG02, the construction site was occasionally audible in the form of reversing alarms however it was not observed to be at a high enough level to warrant specific investigation.

At all locations it was observed that during the attended measurements, the contribution of bird calls to the ambient and background noise level was observably higher than in the winter or autumn occurrences. In addition it was observed at some locations that high levels in some cases up to 92 dB(A) was recorded from cattle calls in close proximity to the measurement position and these were removed, where appropriate.

Insect noise was identified as a significant component of the measured evening noise levels at all locations, especially BG01, BG02 and BG03. In light of this it is proposed, in line with the INP Application notes, to set the RBL to 30 dB(A) at these locations where the measured RBL is above 30 dB(A). Where the measured evening period RBLs are below 30 dB(A), the INP states that the RBL should be set to 30 dB(A), regardless of the presence of insect noise.

Where equipment malfunctioned due to circumstances out of Pacific Environment's control, attempts were made to recover as much valid data as possible. It can be seen that at BG02 where the most significant data loss occurred, the recorded levels are consistent within ±3 dB(A) of the attended measurements during the day. However, due to the large degree of data loss over the monitoring period, it is proposed that these measurements be excluded from the derivation of criteria in subsequent assessments.

This occurrence of noise monitoring occurred during spring and it is expected that noise level during the evening and night may be elevated due to the presence of insects or frogs calling during these periods. This trend is observed by examining the measured RBLs for each season. The spring occurrence has consistently higher levels than the previous occurrences at three of the monitoring locations.

It should also be noted that the noise loggers typically have a noise floor of around 15-20 dB(A) which varies slightly between different monitors. Therefore it can be said that any result that are lower than 20 dB(A) cannot be verified as they are within range of the equipment's noise floor.

Noise Monitoring Graphs

Figure B.13 to **Figure B.16** display the noise monitoring data at each location during the spring 2012 monitoring occurrence. No valid data was recovered from BG02 there it has not been included. Weather data is presented in **Figure B.17**.

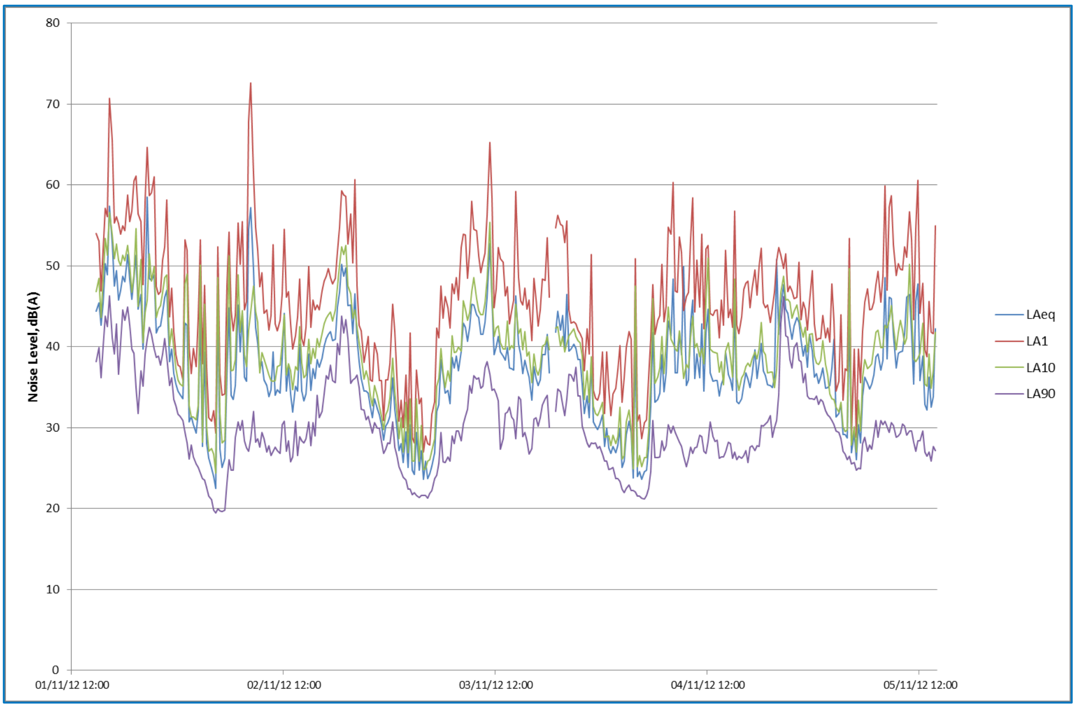

Figure B.13: BG01 Noise Monitoring Spring 2012

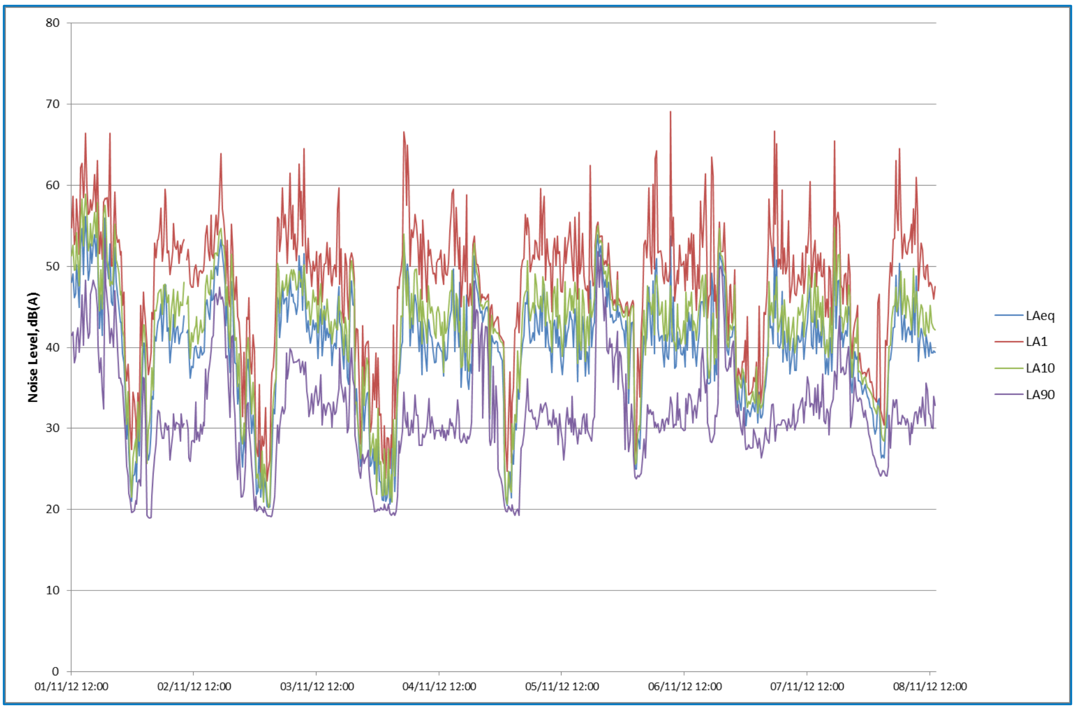

Figure B.14: BG03 Noise Monitoring Spring 2012

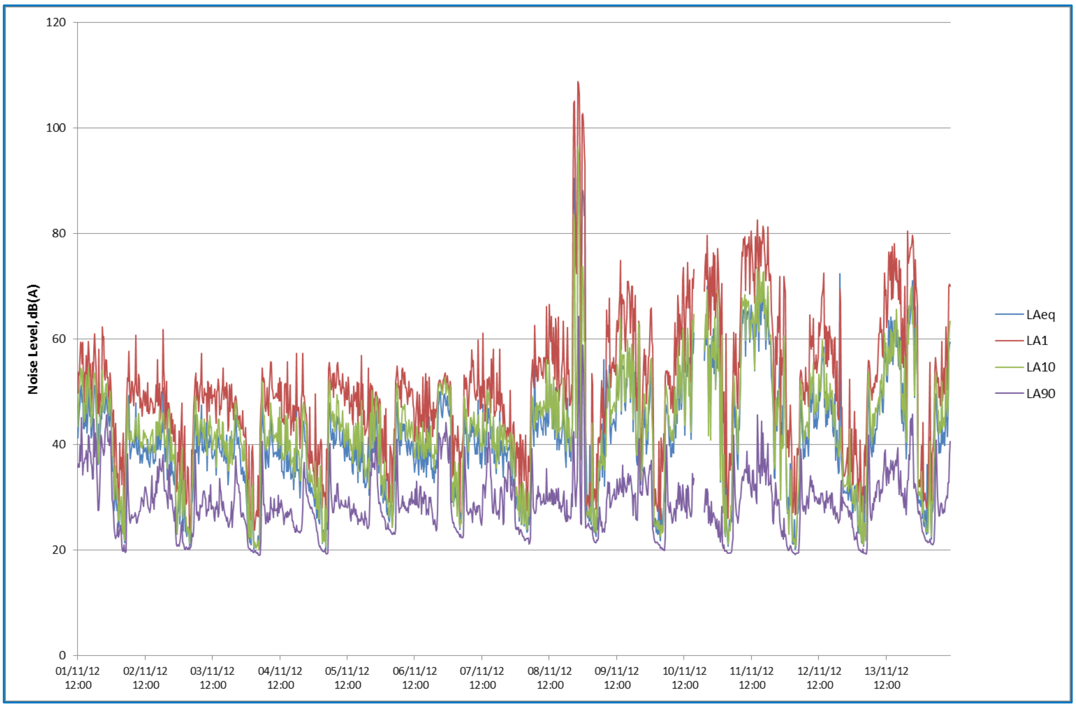

Figure B.15: BG04 Noise Monitoring Spring 2012

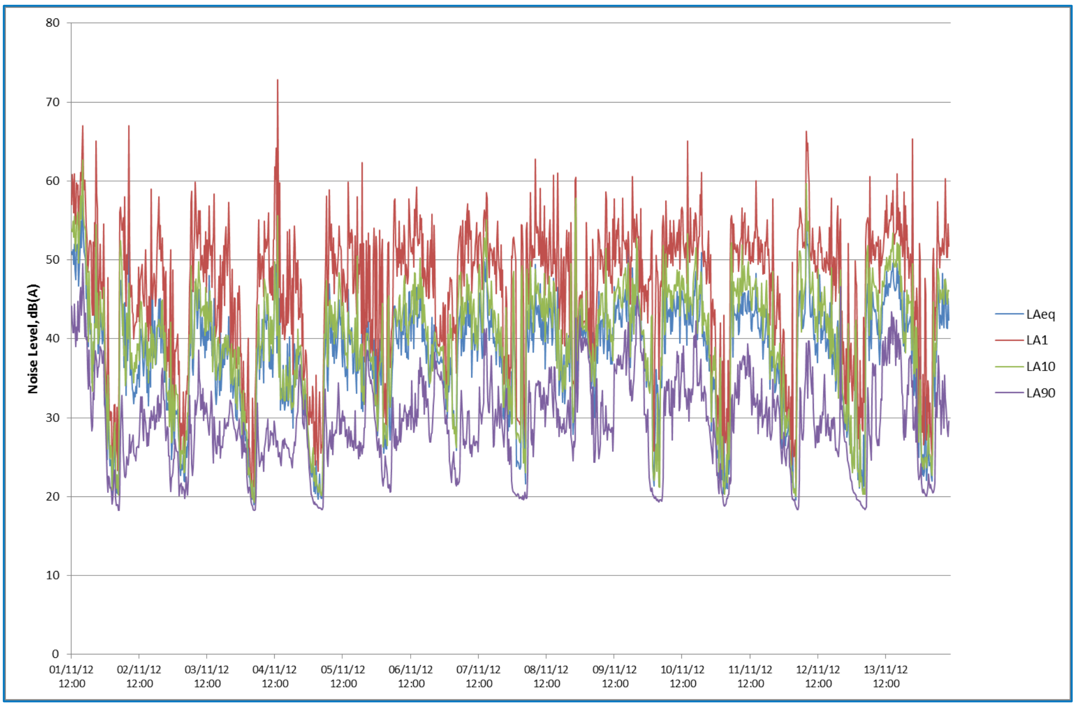

Figure B.16: BG05 Noise Monitoring Spring 2012

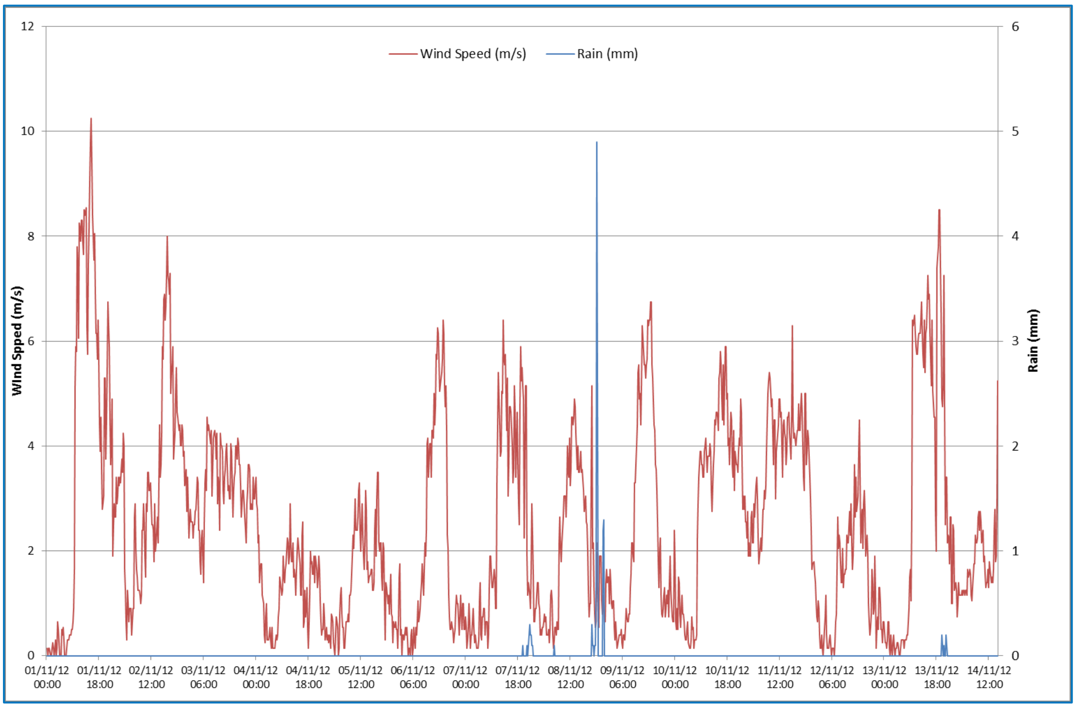

Figure B.17: Weather Data Spring 2012

B.5 SUMMER 2012/2013 MONITORING

Introduction

Summer 2012/2013 baseline noise monitoring was carried out between Friday 1 February and Tuesday 12 February 2013 using five ARL Ngara Environmental noise loggers. The noise logger at BG01 stopped after 9 days.

Attended measurements were carried out at all locations on Friday 1 February. During all measurements the weather was noted to be clear and fine with slight winds estimated to be from 0-1 on the Beaufort Scale with some gusts estimated to be up to 2 m/s.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the AWS. Data was also excluded for identified extraneous events. **Table B-15** details the excluded periods (day, evening and night) which, due to weather conditions, are deemed unsuitable for noise monitoring.

Table B-15: Periods Excluded from Unattended Monitoring

Date	Period	Reason
4/2/13	Evening	Inclement Weather – Wind
5/2/13	Evening	Inclement Weather – Wind
7/2/13	Evening	Inclement Weather – Wind
9/2/13	Evening	Inclement Weather – Wind
10/2/13	Evening	Inclement Weather – Wind

Unattended Monitoring Results

The results of the unattended noise monitoring are detailed in **Table B-16**. The background noise level is described as the RBL as defined within the INP. The results are presented in the time periods defined in the INP as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-16: ABLs for Summer 2012/3 Noise Monitoring, dB(A)

Loc.	Period	ABL by Date (February 2013)											RBL
		1	2	3	4	5	6	7	8	9	10	11	
BG01	Day	32	31	26	27	28	27	23	24	23	-	-	27
	Evening[1]	39	39	37	-	-	32	-	25	-	-	-	37
	Night[1]	40	32	35	35	34	33	31	34		-	-	34
BG02	Day	32	29	28	31	30	30	26	27	27	28	32	30
	Evening[1]	34	34	33	-	-	32	-	32	-	-	35	34
	Night	33	24	25	27	25	25	25	28	31	35	34	27
BG03	Day	34	29	28	29	30	28	28	24	24	27	31	28
	Evening[1]	37	37	34	-	-	35	-	28	-	-	32	35
	Night	33	21	25	26	25	25	24	29	30	35	31	26
BG04	Day	29	25	24	27	25	26	25	25	23	22	27	25
	Evening[1]	30	30	31	-	-	31	-	25	-	-	30	30
	Night[1]	38	25	31	31	29	28	29	30	35	36	34	31
BG05	Day	31	27	26	29	26	25	27	27	25	25	29	27
	Evening[1]	35	34	35	-	-	29	-	25	-	-	34	34
	Night[1]	40	29	36	35	35	34	34	35	38	38	36	35

Notes
1. Affected by insect noise at this location.
2. Logger stopped after 9 days.

Attended Measurement Results

Table B-17 presents the results of the operator attended measurements.

Table B-17: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	01/02/13 1.05pm	42	52	46	34	Noise environment dominated by non-anthropogenic noise sources. Sources include insect noise and occasional bird calls. Infrequent traffic on Bylong Valley Way audible when going past measurement position
BG02	01/02/13 11.35am	41	51	43	33	Noise environment generally dominated by non-anthropogenic noise sources. Sources included bird calls (cockatoos and crows), vegetation rustle and insect noise. Occasional vehicles audible on Bylong Valley Road and Upper Bylong Road
BG03	01/02/13 12.12pm	47	58	45	36	Noise environment dominated by non-anthropogenic noise sources. Noise sources consisted of primarily bird calls and distant vegetation rustle and insect noise. Cockatoo calls also occasionally audible.
BG04	01/02/2013 10.30am	36	43	39	32	Noise environment dominated by insect noise and bird calls. Occasional cicada noise, observable rise in ambient noise level during cicada noise. Cicadas observed for approx. 30 secs of measurement.
BG05	01/02/2013 9.45am	45	53	50	32	Noise environment dominated by insect and bird calls. Cicadas caused observable rise in noise level and were generally present during the measurement period. Occasional

						cockatoo calls observed.

Discussion

During the monitoring period, it was observed that at all of the monitoring locations, the daytime RBL is much lower than that of the evening and in some cases during the night.

A review of the monitoring data reveals that this is caused by insect noise including cicadas, crickets and frogs. Experience indicates that this noise environment could be considered typical of summer in some regional areas of NSW.

The INP application notes state the following:

"In determining project-specific noise levels from the RBLs, the community's expectations also need to be considered. The community generally expects greater control of noise during the more sensitive evening and night-time periods than the less sensitive daytime period. Therefore, in determining project-specific noise levels for a particular development, it is generally recommended that the intrusive noise level for evening be set at no greater than the intrusive noise level for daytime. The intrusive noise level for night -time should be no greater than the intrusive noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified."

Observations made in previous quarter's monitoring indicate that noise levels tend to decrease during the evening and night in the absence of insect noise. Therefore it is considered appropriate to assume that where insect noise does not adversely affect the ambient noise environment, noise levels would be significantly lower than those measured during this occurrence of monitoring.

Overall, the noise environment is generally dominated by non-anthropogenic noise sources. At the time of measurement, occasional road traffic noise was noted. Furthermore, at location BG02 (Bylong Village), during set up of the noise monitor, a freight train was observed to pass on the Sandy Hollow Gulgong Railway Line that runs through the valley.

Noise Monitoring Graphs

Figure B.18 to **Figure B.22** display the noise monitoring data at each location during the Summer 2012/3 monitoring occurrence. Weather data is presented in **Figure B.23**.

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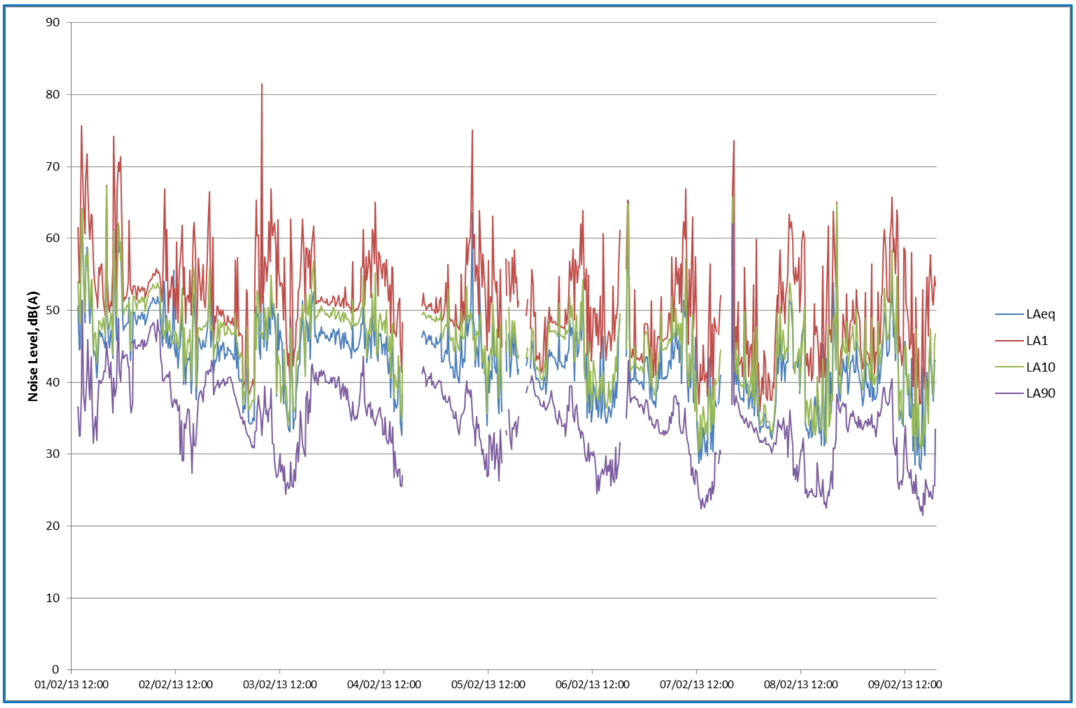

Figure B.18: BG01 Noise Monitoring Summer 2012/3

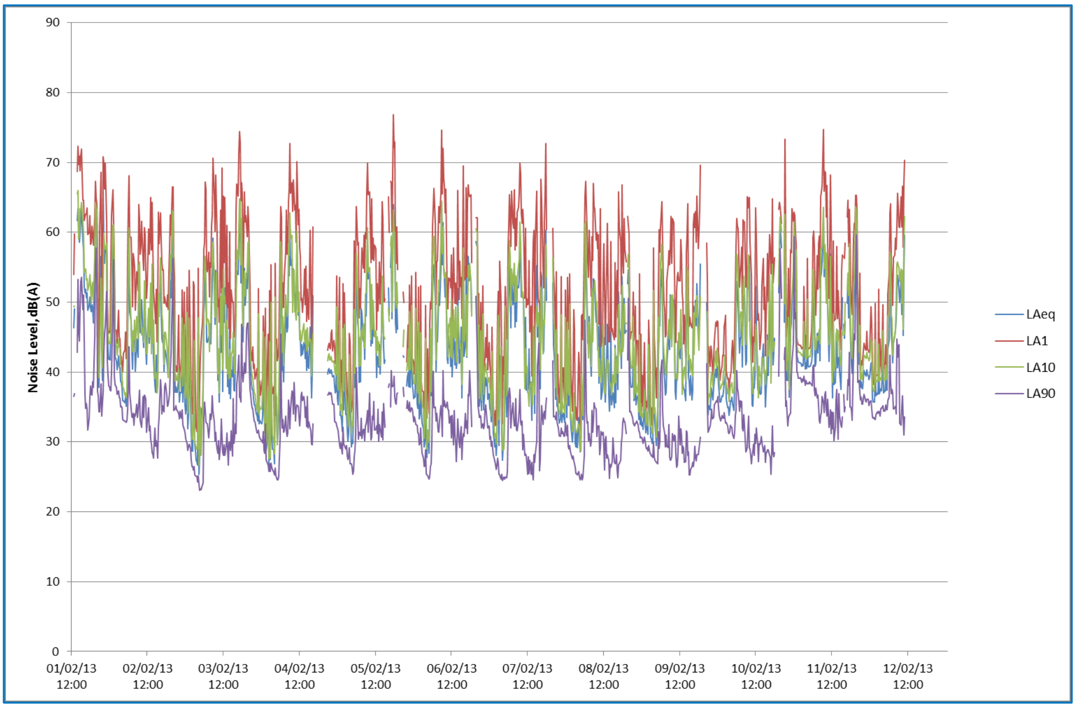

Figure B.19: BG02 Noise Monitoring Summer 2012/3

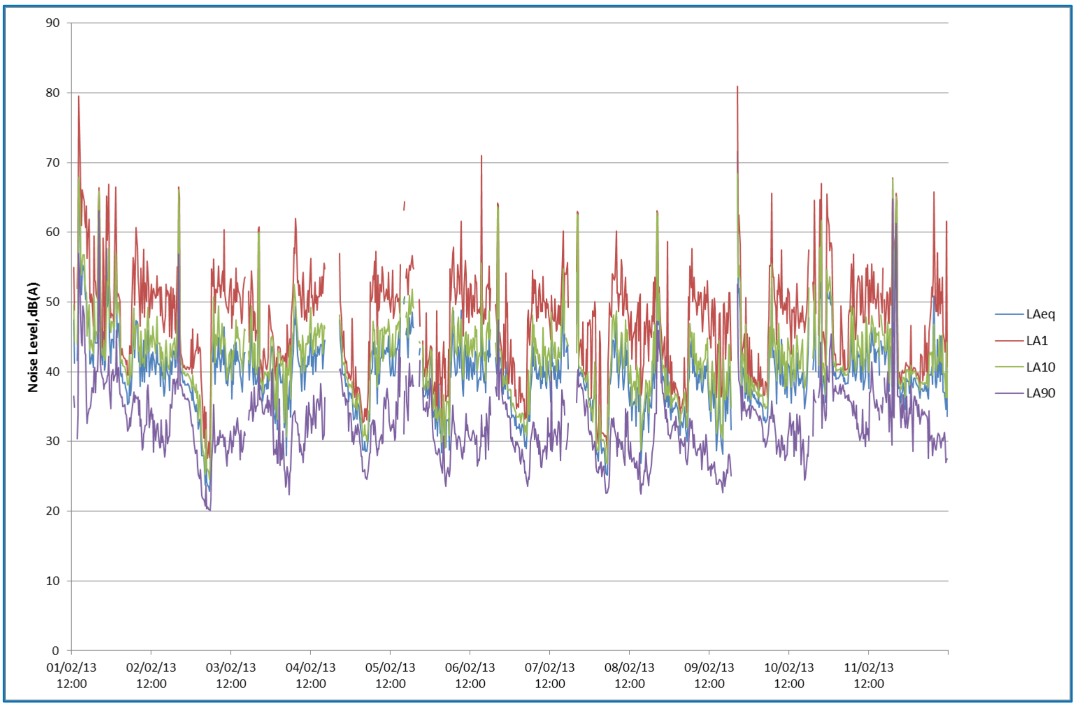

Figure B.20: BG03 Noise Monitoring Summer 2012/3

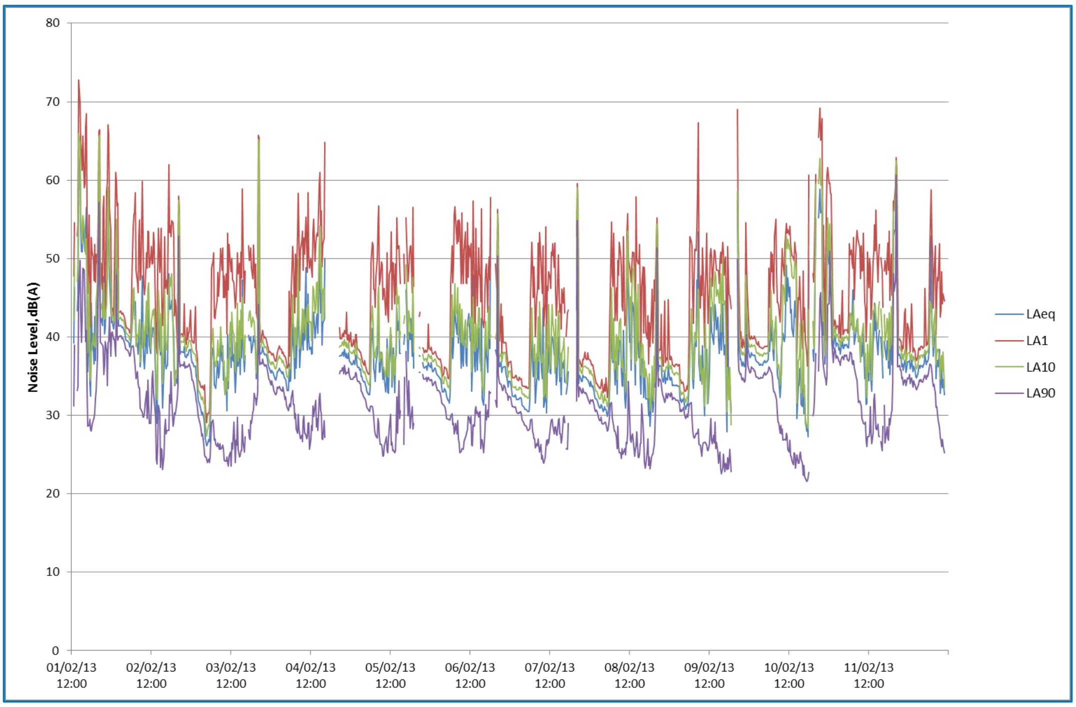

Figure B.21: BG04 Noise Monitoring Summer 2012/3

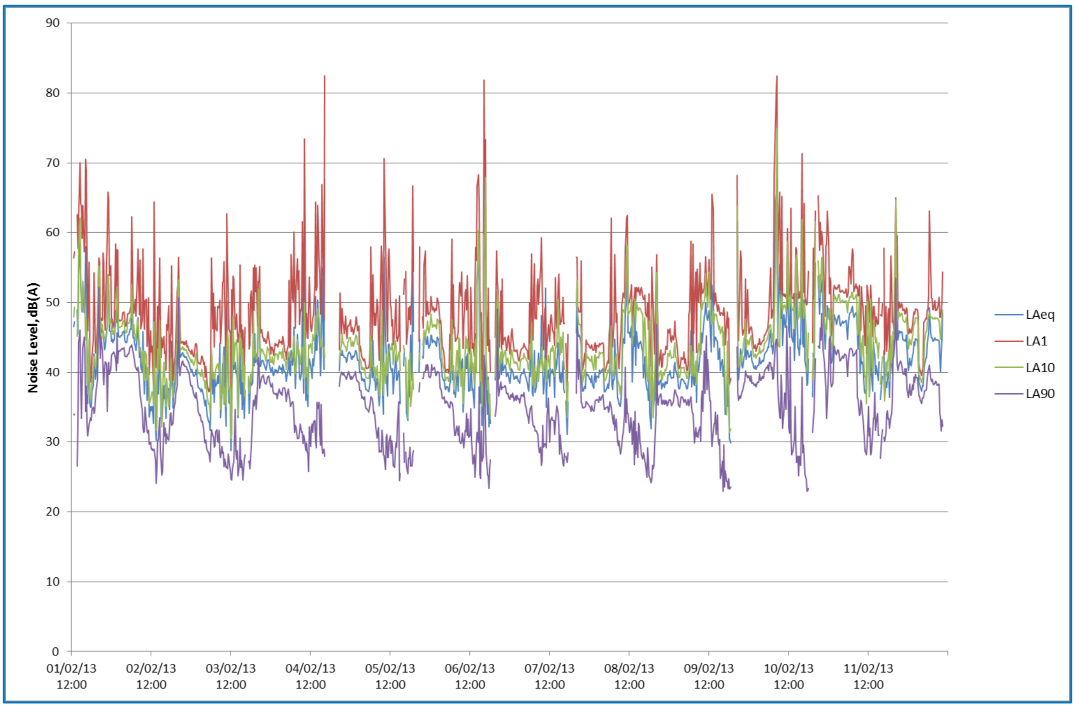

Figure B.22: BG05 Noise Monitoring Summer 2012/3

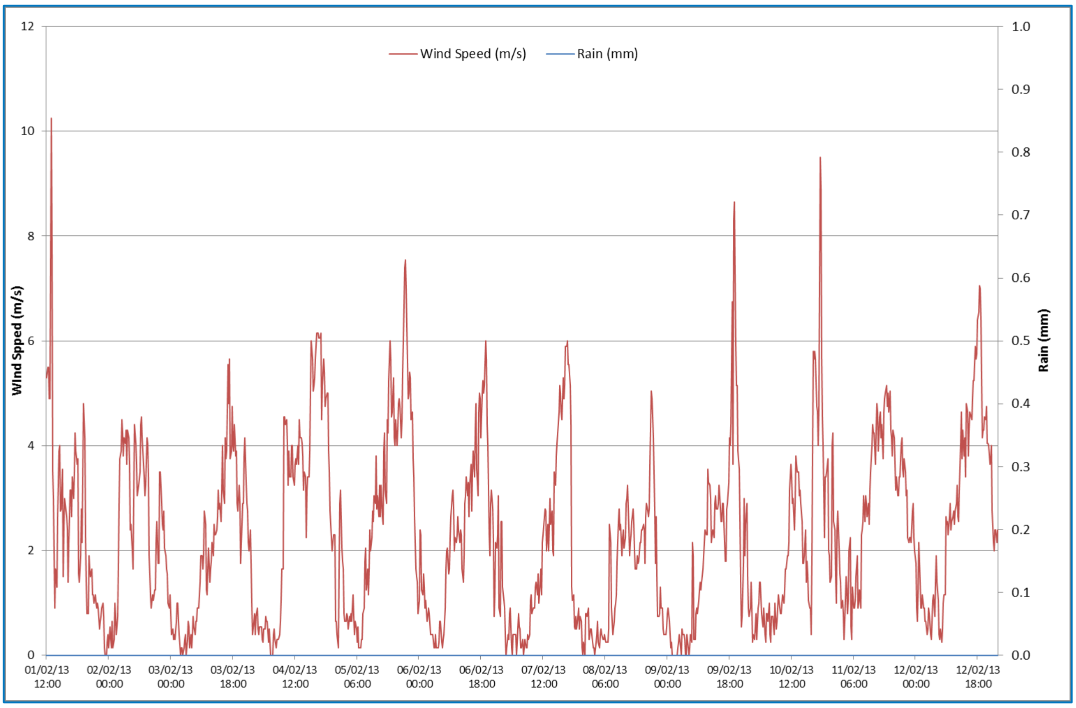

Figure B.23: Weather Data Summer 2012/3

B.6 AUTUMN 2013 MONITORING

Introduction

Autumn 2013 baseline noise monitoring was carried out between Tuesday 30 April and Tuesday 14 May 2013 using five ARL EL-316 noise loggers.

Attended measurements were carried out at all locations on Tuesday 30 April and Tuesday 14 May 2013. During all measurements the weather was noted to be clear and fine with calm wind conditions.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the AWS. Data was also excluded for identified extraneous events. **Table B-18** details the excluded periods (day, evening and night) which, due to weather conditions, are deemed unsuitable for noise monitoring.

Table B-18: Periods Excluded from Unattended Monitoring

Date	Period	Reason
1/5/2013	Day	Inclement Weather – Wind
4/5/2013	Day	Inclement Weather – Wind
13/5/2013	Day	Inclement Weather – Wind

Unattended Monitoring Results

The results of the unattended noise monitoring are detailed in **Table B**-19. The background noise level is described as the 'Rating Background Level' (RBL) as defined within the INP. The results are presented in the time periods defined in the INP as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-19: ABLs for autumn 2013 Noise Monitoring dB(A)

Loc.	Period	ABL by Date (May 2013)														RBL
		30	1	2	3	4	5	6	7	8	9	10	11	12	13	
BG01	D	36	-	34	33	-	33	33	30	30	31	32	31	31	-	32
	E	24	29	23	23	24	24	23	23	23	23	23	23	23	23	23
	N	23	23	23	23	23	24	24	23	22	23	23	23	23	23	23
BG02	D	28	-	30	27	-	28	29	28	30	29	29	27	27	-	29
	E	23	24	22	23	22	22	22	23	22	22	22	22	22	23	22
	N	22	22	23	22	22	22	22	22	22	22	22	22	23	22	22
BG03	D	33	-	30	30	-	29	29	29	29	29	29	28	29	-	29
	E	24	29	24	24	24	25	25	24	24	25	24	24	24	-	24
	N	24	24	24	24	24	24	24	24	24	24	24	24		-	24
BG04[1]	D	Data Excluded														
	E															
	N															
BG05	D	26	-	23	22	-	23	24	23	23	23	24	24	23	-	23
	E	22	26	21	22	22	24	23	21	21	22	21	22	21	22	22
	N	21	21	21	21	22	21	21	21	21	22	21	21	21	22	21

Note:
1. Logger affected by extraneous noise at residence near logger.

Attended Measurement Results

Table B-20 presents the results of the operator attended measurements.

Table B-20: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	14/5/2013 09.09am	44	57	44	32	Noise environment generally dominated by bird calls in the distance observed from 34 to 60 dB(A). Occasional vehicle on road and some just audible drilling noise. Cattle calls also noted.
BG02	30/04/2013 12.45pm	41	53	46	32	Noise environment most significant contributors consisted of bird calls in the distance, some light vegetation rustle and occasional car passing on Bylong Valley Way. A car door slam was audible from the Bylong General store. No other anthropogenic noise sources were noted.
BG03	30/04/2013 12.16pm	41	49	42	32	Noise environment consisted of bird calls in the distance, some light vegetation rustle and infrequent cars passing on Bylong Valley way observed to be barley to just audible. Some horse related noise (snorting and foot stamping) also noted. No other anthropogenic noise sources were noted.
BG04	30/04/2013 11.10	35	42	36	30	Noise environment observed to consist of light vegetation rustle, bird chatter in distance and infrequent car passing on gravel road. No other anthropogenic noise sources were noted.
BG05	30/04/2013 10.45	34	40	35	32	Noise environment observed to consist of intermittent bird calls and some light vegetation rustle. Other contributors included distant cattle calls and two impact noises from nearby residence. No other anthropogenic noise sources were noted.

Discussion

A review of the monitoring data reveals that in general it is not thought that insect noise adversely affected the noise measurements. It is considered based on observations made on site that non-anthropogenic noise sources were the dominant ambient and background noise sources.

The monitoring data is characterised by generally low background (L_{A90}) levels and varying L_{Aeq} levels close in value to the L_{A10} levels, with relatively high L_{A1} levels. This indicates that a number of short duration but high level noise events took place during those periods. Experience and knowledge of the noise environment suggests that these events are likely to be caused by either birds or other animal calls such as cattle. Typically insect noise from crickets, frogs or cicadas exhibits a steady state character, causing the statistical indicators and L_{Aeq} levels to converge.

A review of the monitoring data from BG04 seems to indicate that extraneous noise was present throughout much of the monitoring period. This could be either from insect noise or from activities at the nearby residential building. The night and evening noise descriptors appear to converge generally around 30 dB(A) and in some cases are as high as 50 dB(A). As a result it is considered to be adversely affected by extraneous noise.

Furthermore, the background noise levels at BG04 appeared inconsistent with previous monitoring occasions with the exception of the Summer 2012/3 occurrence which was affected by insects and measured similar background noise levels during the evening and night periods.

Noise Monitoring Graphs

FigureB.24 to **FigureB.28** display the noise monitoring data at each location during the autumn 2013 monitoring occurrence. Weather data is presented in **FigureB.29**.

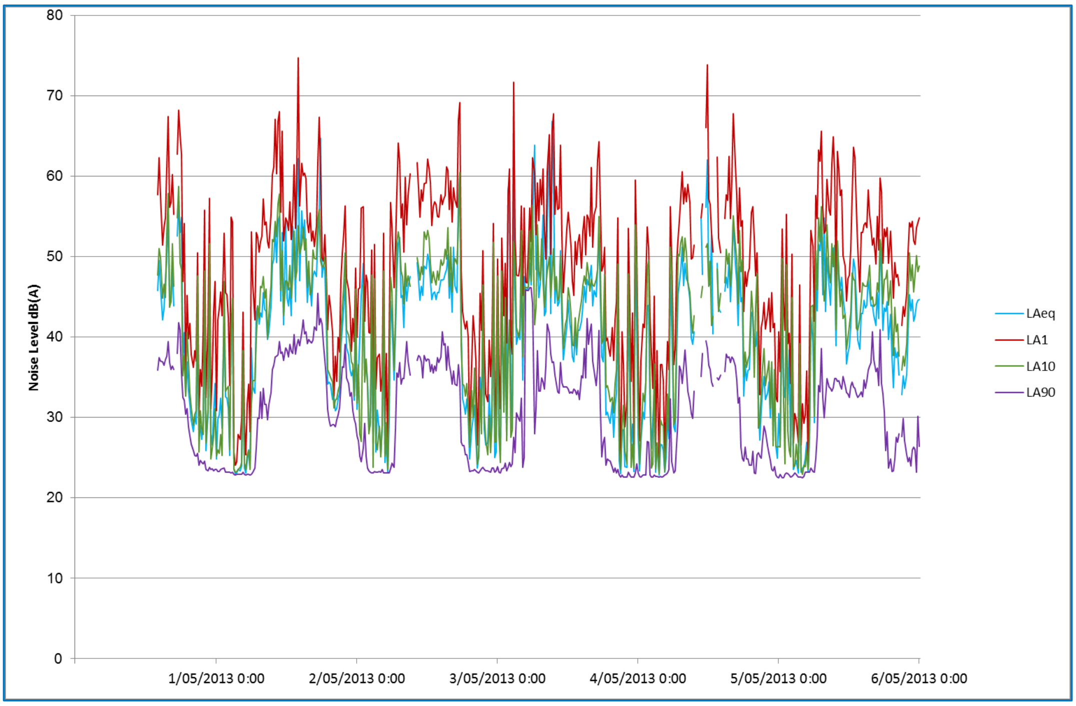

Figure B.24: BG01 Noise Monitoring Autumn 2013

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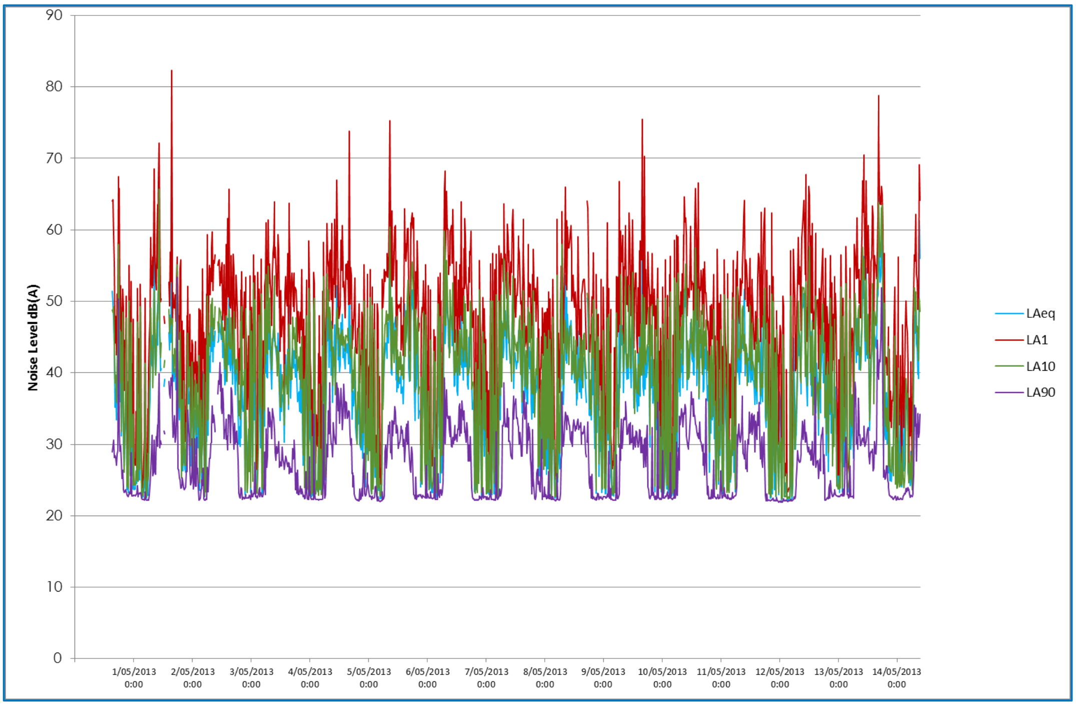

FigureB.25: BG02 Noise Monitoring Autumn 2013

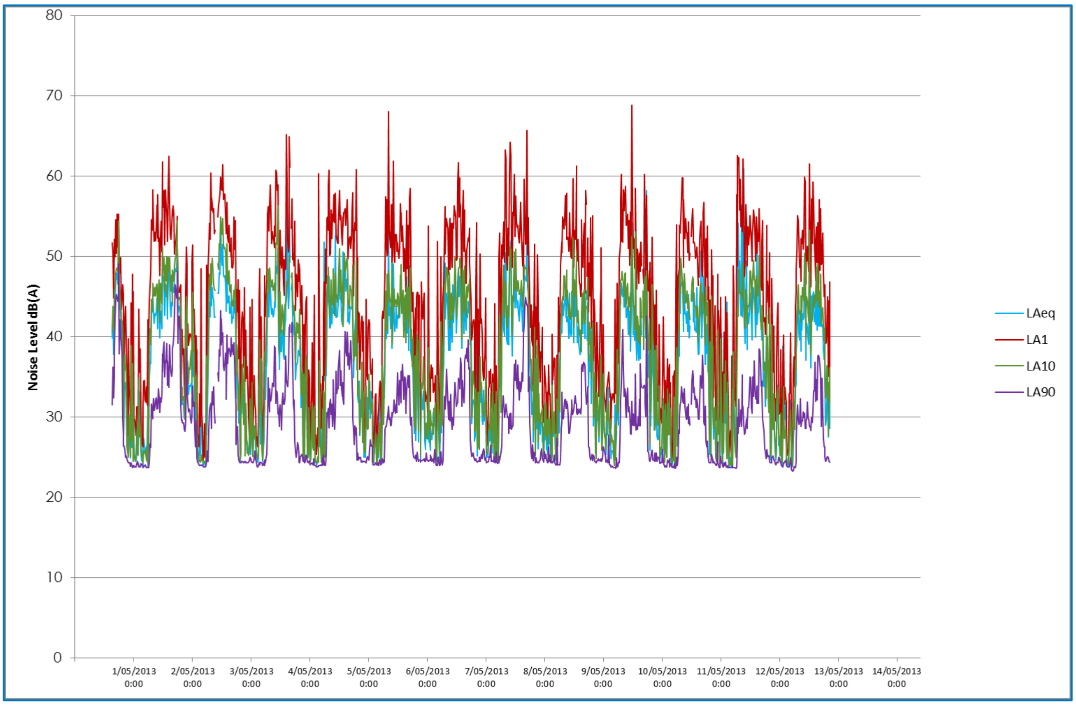

Figure B.26: BG03 Noise Monitoring Autumn 2013

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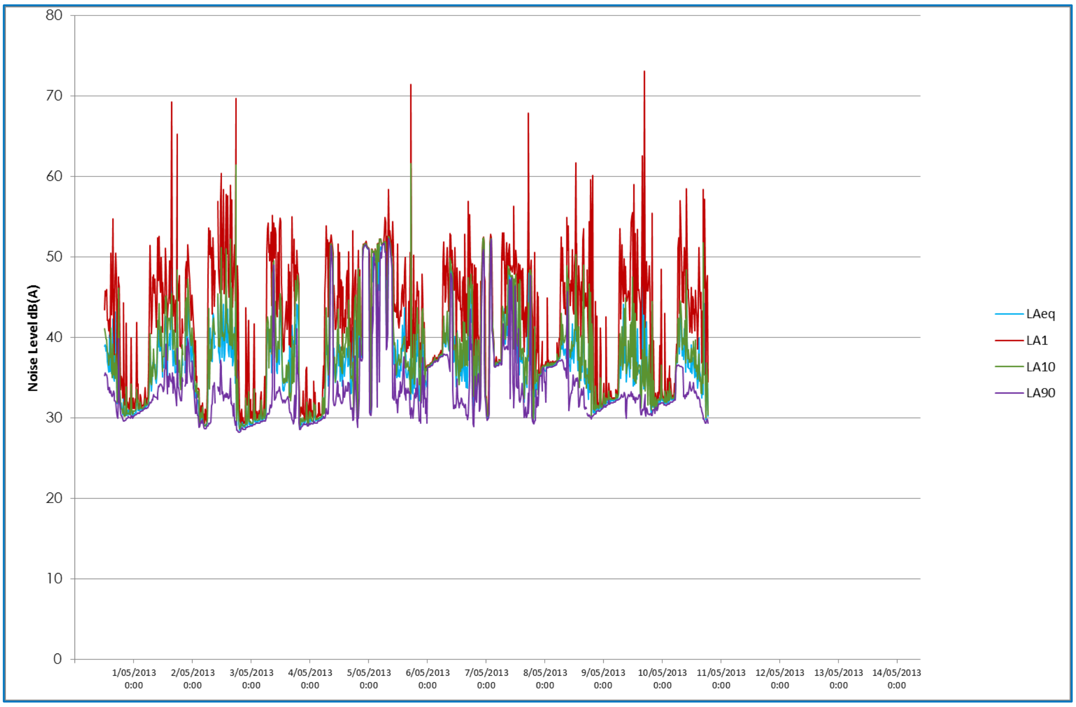

Figure B.27: BG04 Noise Monitoring Autumn 2013

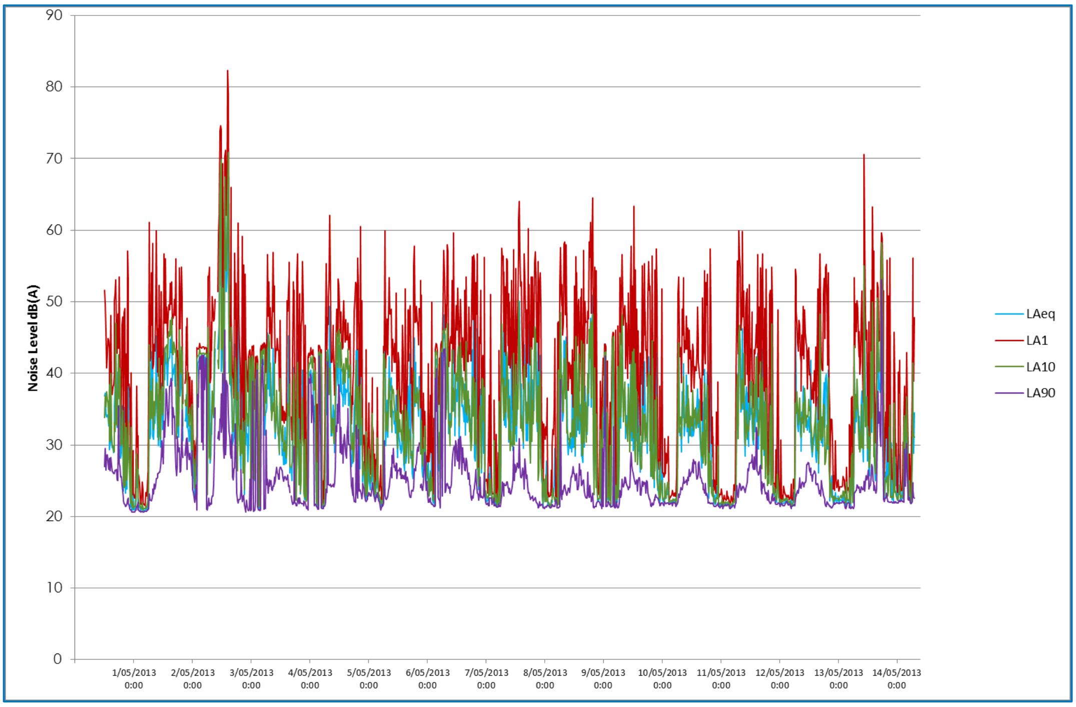

Figure B.28: BG05 Noise Monitoring Autumn 2013

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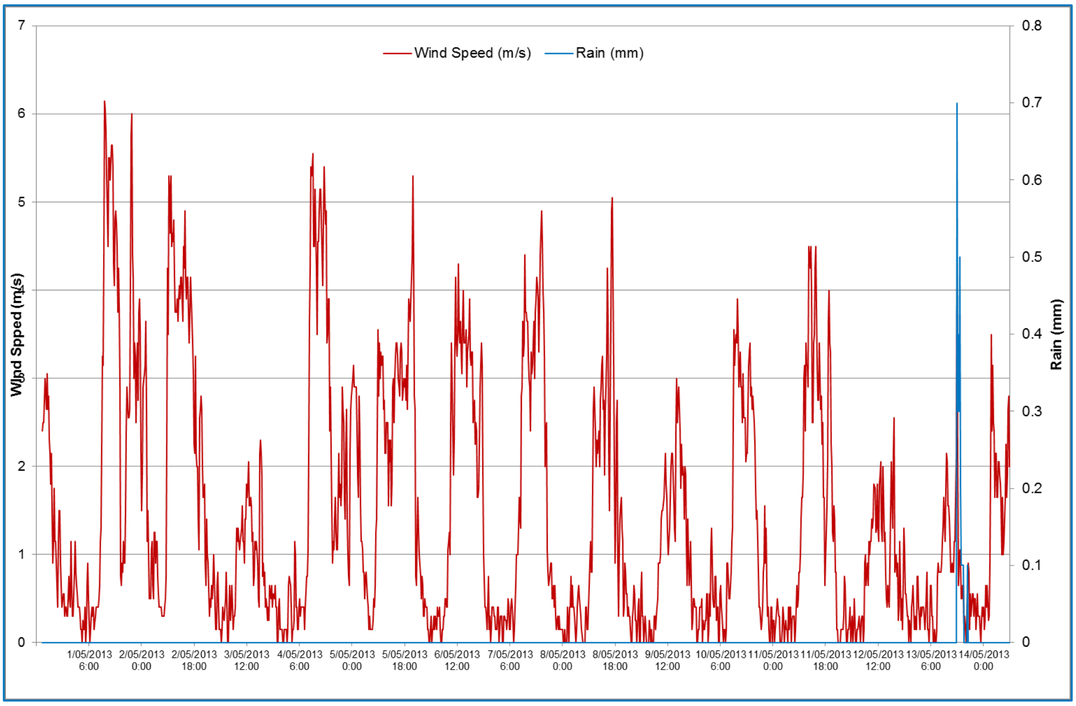

Figure B.29: Weather Data Autumn 2013

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B.7 WINTER 2013 MONITORING

Introduction

Winter 2013 baseline noise monitoring was carried out between Thursday 8 August and Friday 16 August 2013 using four ARL Ngara Environmental noise loggers and one NTi Audio Noise Logger. The noise logger at BG05 stopped after three days.

Attended measurements were carried out at all locations on Thursday 8 August and Friday 16 August. During all measurements the weather was noted to be clear and fine with slight winds estimated to be from 0-1 on the Beaufort Scale with some gusts estimated to be up to 2.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the AWS. Data was also excluded for identified extraneous events. **Table B-21** details the excluded periods (day, evening and night) which, due to weather conditions, are deemed unsuitable for noise monitoring.

Table B-21: Periods Excluded from Unattended Monitoring

Date	Period	Reason
08/08/2013	Day	Inclement weather – wind
12/08/2013	Day	Extraneous noise at BG2 only
13/08/2013	Day	Inclement weather – wind
14/08/2013	Day	Inclement weather – wind

Unattended Measurement Results

The results of the unattended noise monitoring are detailed in **Table B-22**. The background noise level is described as the RBL as defined within the INP. The results are presented in the time periods defined in the INP as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-22: Winter 2013 Noise Monitoring Results, dB(A)

Loc.	Period	ABL by Date (August 2013)[1]								RBL
		8	9	10	11	12	13	14	15	
BG01[2]	D	-	27	27	-	-	-	-	-	27
	E	20	20	-	-	-	-	-	-	20
	N	19	20	-	-	-	-	-	-	20
BG02	D	-	30	29	30	32	-	-	30	30
	E	25	25	25	25	25	25	29	28	25
	N	25	25	25	25	25	25	28	27	25
BG03	D	-	25	26	26	28	-	-	25	26
	E	22	21	22	22	23	23	22	22	22
	N	22	22	22	22	23	23	24	23	22
BG04	D	-	29	29	29	-	-	-	29	29
	E	27	28	28	29	30	28	28	28	28
	N	27	28	28	30	29	28	28	27	28
BG05	D	-	24	24	24	24	-	-	23	24

	E	23	23	24	23	24	23	23	22	23
	N	22	23	22	22	23	22	23	22	22

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Logger Stopped after 3 days.

Attended Measurement Results

TableB-23 presents the results of the operator attended measurements.

Table B-23: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	16/08/2013 09.45am	37	48	41	27	Noise environment generally dominated by insect and bird calls. Some industrial noise from direction of Quarry was noted although it was just audible and its contribution estimated to be below 30 dB(A).
BG02	16/08/2013 8.35am	42	53	43	35	Noise environment dominated by and bird calls and noise from vehicles on Bylong Valley Way. Bird calls were frequent from cockatoos and galahs. An occasional bang was noted from the General Store. Freight train passby noted eight minutes into measurement for rest of period.
BG03	16/08/2013 9.10am	41	52	43	29	Noise environment dominated by non-anthropogenic noise sources. Noise sources consisted of primarily bird calls and distant vegetation rustle and insect noise. Some noise audible from ute driving on property in distance.
BG04	08/08/2013 9.50am	33	42	34	27	Noise environment generally dominated by non-anthropogenic noise sources. Sources included bird calls (cockatoos and crows) and occasional wind in trees.
BG05	08/08/2013 9.10am	37	44	40	31	Noise environment dominated by non-anthropogenic noise sources. Sources occasional bird calls. Some noise from distant wind in trees.

Discussion

A review of the attended and unattended noise monitoring indicates that the noise monitoring was characterised by low ambient noise levels with few anthropogenic noise sources. At all locations the RBL was noted to be less than 30 dB(A) during the evening and night at all locations.

The most significant anthropogenic noise sources were generally observed to be road traffic on Bylong Valley Way at BG02, BG03, although it is noted that their absolute noise levels are not high. Intermittent passbys of freight trains on the Gulgong-Sandy Hollow railway have also been noted. Construction of the rail passing loop in the vicinity of BG02 was noted to be significantly less during this occurrence of noise monitoring with no mobile plant visible during site visits.

At BG01, it was noted that industrial noise considered to be from the Quarry was audible at the measurement location, however its contribution was estimated to be less than 30 dB(A). The industrial noise has been previously noted once before.

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Noise Monitoring Graphs

Figure B.30 to **Figure B.34** display the noise monitoring data at each location during the Winter 2013 monitoring occurrence. Weather data is presented in **Figure B.35**.

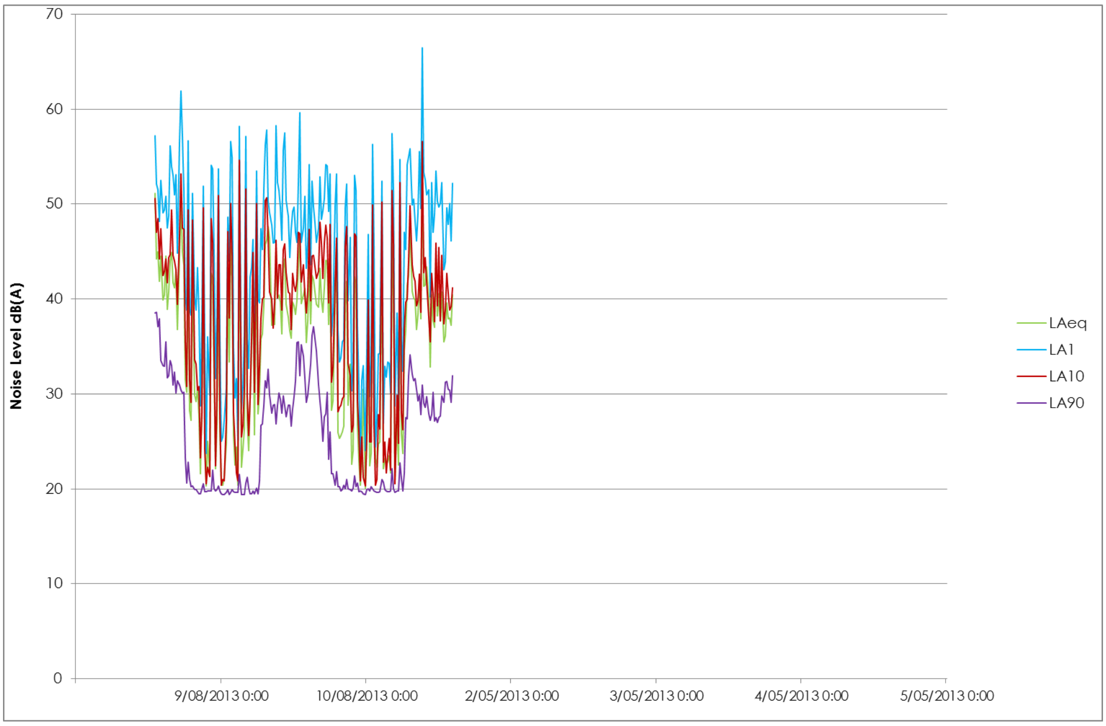

Figure B.30: BG1 Noise Monitoring Winter 2013

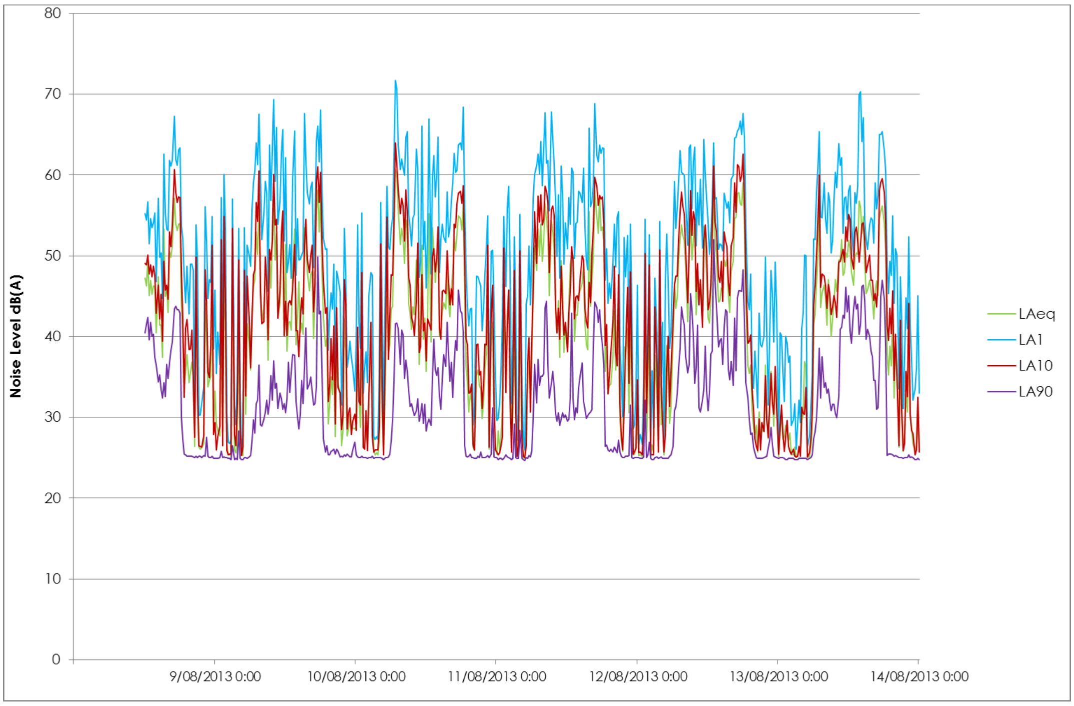

Figure B.31:BG2 Noise Monitoring Winter 2013

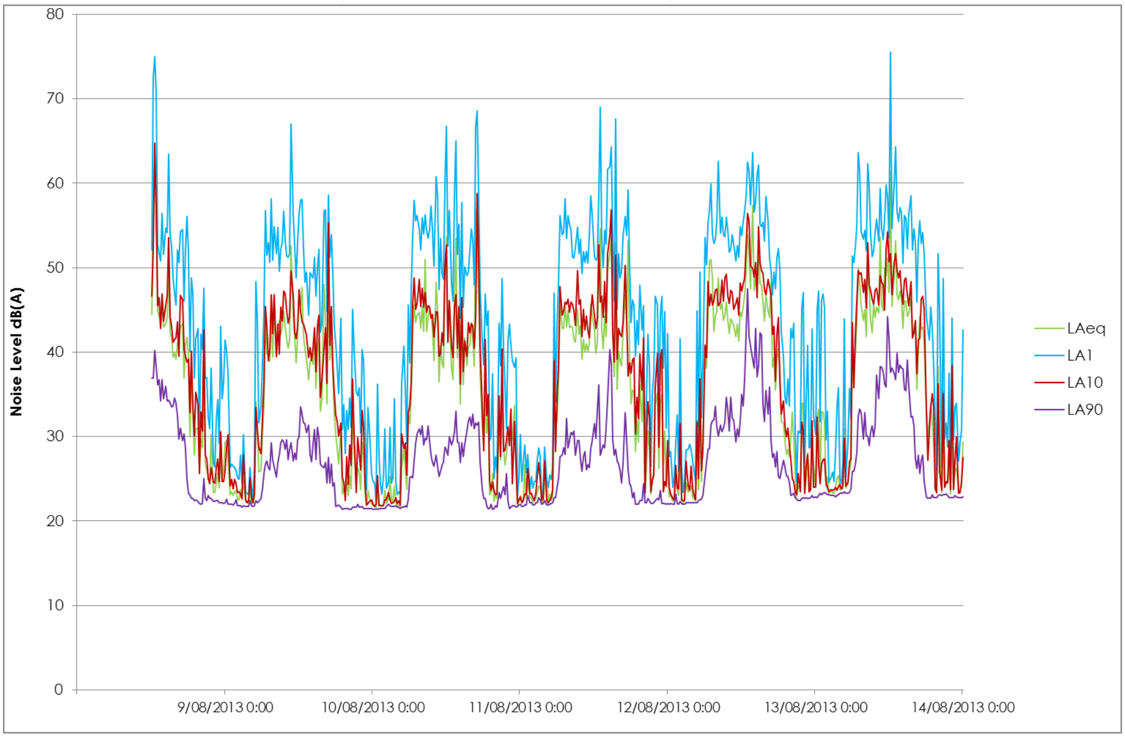

Figure B.32: BG3 Noise Monitoring Winter 2013

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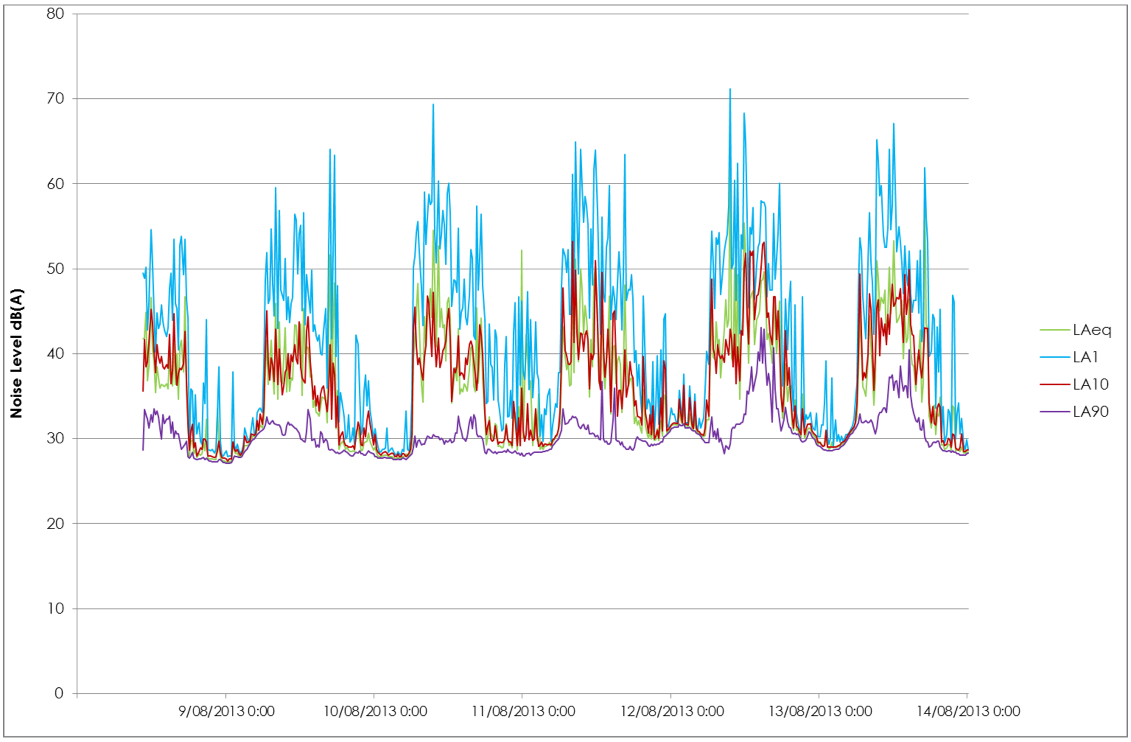

Figure B.33: BG4 Noise Monitoring Winter 2013

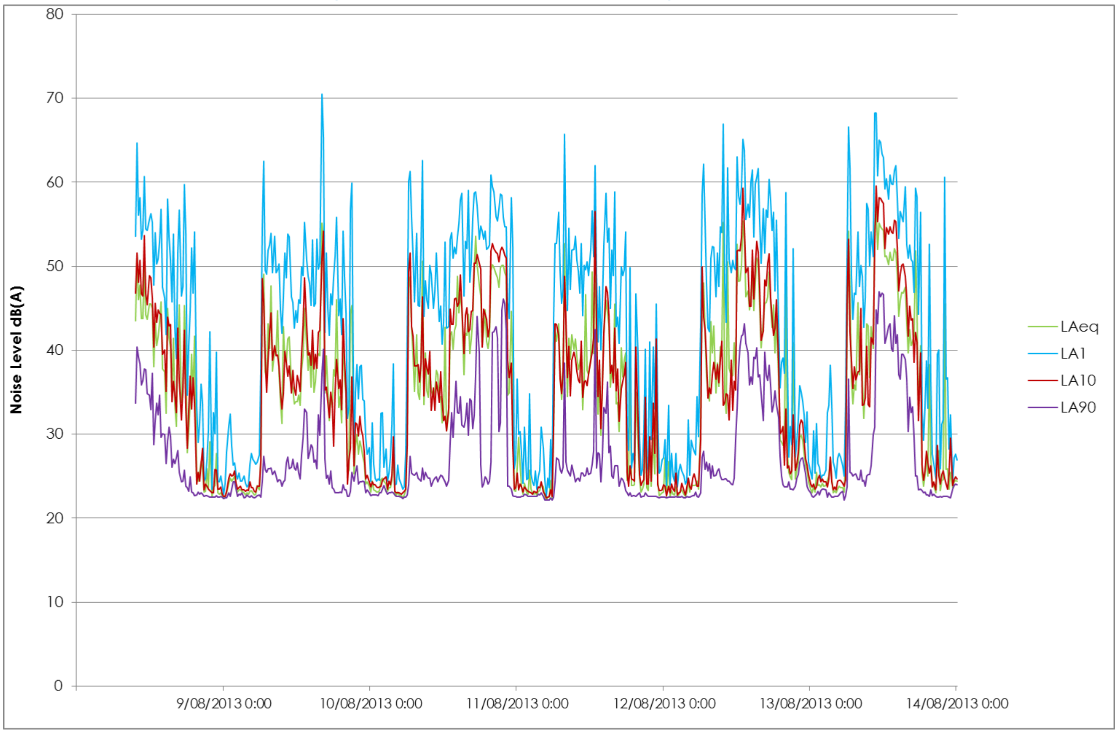

Figure B.34: BG5 Noise Monitoring Winter 2013

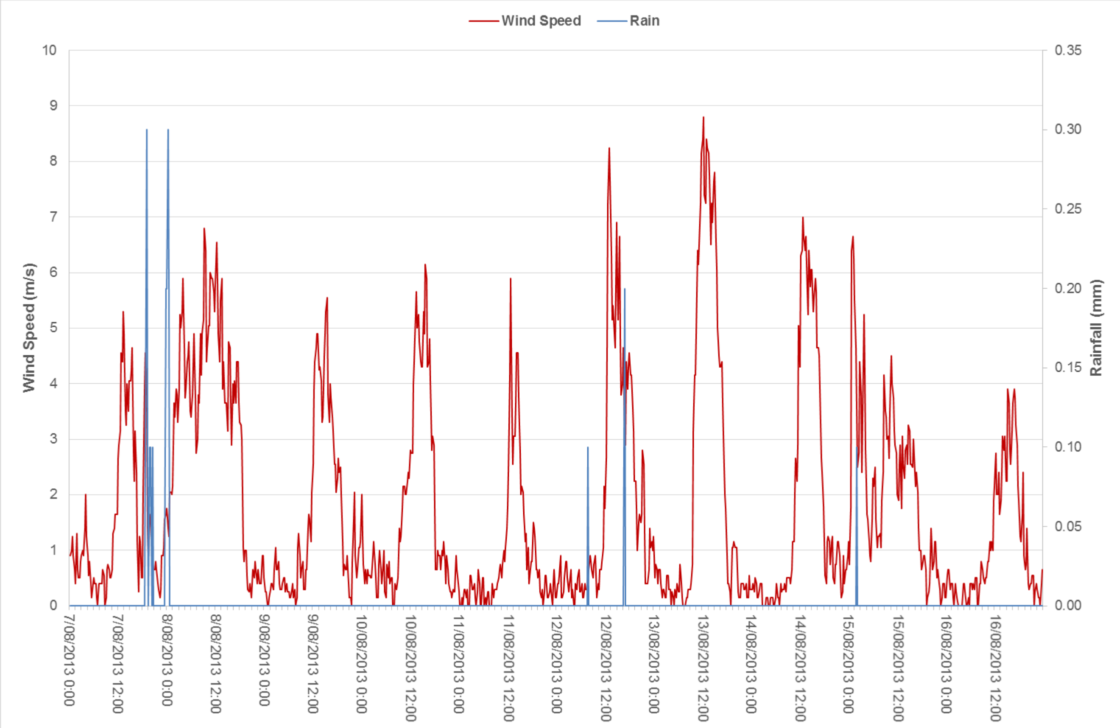

Figure B.35: Weather Data Winter 2013

B.8 SPRING 2013 MONITORING

Introduction

Spring 2013 baseline noise monitoring was carried out between Tuesday 31 October and Friday 8 November 2013 using five ARL EL-316 Environmental noise loggers. Calibration of the loggers was checked before and after the measurements and no significant drift was noted. The noise logger at BG05 stopped after eight days.

Attended measurements were carried out at all locations on Tuesday 31 October and Friday 8 November. A Rion NL-31 or NTi Audio XL2 Type 1 sound level meter was used to conduct the measurements. Calibration of the meter was checked before and after the measurements and no significant drift was noted. During all measurements the weather was noted to be clear and fine with slight winds estimated to be from 0-1 on the Beaufort Scale.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the project AWS. Data was also excluded for identified extraneous events. **Table B-24** details the excluded periods (day, evening and night) which, due to weather conditions or extraneous noise, are deemed unsuitable for noise monitoring.

Table B-24: Periods Excluded from Unattended Monitoring

Date	Period	Reason
02/11/2013	Day	Inclement weather – wind
03/11/2013	Day, Evening	Inclement weather – wind
04/11/2013	Day, Evening	Inclement weather – wind

Unattended Measurement Results

The results of the unattended noise monitoring are detailed in **Table B-25**. The background noise level is described as the RBL as defined within the INP. The results are presented in the time periods defined in the INP as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-25: Spring 2013 Noise Monitoring Results, dB(A)

Loc.	Period	ABL by Date (October/November 2013)[1]								RBL
		31	1	2	3	4	5	6	7	
BG01[2]	D	24	26	-	-	-	24	24	24	24
	E	21	18	22	-	-	21	20	21	21
	N	20	20	20	20	20	20	20	20	20
BG02	D	-	29	-	-	-	33	29	30	29
	E	26	28	25	-	-	23	25	28	26
	N	23	26	27	24	24	22	26	27	25
BG03	D	-	30	-	-	-	33	28	29	29
	E	23	24	23	-	-	25	23	23	23
	N	22	23	23	22	23	23	23	23	23
BG04	D	-	25	-	-	-	28	25	25	25
	E	23	24	23	-	-	23	22	24	23
	N	21	21	22	25	23	23	22	21	22
BG05[3]	D	-	26	-	-	-	27	26	27	26
	E	26	26	29	-	-	24	27	-	26
	N	22	22	22	22	22	22	21	-	22

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Periods of L_{90} noise levels recorded during the Night period fall within the loggers noise floor which is approximately 20 dB(A). Therefore noise levels have been set to 20 dB(A).
3. Logger at BG05 stopped on 7/11/2013.

Attended Measurement Results

Table B-26 presents the results of the operator attended measurements.

Table B-26: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	08/11/2013 11.15am	43	50	47	35	Noise environment generally dominated by non-anthropogenic noise sources including bird calls, distant insects and slight rustle of vegetation in trees.
BG02	31/10/2013 11.05am	40	49	41	34	Noise source included birds, occasional cars passing on Bylong Valley Way, engines at the General Store (Lmax 34 dB(A)and a freight train passing (Lmax 40 dB(A)).
BG03	16/08/2013 9.10am	43	54	46	32	Noise sources included bird calls, insects and occasional tree rustle, car pass on access drive.
BG04	08/08/2013 9.50am	43	54	46	32	Noise sources included bird calls and distant vegetation rustle. One plane flyover was noted L_{max} 54 dB(A).

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG05	08/08/2013 9.10am	43	51	46	34	Noise sources included distant bird calls and vegetation rustle, no anthropogenic noise audible at location.

Discussion

A review of the attended and unattended noise monitoring indicates that the noise monitoring was characterised by low ambient noise levels with few anthropogenic noise sources. At all locations the RBL was noted to be less than 30 dB(A) during the day, evening and night at all locations.

The most significant anthropogenic noise sources were generally observed to be road traffic on Bylong Valley Way at BG01, BG02 and BG03, although it is noted that their absolute noise levels are not high. Intermittent passbys of freight trains on the Gulgong-Sandy Hollow railway have also been noted.

At BG01 L_{90} noise levels recorded were noted to be within the noise floor of the instrument and therefore the value of 20 dB(A) has been adopted during these times which represents the typically lowest noise level measureable by the equipment. In any case, the INP states where RBLs are less than 30 dB(A), the RBL shall be set to 30 dB(A).

Noise Monitoring Graphs

Figure B.36to **Figure B.40** display the noise monitoring data at each location during the Spring 2013 monitoring occurrence. Weather data is presented in **Figure B.41**.

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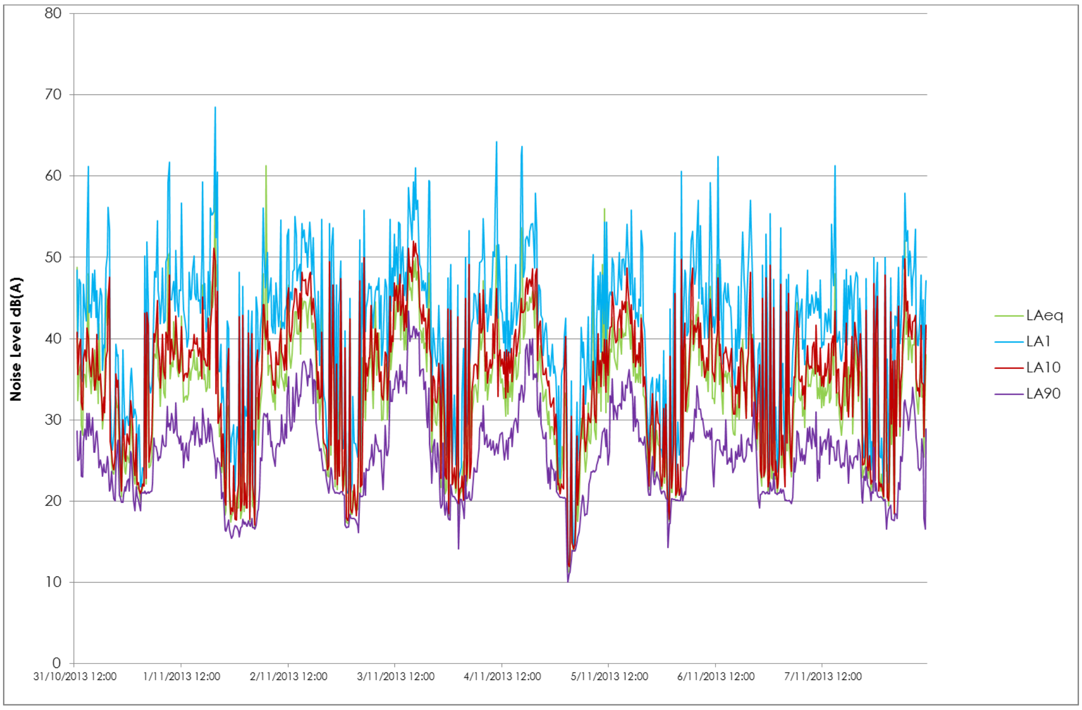

Figure B.36: BG1 Noise Monitoring Spring 2013

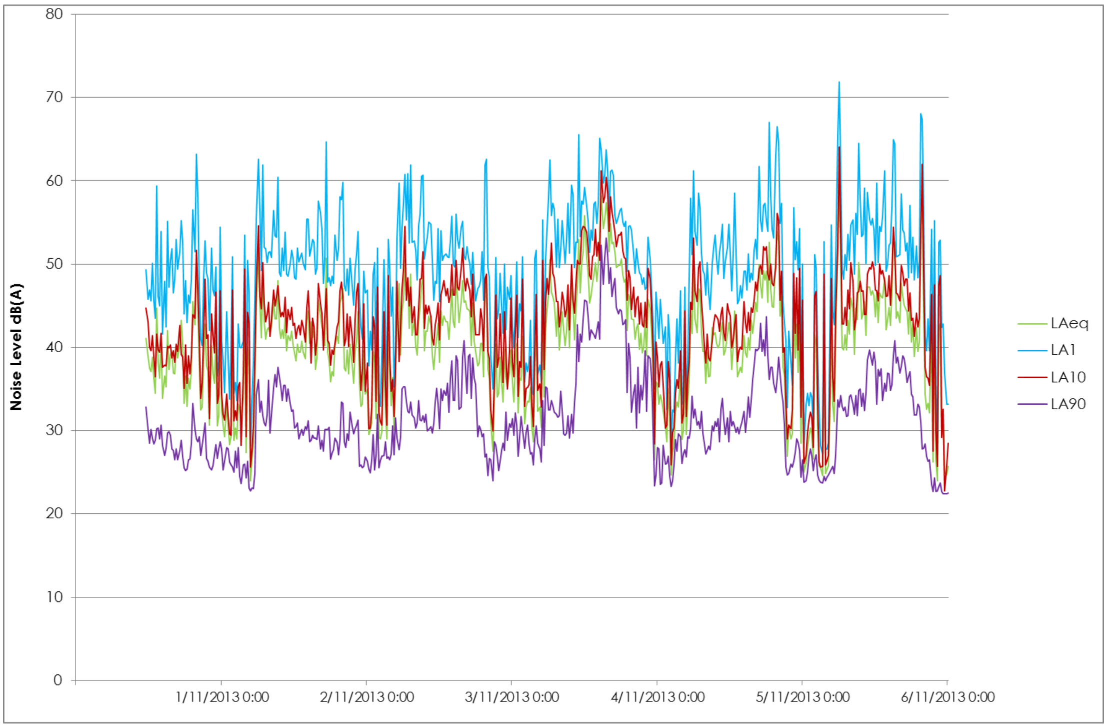

Figure B.37: BG2 Noise Monitoring Spring 2013

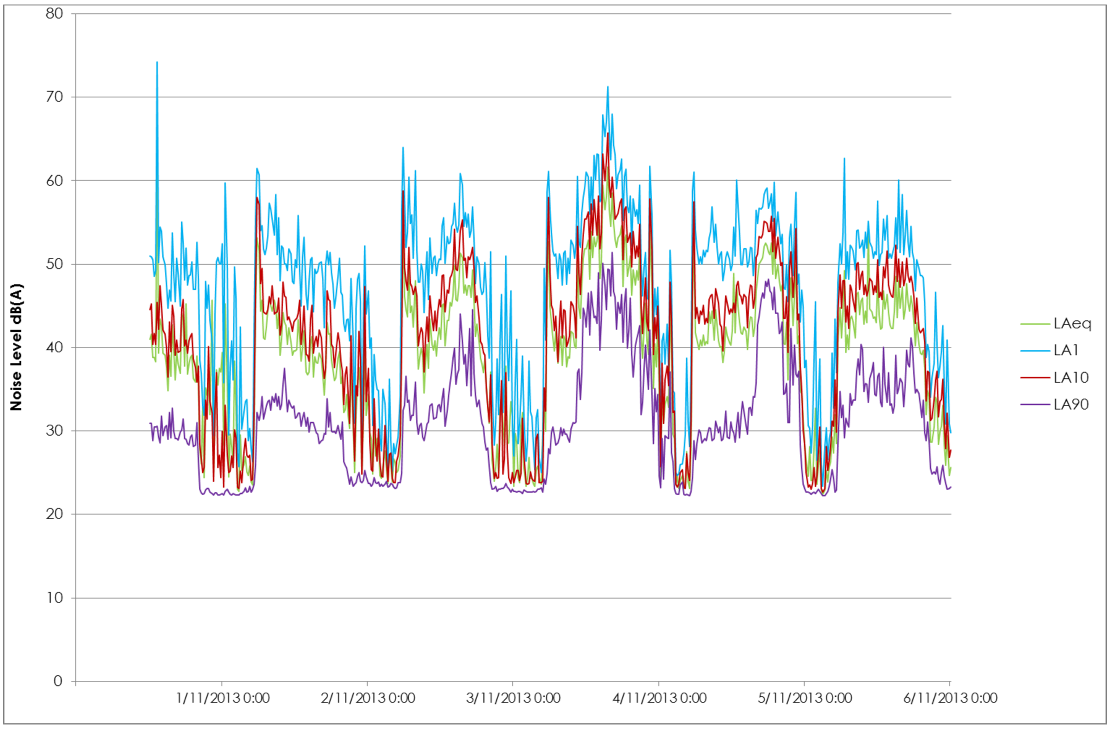

Figure B.38: BG3 Noise Monitoring Spring 2013

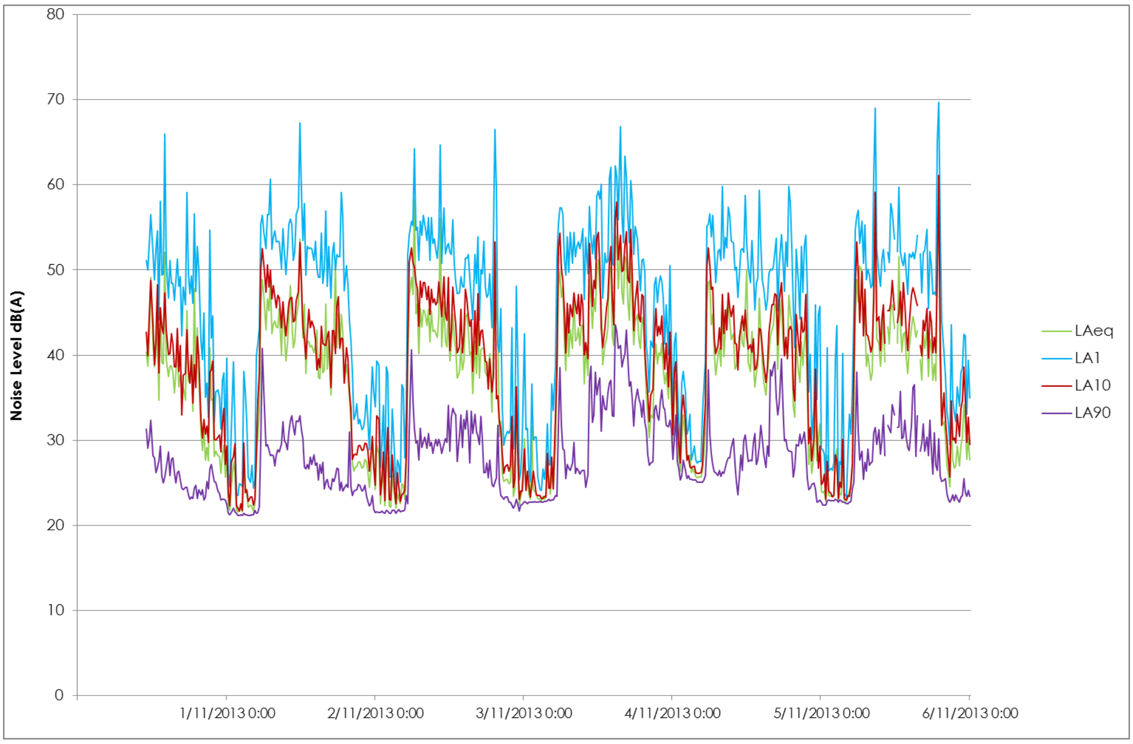

Figure B.39: BG4 Noise Monitoring Spring 2013

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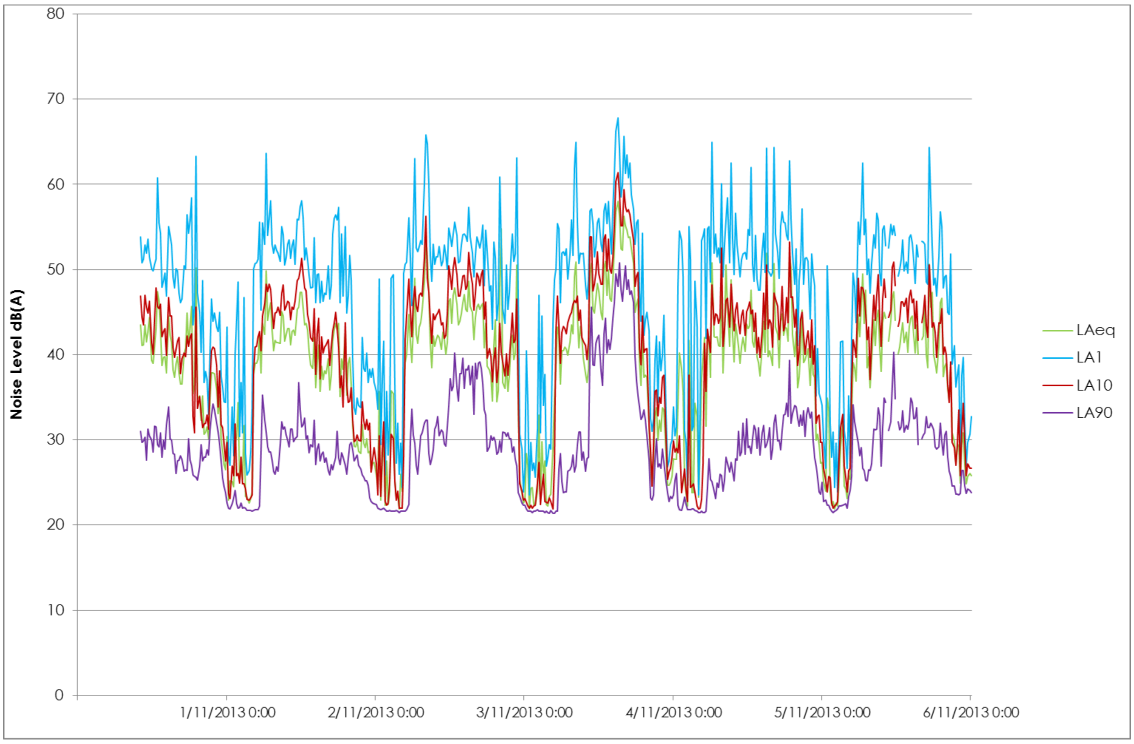

Figure B.40: BG5 Noise Monitoring Spring 2013

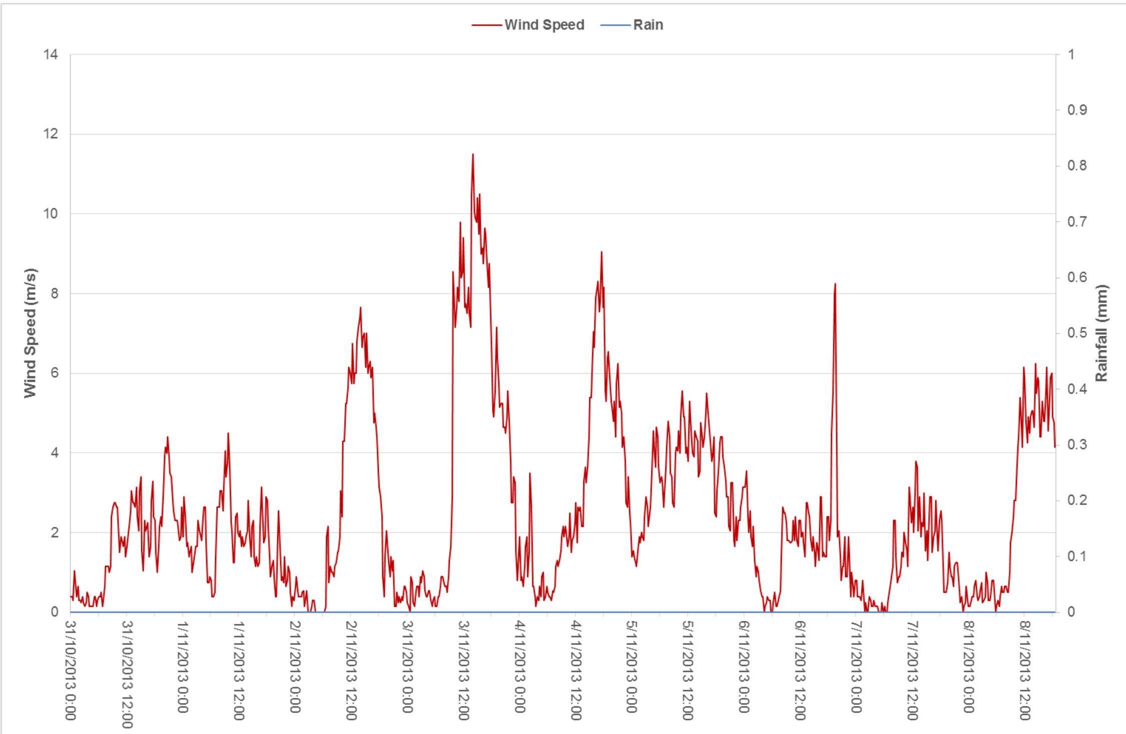

Figure B.41: Weather Data Spring 2013

B.9 SUMMER 2013/2014 MONITORING

Introduction

Summer 2014 baseline noise monitoring was carried out between Thursday 13 February and Monday 24 February 2014 using three ARL EL-316 and two NTi XL2 environmental noise loggers. Calibration of the loggers was checked before and after the measurements and no significant drift was noted. The noise logger at BG05 stopped after seven days.

Attended measurements were carried out at all locations on Thursday 13 February. A NTi Audio XL2 Type 1 sound level meter was used to conduct the measurements. Calibration of the meter was checked before and after the measurements and no significant drift was noted. During all measurements the weather was noted to be clear and fine with slight winds estimated to be from 0-1 on the Beaufort Scale.

Data Exclusion

In accordance with the procedures set out in Appendix B of the NSW INP, data has been excluded based on weather information supplied from the project AWS. Data was also excluded for identified extraneous events. **Table B-27** details the excluded periods (day, evening and night) which, due to weather conditions or extraneous noise, are deemed unsuitable for noise monitoring.

Table B-27: Periods Excluded from Unattended Monitoring

Date	Period	Reason
13/2/2014	Evening, Night	Inclement Weather
14/2/2014	Night	Inclement Weather
16/2/2014	Day	Inclement Weather
17/2/2014	Day	Inclement Weather
19/2/2014	Day	Inclement Weather
20/2/2014	Day	Inclement Weather
21/2/2014	Evening	Inclement Weather
22/2/2014	Evening	Inclement Weather

Unattended Measurement Results

The results of the unattended noise monitoring are detailed in **Table B-28**. The background noise level is described as the RBL as defined within the INP. The results are presented in the time periods defined in the INP as follows:

Day - 7.00am to 6.00pm;
Evening - 6.00pm to 10.00pm; and
Night - 10.00pm to 7.00am.

Table B-28: Summer 2014 Noise Monitoring Results, dB(A)

Loc.	Period	ABL by Date (February 2014)[1]										RBL
		14	15	16	17	18	19	20	21	22	23	
BG01	D	23	22	-	-	24	-	-	23	28	29	23
	E	24	21	28	28	28	33	26	-	-	25	27
	N	-	26	30	27	27	32	22	24	23	21	26
BG02	D	25	26	-	-	27	-	-	25	29	30	26
	E	24	26	29	28	26	31	26	-	-	24	26
	N	-	26	28	24	25	28	21	22	23	21	24
BG03	D	26	25	-	-	26	-	-	27	29	29	27
	E	26	27	30	29	30	29	25	-	-	25	28
	N	-	26	25	24	24	25	23	23	23	22	24
BG04	D	26	26	-	-	26	-	-	27	28	28	26
	E	26	26	28	28	28	31	27	-	-	27	27
	N	-	29	29	27	28	30	25	26	26	25	27
BG05[2]	D	23	25	-	-	24	-	-	-	-	-	24
	E	27	28	29	29	27	32	-	-	-	-	28
	N	-	27	26	25	26	-	-	-	-	-	26

Notes: 1. According to the INP where the RBL is below 30 dB(A), the background level is to be set at 30 dB(A).
2. Logger at BG05 stopped after seven days.

Attended Measurement Results

Table B-29 presents the results of the operator attended measurements.

Table B-29: Operator Attended Measurement Results

Location	Date and Time	Noise Level dB(A)				Comments
		L_{Aeq}	L_{A1}	L_{A10}	L_{A90}	
BG01	13/2/2014 1.45pm	31	40	33	26	Noise environment generally dominated by non-anthropogenic noise sources including bird calls (40-54 L_{Amax}), distant insects and slight rustle of vegetation in trees. Faint helicopter noise audible, estimated less than 25 dB(A).
BG02	13/2/2014 12.50pm	46	61	45	31	Noise source included vegetation rustle, birds, occasional cars passing on Bylong Valley Way and engines at the General Store (L_{Amax} 33 dB(A). Bird calls (L_{Amax} 60-67).
BG03	13/2/2014 1.15pm	41	50	37	27	Noise sources included bird calls, insects and occasional tree rustle, occasional car pass on Bylong Valley Way (L_{Amax} 40-45). Helicopter audible (L_{Amax} 35-39).
BG04	13/2/2014 11.31am	36	44	37	31	Noise sources included distant bird calls (L_{Amax} 30-35) and distant vegetation rustle (L_{Amax} 30-38).
BG05	13/2/2014 11.00am	38	45	41	34	Noise sources included distant bird calls, distant cicadas (noted in 3.15 and 4 kHz third octave bands), and occasional cattle calls (L_{Amax} 47-57).

Discussion

A review of the attended and unattended noise monitoring indicates that the noise monitoring was characterised by low ambient noise levels with few anthropogenic noise sources. At all locations the

RBL was noted to be less than 30 dB(A) during the day, evening and night at all locations. No industrial noise was noted at any of the locations.

The most significant anthropogenic noise sources were generally observed to be road traffic on Bylong Valley Way at BG01, BG02 and BG03, although it is noted that their absolute noise levels are not high. Intermittent passbys of freight trains on the Gulgong-Sandy Hollow Railway Line have also been noted.

In some cases, the measured evening RBL was higher than the day RBL. However, it is noted that in these cases, both RBLs are less than 30 dB(A) and as the INP states where RBLs are less than 30 dB(A), the RBL shall be set to 30 dB(A), the evening shall be set to 30 dB(A).

Noise Monitoring Graphs

Figure B.42 to **Figure B.46** display the noise monitoring data at each location during the Summer 2013/14 monitoring occurrence. Weather data is presented in **Figure B.47**.

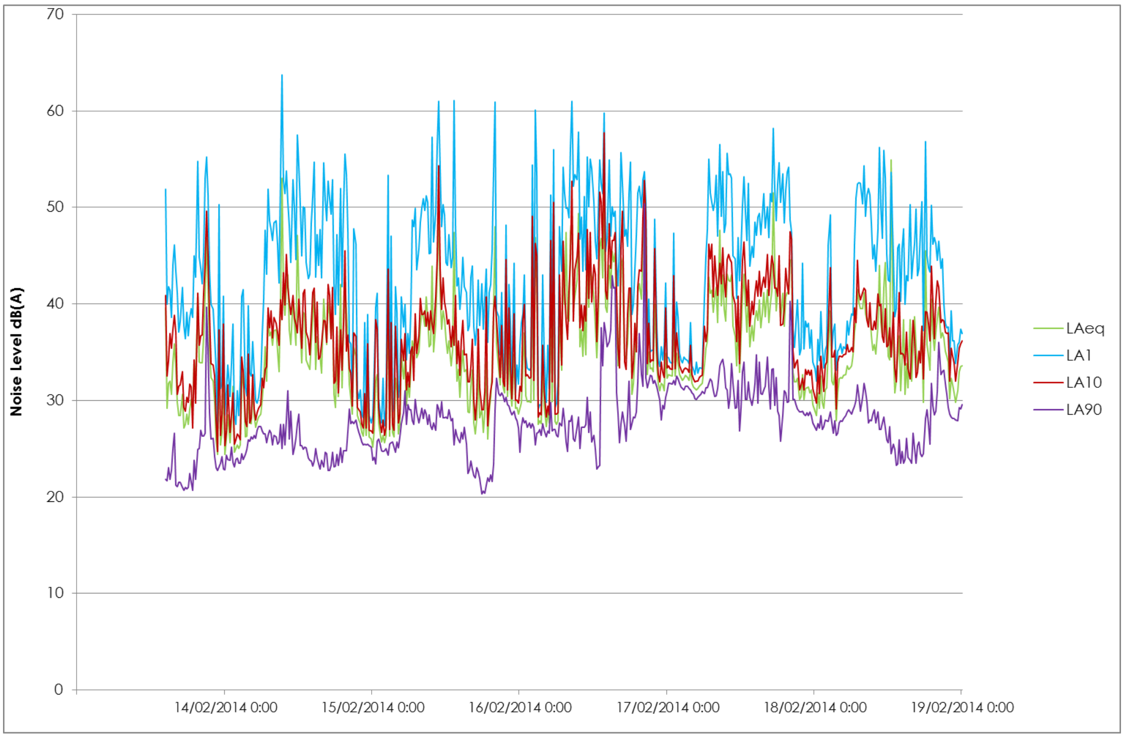

Figure B.42: BG1 Noise Monitoring Summer 2013/2014

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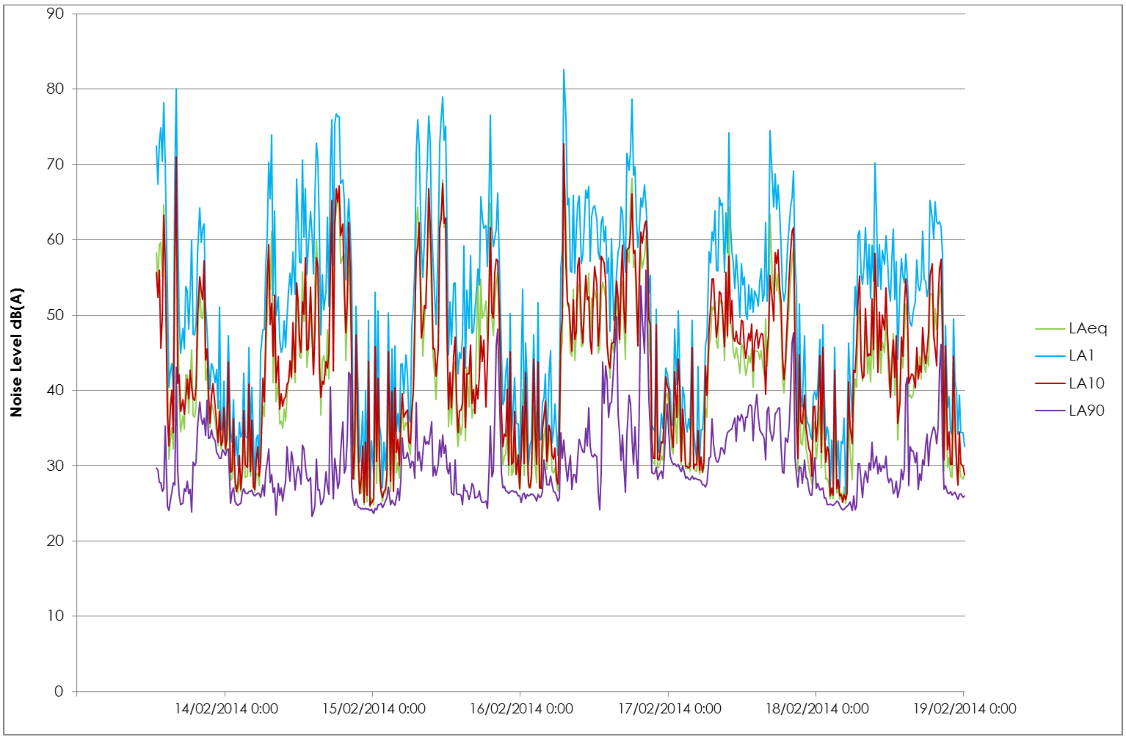

Figure B.43:BG2 Noise Monitoring Summer 2013/2014

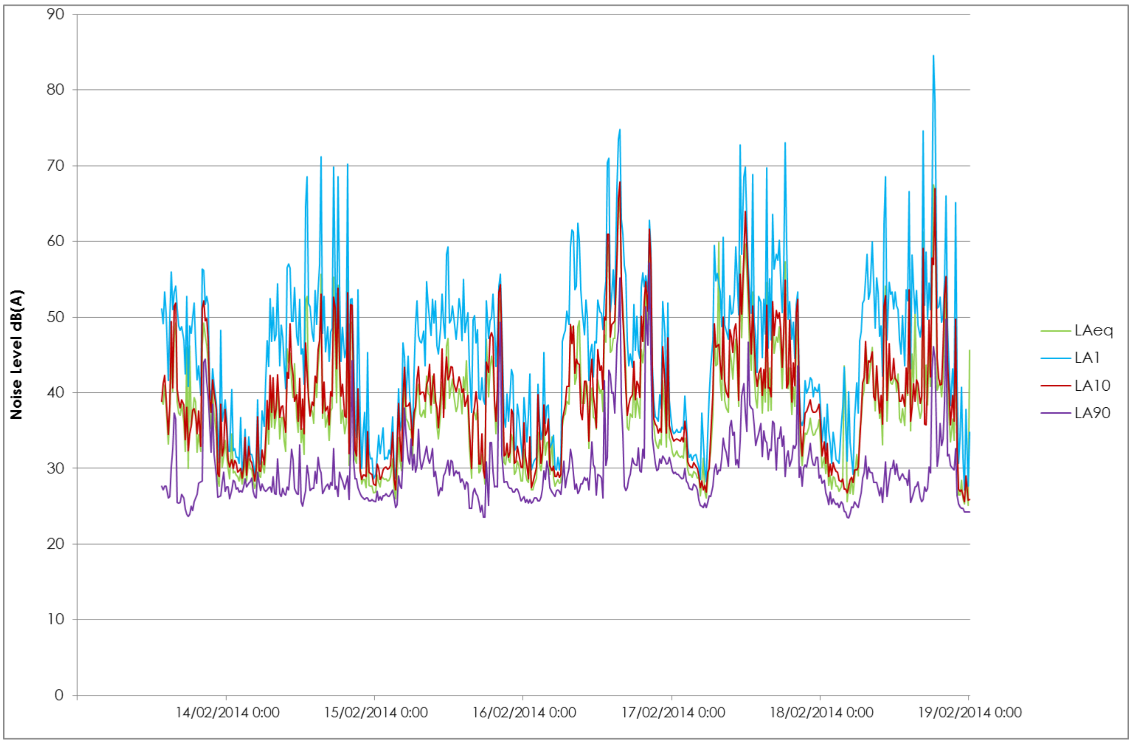

Figure B.44: BG3 Noise Monitoring Summer 2013/2014

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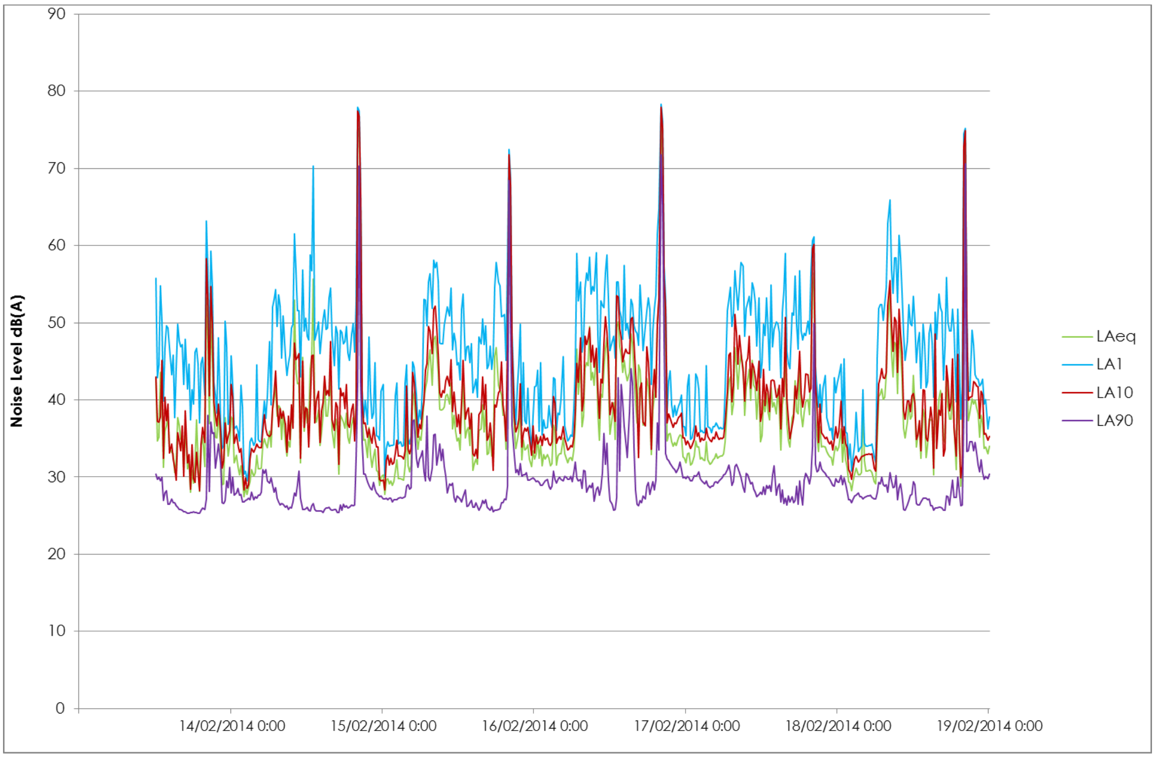

Figure B.45: BG4 Noise Monitoring Summer 2013/2014

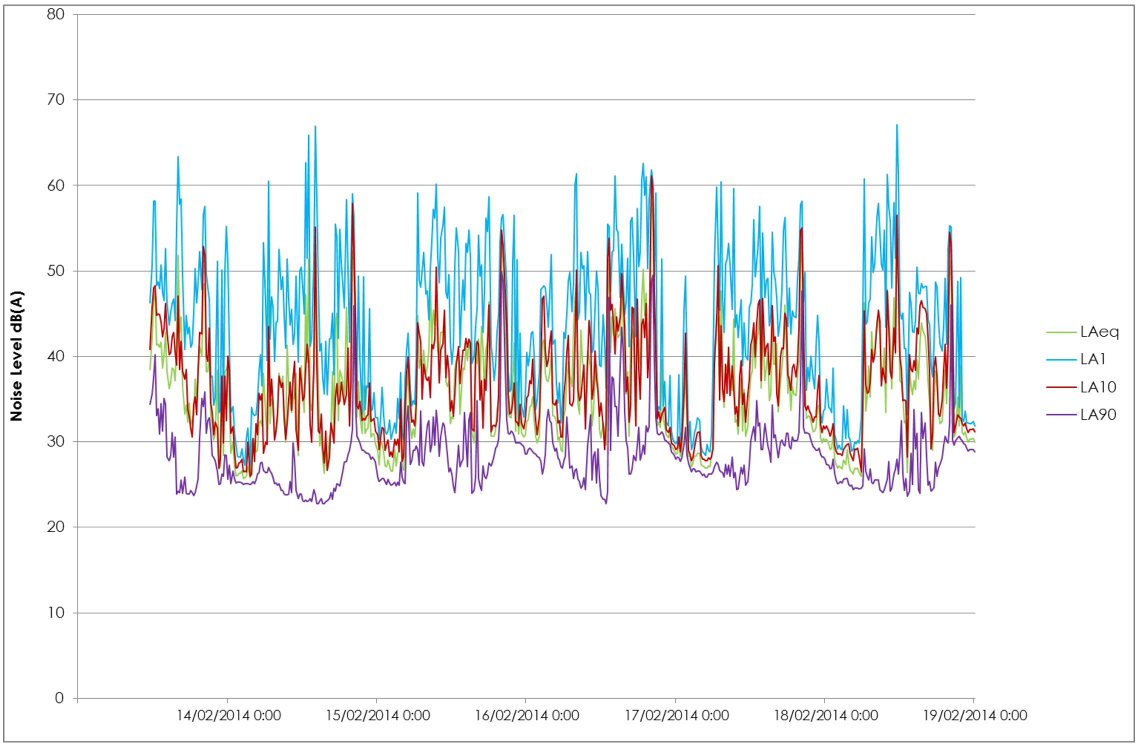

Figure B.46: BG5 Noise Monitoring Summer 2013/2014

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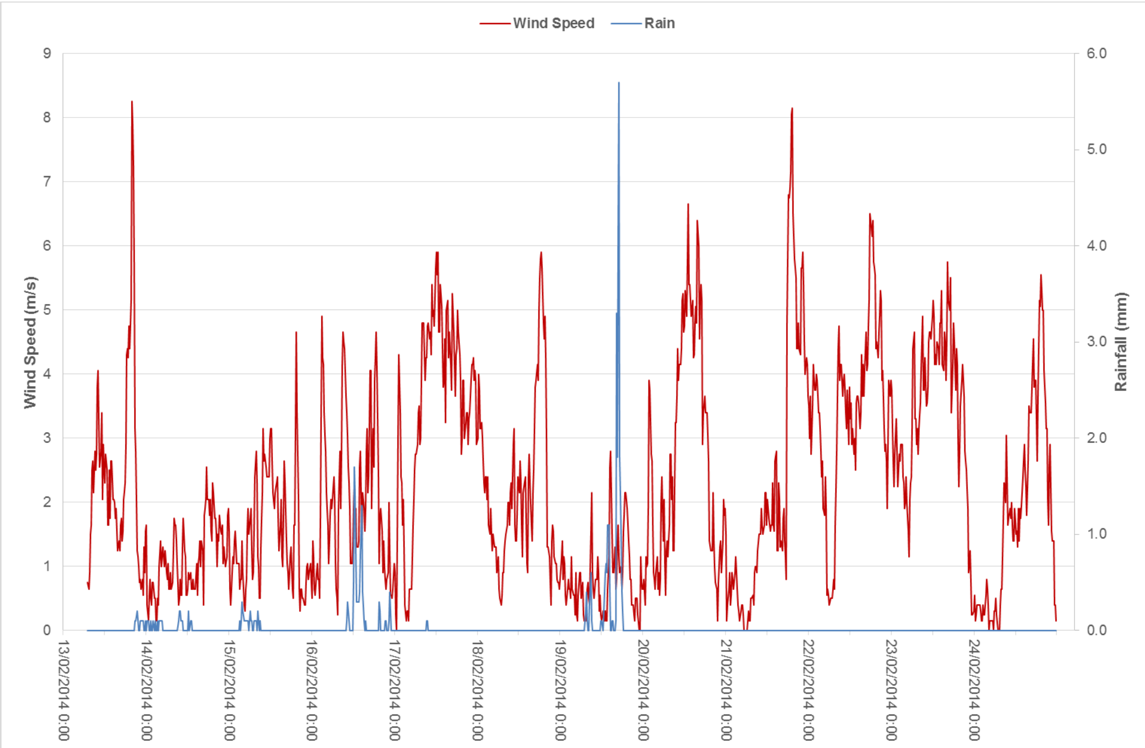

Figure B.47: Weather Data Summer 2013/4

Appendix C NOISE MODELLING ASSUMPTIONS

C.1 SOUND POWER LEVELS

Table C-1: Mitigated (as modelled) Octave Band Sound Power Levels

Name	Type	Octave Band Frequency (Hz) Noise Level dB(A)								Sum dB(A)
		63	125	250	500	1000	2000	4000	8000	
Excavator	EX5600 (or equivalent)	99	104	104	114	114	110	100	88	118
Excavator	EX2600 (or equivalent)	89	100	106	111	111	110	104	96	116
FEL	CAT993 (or equivalent)	87	103	108	107	10333	108	102	96	114
Haul Truck on flat ground	HITACHI EH4000/3500AC-3 (or equivalent)	89	102	107	109	103	105	102	92	113
Haul Truck on incline	HITACHI EH4000/3500AC-3 (or equivalent)	81	100	106	110	110	111	104	95	116
Dozer	CAT D11 (or equivalent)	94	95	106	110	108	107	105	99	115
Grader	CAT 16M (or equivalent)	80	97	100	104	106	105	98	96	111
Water Cart	HITACHI EH3500AC-3 (or equivalent)	89	102	107	109	103	105	102	92	113
Drill Rig	CAT MD6240 (or equivalent)	81	103	104	106	109	108	100	92	114
Service/Lube Truck	Bell 50D (or equivalent)	82	95	95	101	103	104	90	89	108
Conveyor Belt (SWL per metre)	-	48	57	65	73	77	74	64	51	80
Conveyor Drive	-	75	84	87	94	93	90	85	74	98
Transfer Tower or Station	-	76	87	94	98	100	96	89	78	104
CHPP	-	100	103	103	106	107	105	98	86	113
Rail Loader	-	70	82	89	98	101	99	95	88	105
Coal Train and Wagons on Loop	-	78	85	91	97	100	97	98	92	105
ROM crusher	-	80	86	93	98	102	98	91	79	105
Open Cut Sizer	-	74	84	89	96	101	100	96	89	105
UG Sizer	-	82	92	97	104	109	108	104	97	113
Rejects Bin	-	68	79	86	90	92	88	81	70	96
Skyline Stacker SWL per metre	-	72	71	71	74	74	70	60	50	80
Stacker Chute	-	79	90	93	99	98	98	91	83	104
Ventilation Fan 700kW	-	82	89	90	95	99	99	96	89	104

Name	Type	Octave Band Frequency (Hz) Noise Level dB(A)								Sum dB(A)
		63	125	250	500	1000	2000	4000	8000	
UG Compressors 250 kW	-	63	78	84	88	94	100	97	88	103
UG Compressors 160 kW	-	61	76	82	86	92	98	95	86	101
LHD	Sandvik LS195 (or equivalent)	87	103	108	107	103	108	102	96	114
UG Personnel Carriers (Driftrunner)	Driftrunner (or equivalent)	73	93	97	101	104	101	95	84	108

C.2 OPERATIONAL NOISE MODELLING SCENARIOS

Four operational scenarios were considered:

- Year 3 open cut operations.
- Year 5) open cut operations.
- Year 7 open cut and underground operations.
- Underground (Year 11+) underground only operations.

In all of the scenarios it is assumed that the coal processing infrastructure is operational. This includes:

- Coal Handling and Preparation Plant (CHPP).
- Rail Loader.
- Trains on the rail loop.
- Stockpile and skyline stockpile management.
- Conveyors associated with the CHPP, rail loader and stockpiling.

Table C- presents the activities and assumptions for modelling scenario.

Table C-2: Modelled Activities

Item	Type	Utilisation Rates	Number Modelled per Scenario			
			Year 3	Year 5	Year 9	UG Only
Excavator	Hitachi EX5600		1	2	2	0
Excavator	Hitachi EX2600		3	3	2	0
FEL[1]	CAT 993 FEL		3 (4)	3	2	1
Haul Truck (Waste)	Hitachi EH4000AC-3	0.75	5	10	9	0
Haul Truck (Coal)	Hitachi EH3500AC-3	0.75	5	5	5	0
Haul Truck (Waste/Coal)	Hitachi EH3500AC-4	0.75	9	9	6	6
Dozer	CAT D11T		7	9	8	1
Grader	CAT 16M		1	2	1	1
Water Cart	Hitachi EH3500AC-3		1	1	1	1
Drill Rig	CAT MD 6240		1	2	3	0
Service Truck	BELL B50D Lube Truck		1	1	1	1
Overland Conveyor	-		1	1	1	0
Conveyors	-		8	8	10	2
Conveyor Drives	-		5	5	6	5
Transfer station	-		4	4	4	4
CHPP	-		1	1	1	1
Rail Loadout	-		1	1	1	1
Trains	-		2	2	2	2
ROM Bin Crusher	-		1	1	1	0
OC ROM Sizer	-		1	1	1	0
UG ROM Sizer	-		0	0	1	1
Rejects bin	-		1	1	1	1
Skyline Stacker	-		1	1	1	1
Ventilation Fans	-		0	0	2	2
250kW Compressor	-		0	0	3	3
160kW Compressor	-		0	0	2	2
UG LHD	Sandvik LS195		0	0	3	3
UG Personnel Carrier	Driftrunner		0	0	5	5

Notes 1; 4 FEL during day time Year 3, 3 FEL during night time.

C.2.1 Source Locations

Source locations are presented for scenarios Years 2, 7, 9 and underground only in **Figure C.1** to **C.4**.

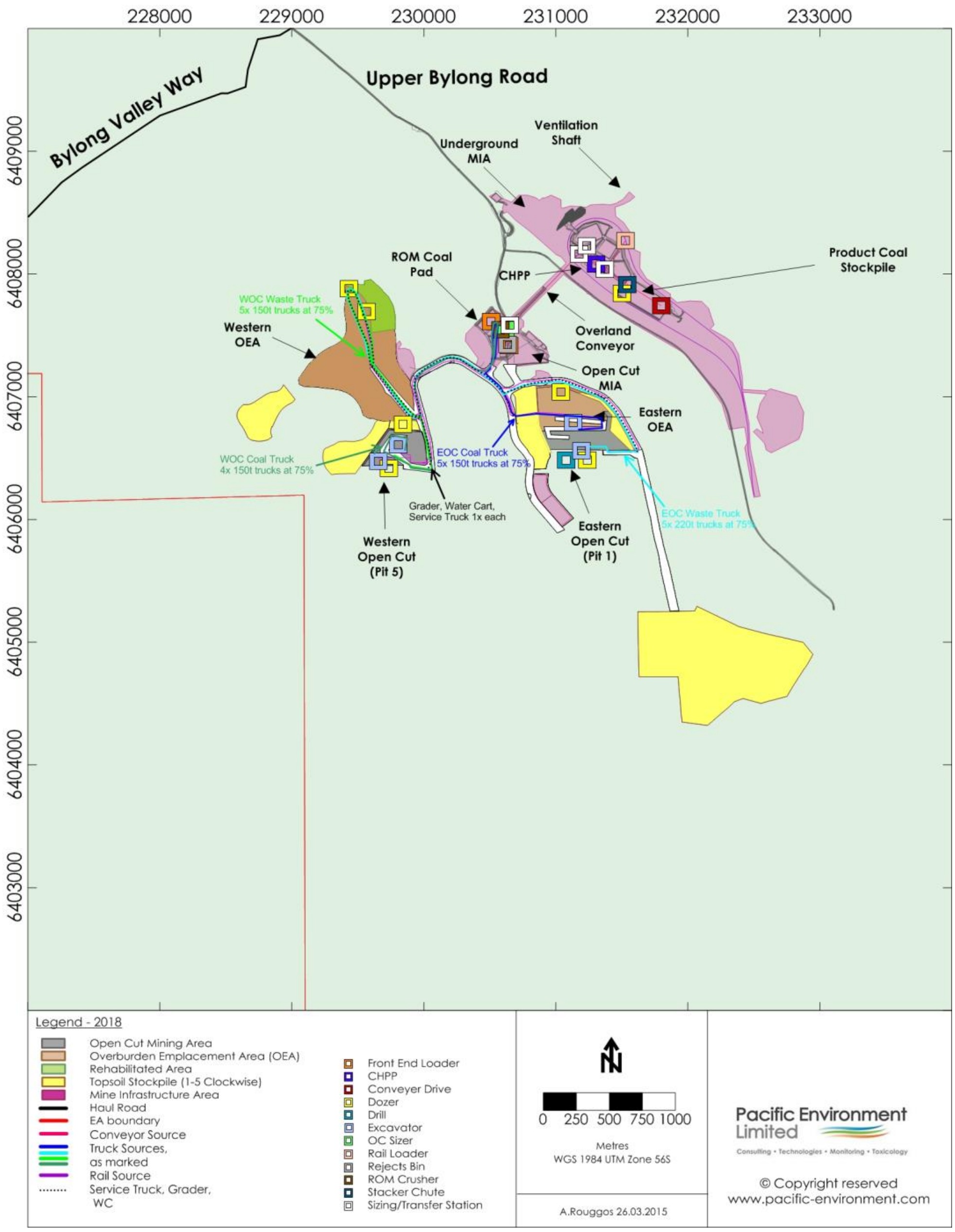

Figure C.1: Year 3 Source Locations

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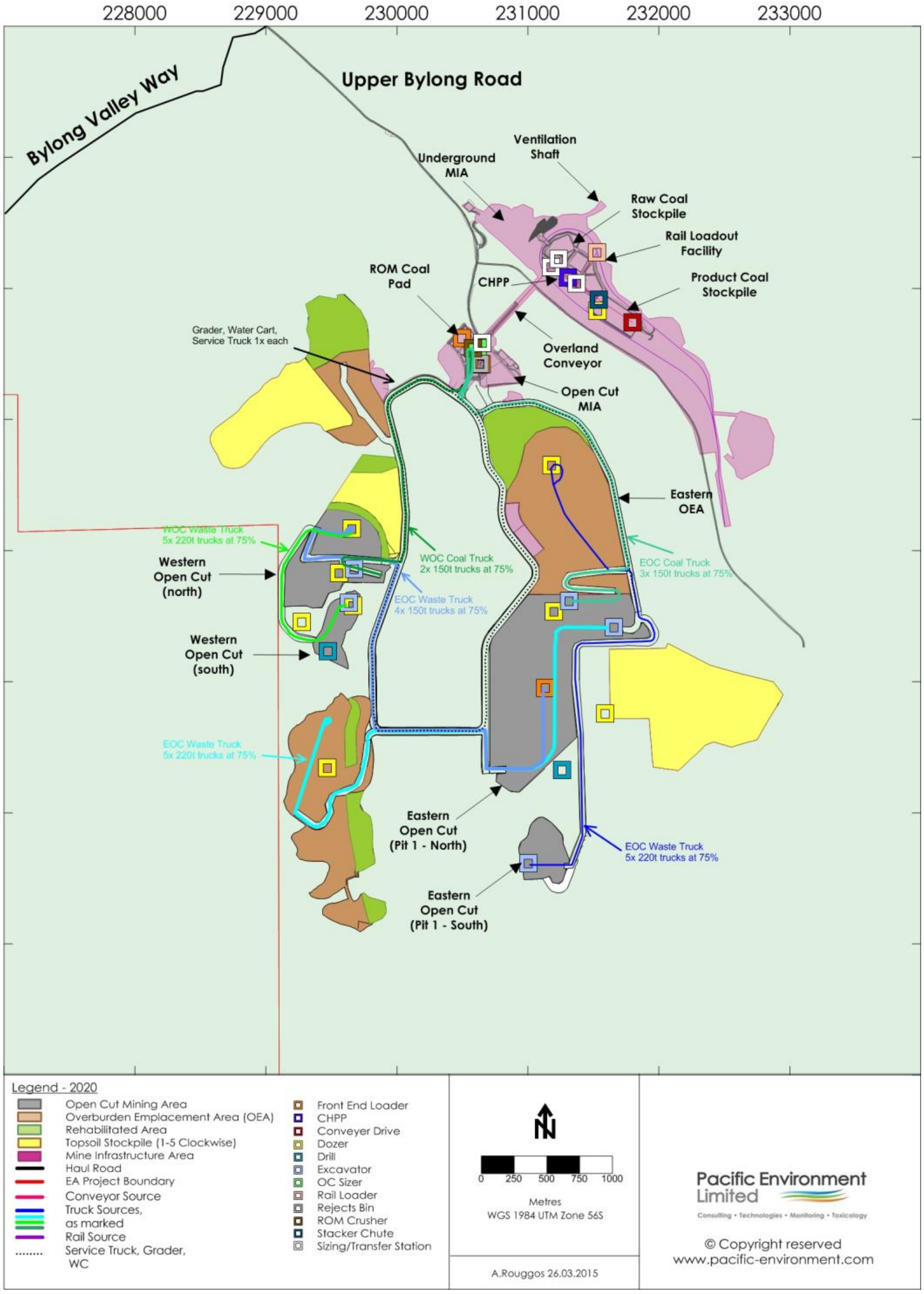

Figure C.2: Year 5 Source Locations

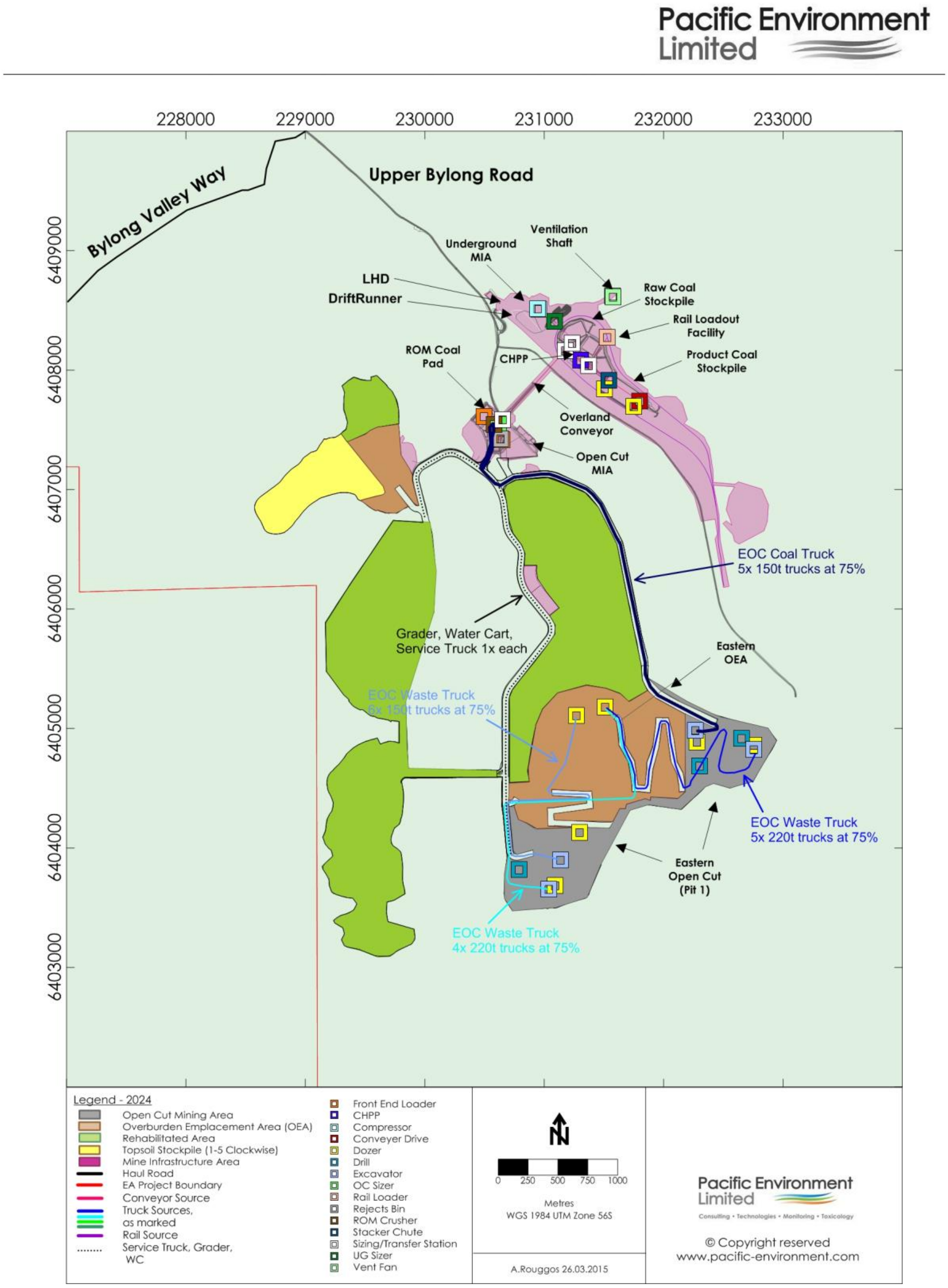

Figure C.3: Year 9 Source Locations

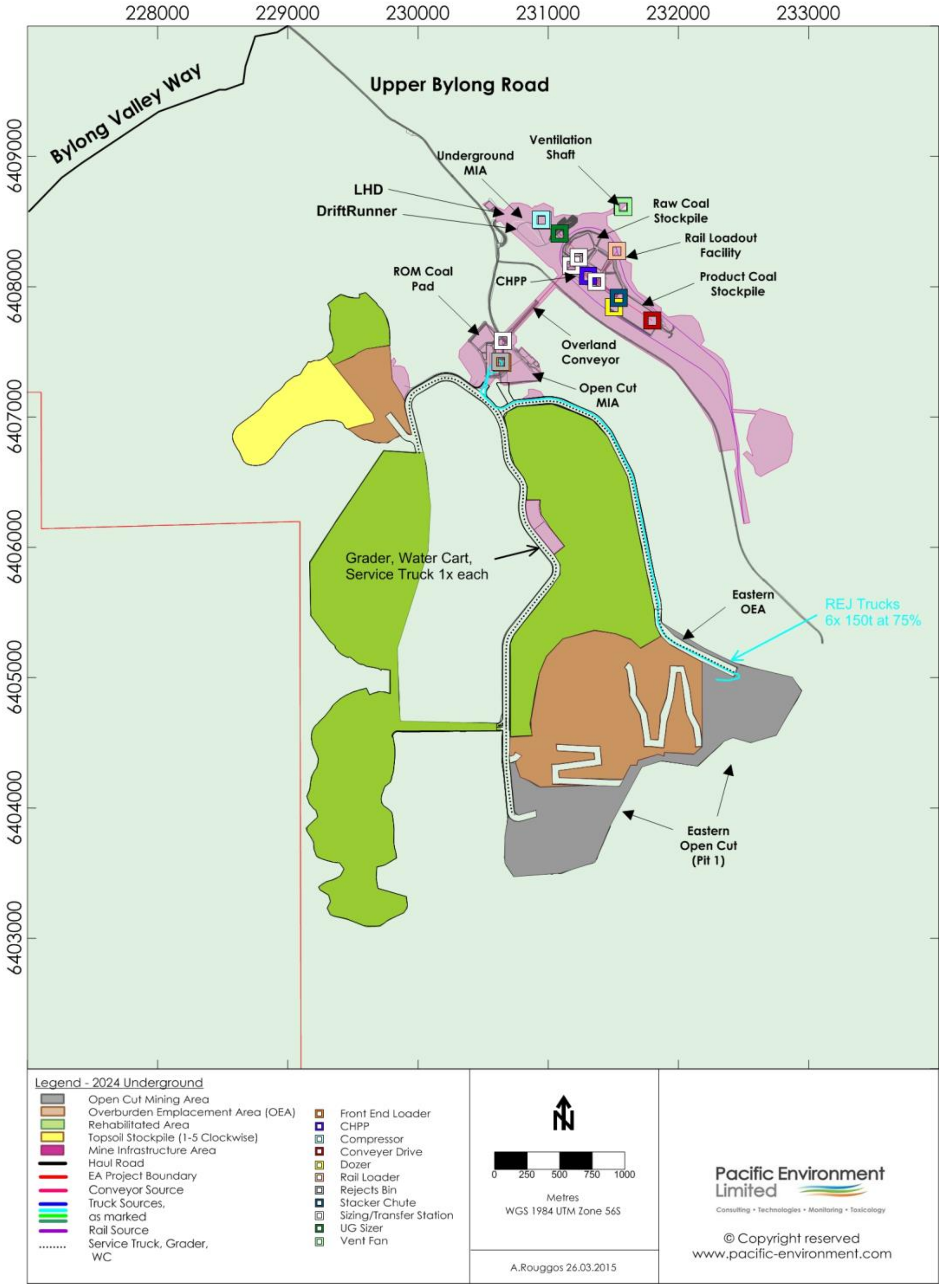

Figure C.4: Underground Only Source Locations

C.2.2 Mitigated Source Locations

Source locations are presented for scenario Year 3 under adverse daytime conditions and Year 3 under adverse evening and night conditions in **Figure C.5** and **C.6**. For all other scenarios, including Year 3 day and evening and night neutral conditions, the source locations are unchanged from the source locations shown in **Section C.2.1**.

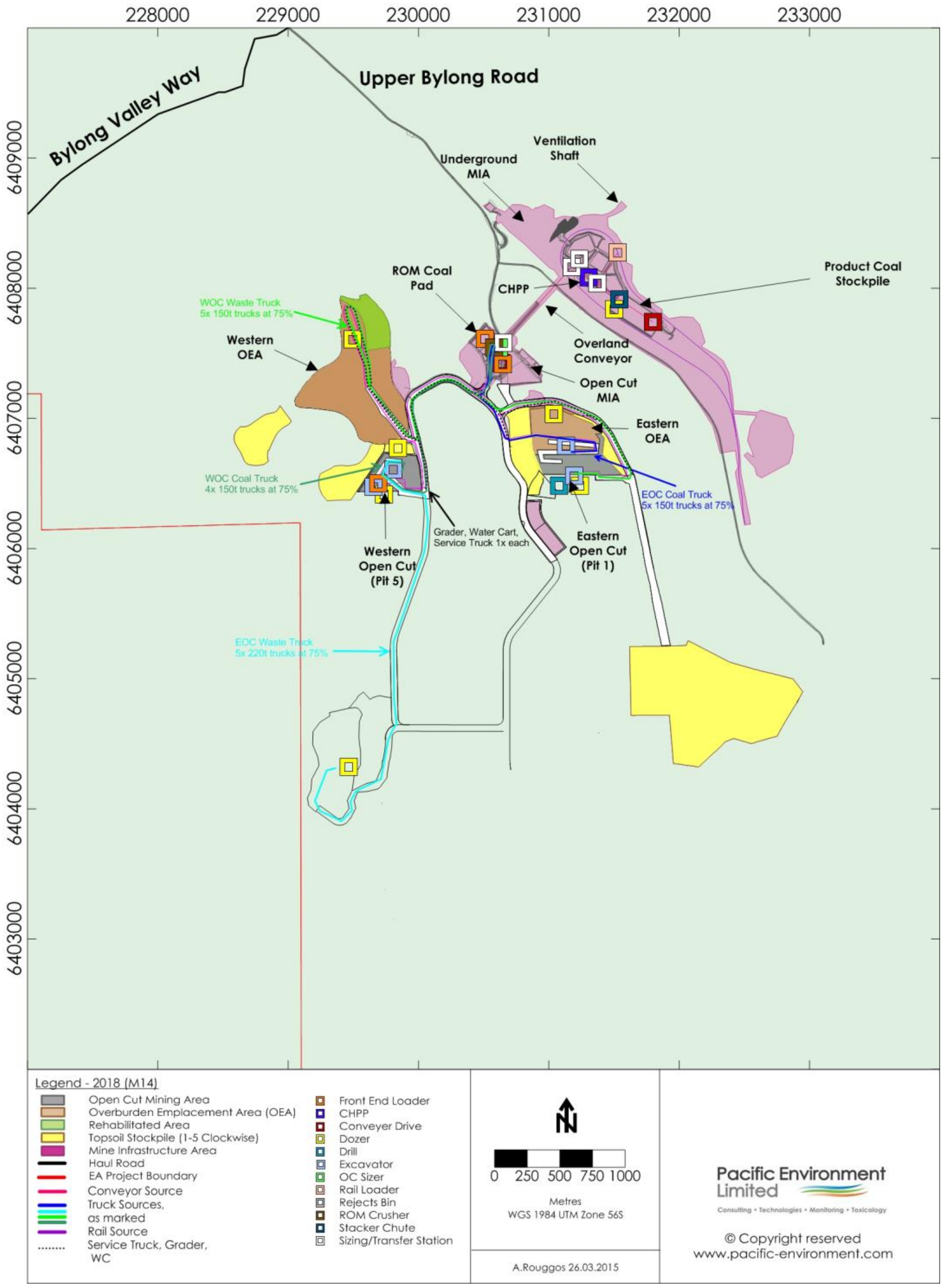

Figure C.5: Year 3 Mitigated Source Locations Under Daytime Adverse Conditions

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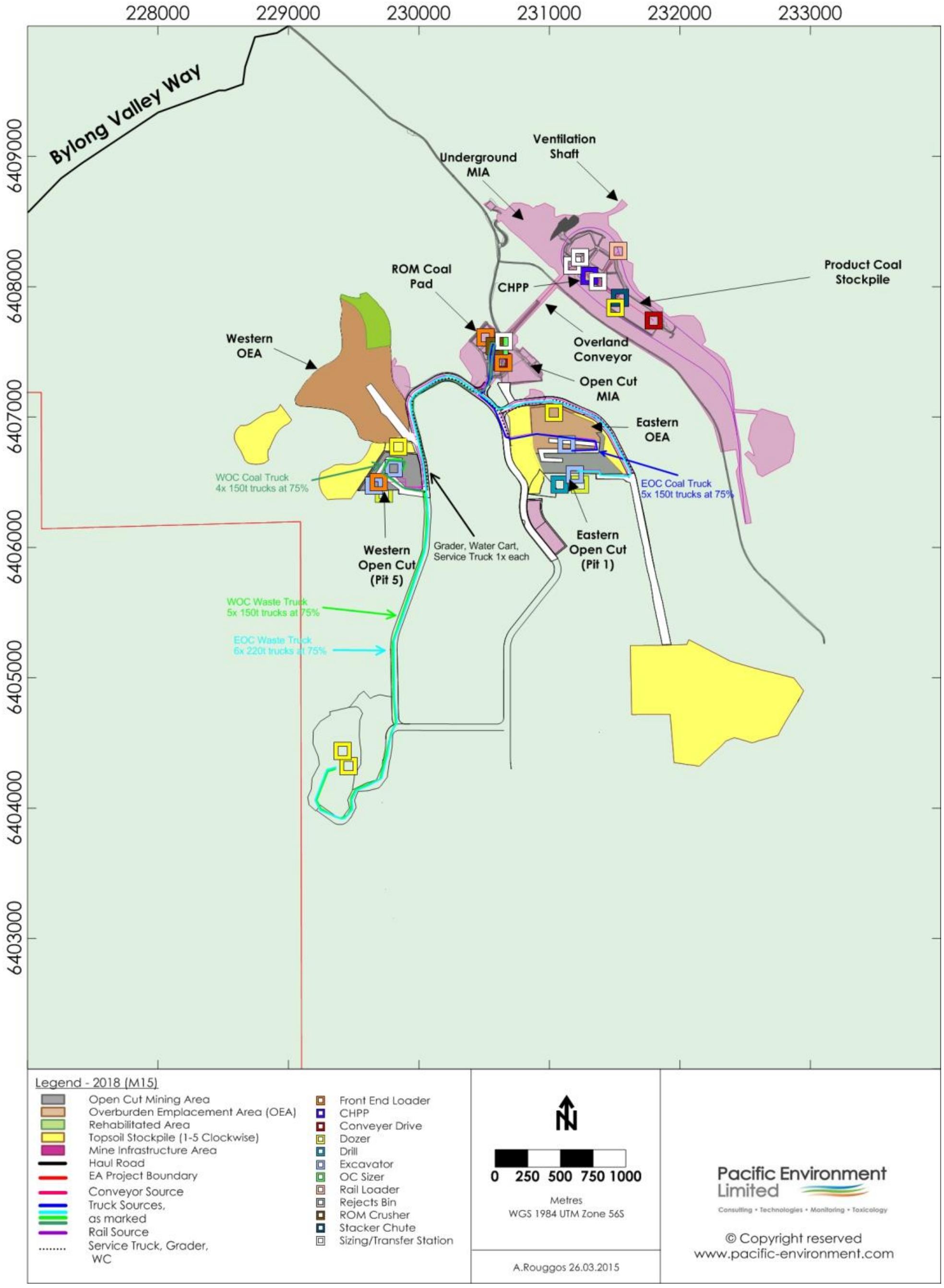

Figure C.6: Year 3 Mitigated Source Locations Under Eve/Night Time Adverse Conditions

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C.3 CONSTRUCTION MODELLING SCENARIOS

The following figures present source locations for each of the five construction scenarios assessed.

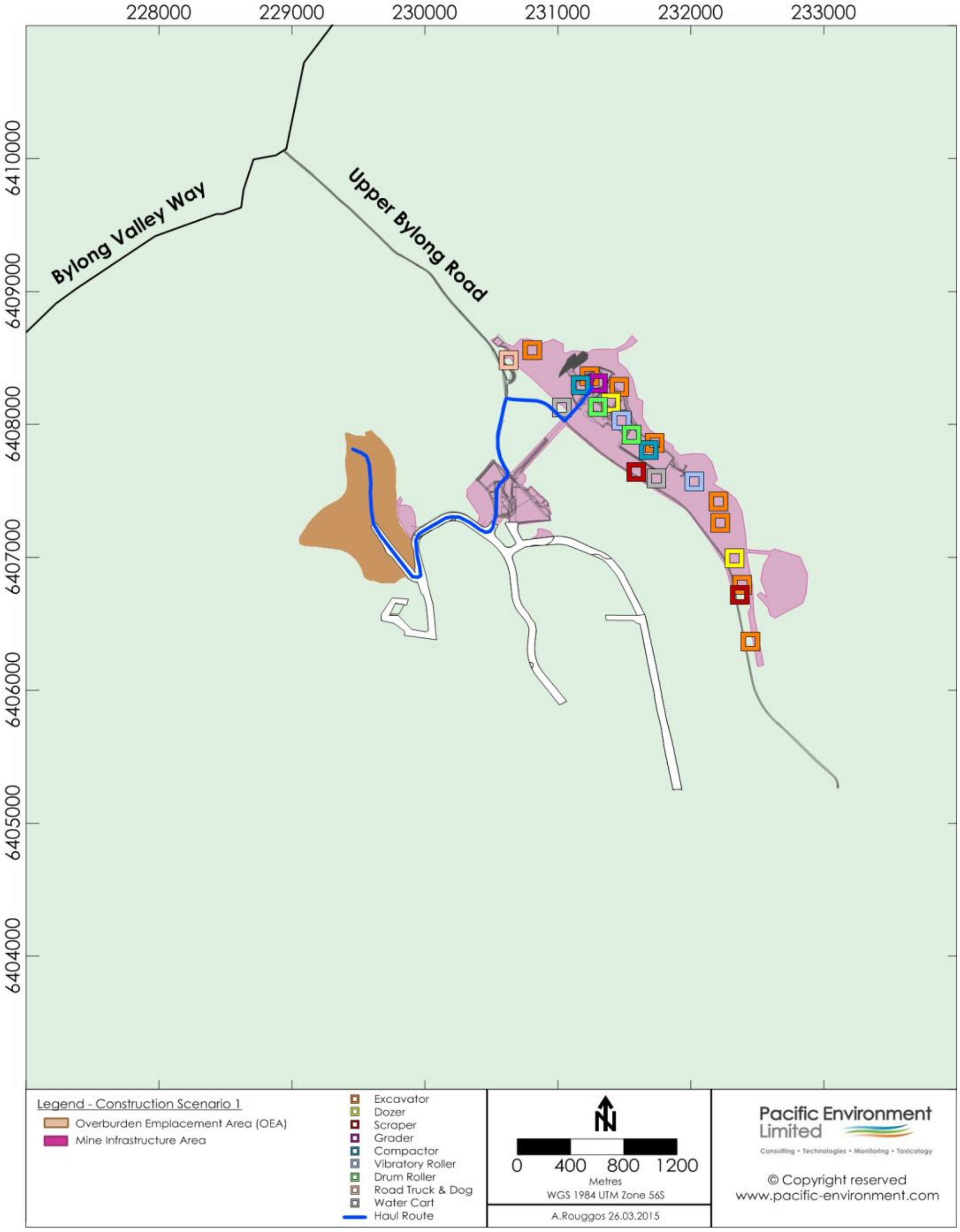

Figure C.7: Construction Scenario 1

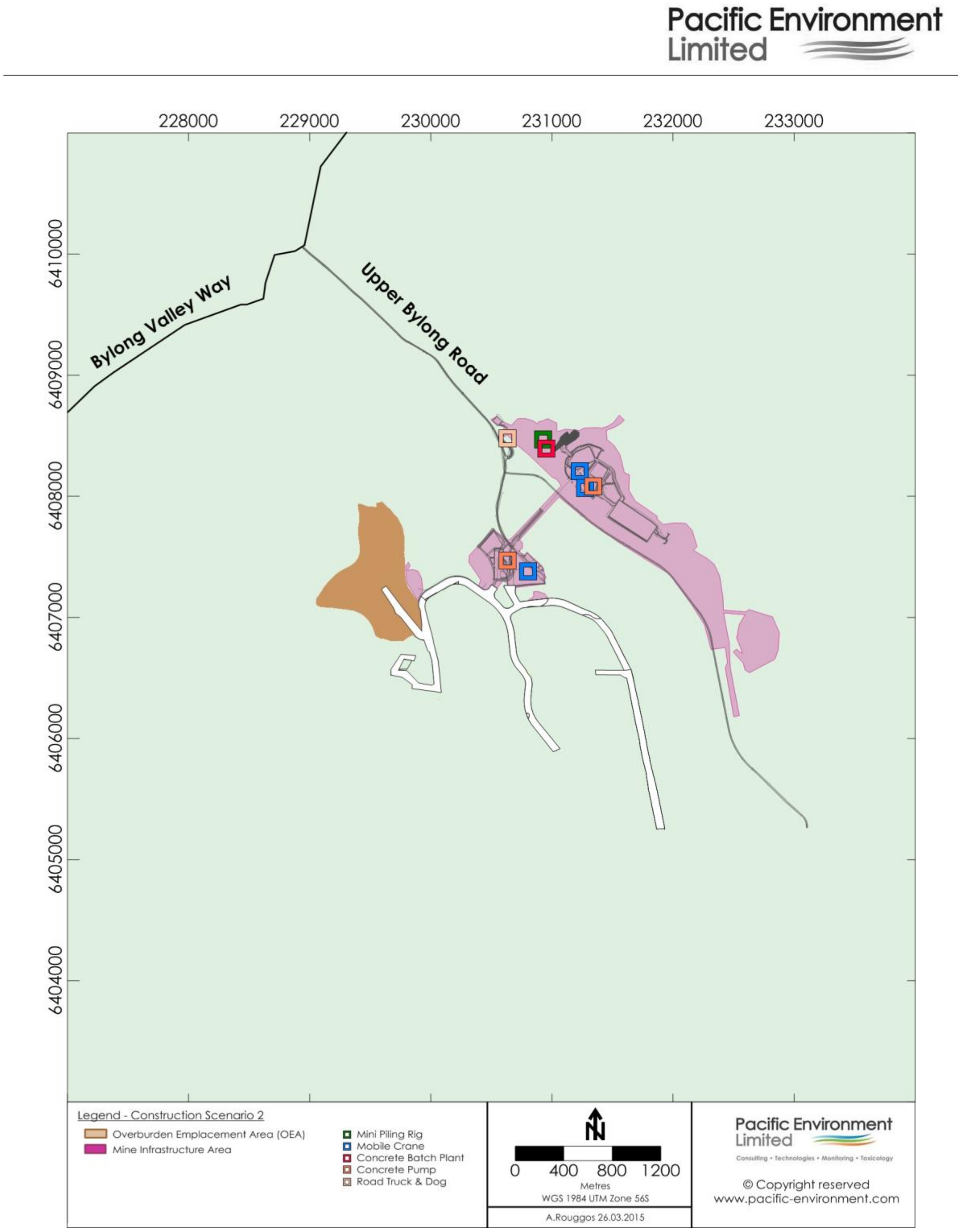

Figure C.8: Construction Scenario 2

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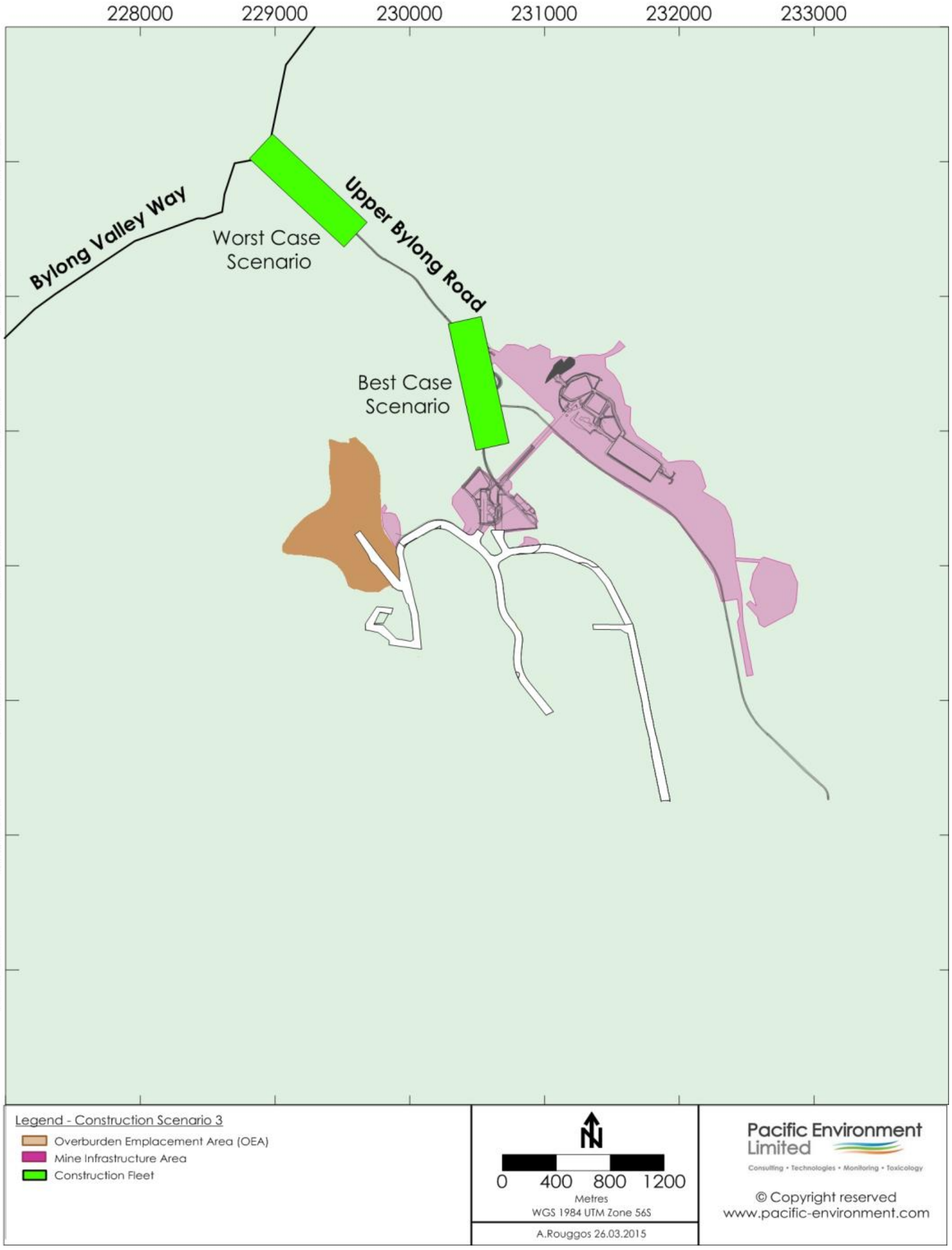

Figure C.9: Construction Scenario 3

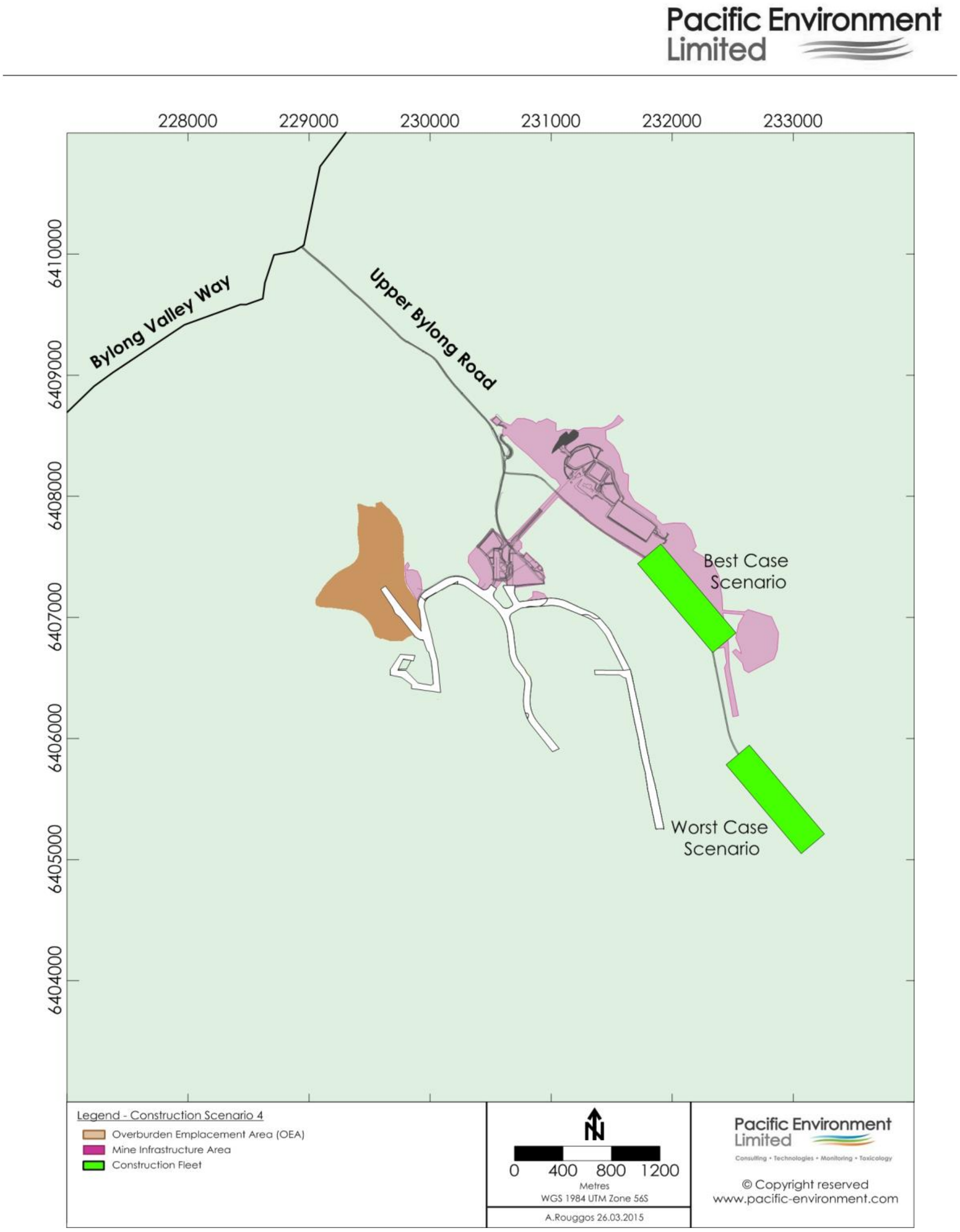

Figure C.10: Construction Scenario 4

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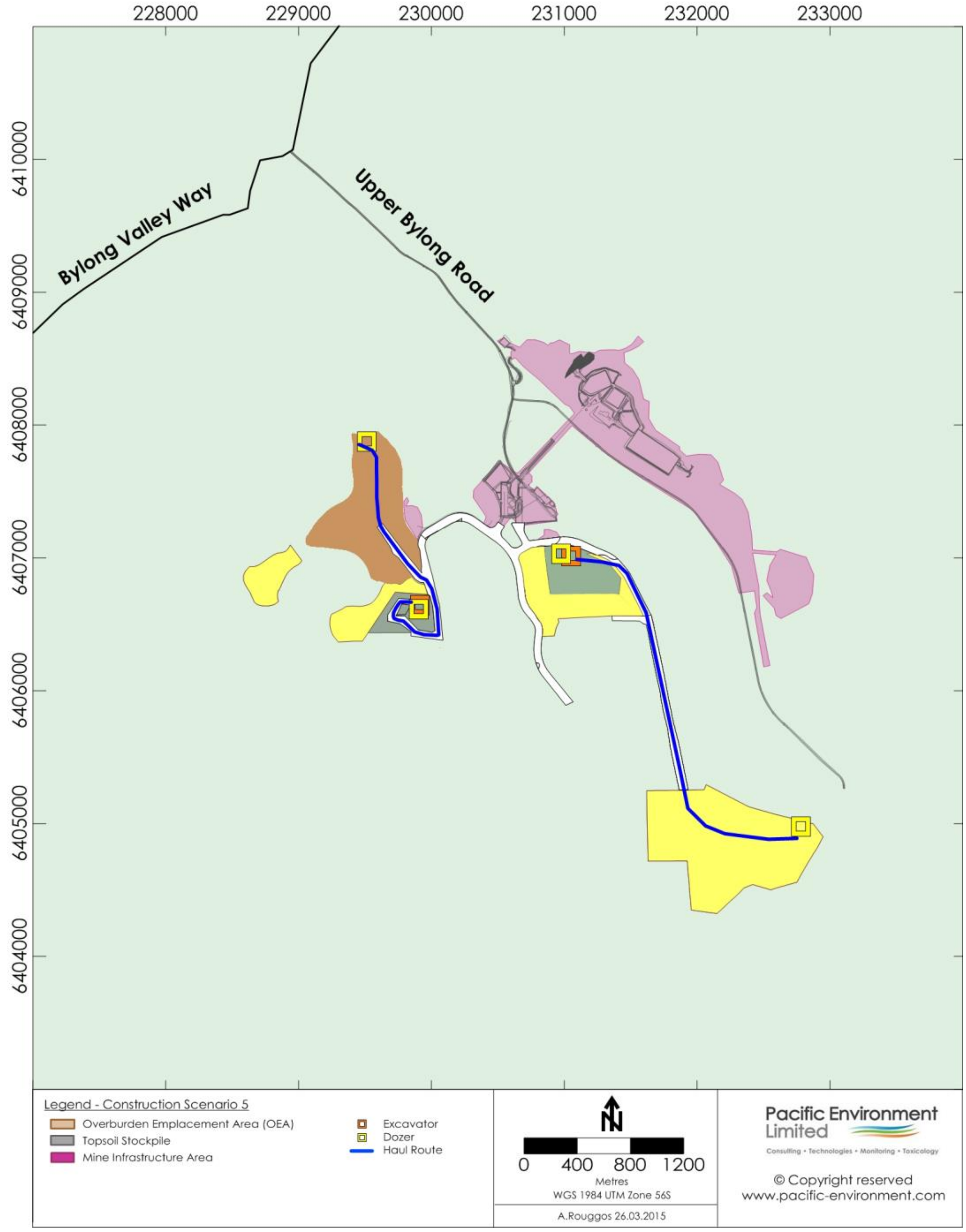

Figure C.11: Construction Scenario 5

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Appendix D NOISE MODELLING RESULTS

D.1 OPERATIONAL NOISE MODELLING RESULTS

Table D-1: Year 3 Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	15	21	21	<15	15	22	22	<15	22	19
5	15	21	21	<15	16	22	22	15	22	20
41A	16	23	23	16	17	24	24	17	24	21
41B	17	23	23	16	17	24	24	17	24	21
42	18	24	24	18	19	25	25	19	25	22
43	17	23	23	19	18	24	24	20	24	21
44	18	24	24	23	19	26	26	24	26	23
47	18	24	24	21	19	25	25	22	25	23
49	19	25	25	24	20	27	27	25	27	24
50	19	26	26	25	21	28	28	27	28	25
56	30	35	35	25	31	37	37	26	37	36
57A	28	34	34	23	29	35	35	24	35	34
57B	27	34	33	23	29	35	35	24	35	34
57C	27	34	34	23	29	35	35	24	35	34
58	31	37	37	26	33	38	38	27	38	37
60	35	40	40	32	37	41	41	33	41	40
61A	34	39	39	31	36	40	40	32	40	40
61B	34	39	39	31	36	40	40	32	40	40
65A	35	39	39	32	36	40	40	32	40	40
63	35	40	40	32	37	41	41	33	41	40
68	34	39	39	32	36	40	40	34	40	39
69	38	42	42	39	40	43	43	39	43	43

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
141	27	24	27	34	29	25	30	36	36	31
146	25	21	21	32	27	22	22	34	34	27
151	23	22	21	21	25	24	24	24	35	28
158	23	22	22	23	24	24	24	27	35	28
161	21	19	19	21	23	22	22	25	33	26
162	20	17	17	20	21	19	19	22	31	24
165	19	17	17	17	21	19	19	19	31	23
168	19	16	15	15	20	17	17	17	30	22
349	15	<15	<15	<15	16	<15	<15	<15	24	17
348	16	<15	<15	<15	17	<15	<15	<15	26	18
181A	25	32	26	21	27	34	29	22	34	32
181B	25	32	26	21	27	34	29	22	34	32
181C	25	32	26	21	27	34	29	22	34	32
181D	25	32	27	21	27	34	29	22	34	32
225	21	28	17	17	23	23	18	18	30	23
226	19	25	15	15	20	19	15	15	27	19
242	15	16	12	12	16	13	13	13	25	17
292	20	28	17	17	22	26	18	18	30	26
317	<15	<15	<15	<15	<15	<15	<15	<15	20	<15
17	21	27	27	27	22	29	29	29	29	26
Bylong Oval	35	39	39	32	36	40	40	32	40	40
Bylong Community Hall	35	39	39	31	36	40	40	32	40	40
Bylong Quarry	27	24	34	34	29	32	36	36	36	34

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-2: Year 5 Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	21	<15	<15	15	22	22	<15	22	19
5	15	21	<15	15	15	22	22	15	22	20
41A	16	23	16	16	17	24	24	17	24	21
41B	16	23	16	16	17	24	24	17	24	21
42	17	24	20	17	18	25	25	21	25	22
43	16	23	19	16	17	24	24	21	24	21
44	17	24	22	17	18	25	25	24	25	23
47	17	24	21	17	18	25	25	22	25	22
49	18	25	23	18	19	26	26	25	26	23
50	19	26	24	19	20	27	27	26	27	24
56	28	34	25	28	29	36	36	26	36	35
57A	27	33	23	27	28	36	35	24	36	34
57B	26	33	22	26	28	35	35	24	35	34
57C	26	33	22	26	28	36	35	24	36	34
58	29	36	26	29	31	38	38	27	38	37
60	32	38	31	32	33	40	40	33	40	39
61A	31	37	31	31	32	39	39	32	39	38
61B	31	37	31	31	32	39	39	32	39	38
65A	31	38	32	31	33	39	39	33	39	39
63	31	38	32	31	33	40	40	33	40	39
68	31	37	33	31	32	39	39	35	39	38
69	34	40	36	34	36	42	42	38	42	42

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
141	29	25	36	29	31	27	35	38	38	36
146	26	23	33	26	28	24	24	35	35	28
151	31	30	27	31	33	29	29	29	39	33
158	30	26	27	30	31	27	27	28	38	31
161	27	23	25	27	29	25	25	27	35	29
162	24	20	22	24	25	21	21	24	33	25
165	24	22	20	24	25	21	21	21	33	25
168	23	21	19	23	24	20	20	20	32	24
349	18	15	<15	18	19	15	15	15	27	19
348	19	16	15	19	20	16	16	16	28	20
181A	25	32	21	25	27	34	34	23	34	33
181B	25	32	21	25	27	34	34	23	34	33
181C	25	32	21	25	27	34	33	23	34	32
181D	25	32	21	25	27	34	34	23	34	33
225	24	31	20	24	25	31	21	21	32	31
226	21	28	17	21	23	26	18	18	30	27
242	19	23	15	19	20	17	15	15	27	20
292	24	31	20	24	25	30	21	21	33	30
317	<15	<15	<15	<15	<15	<15	<15	<15	21	<15
17	20	27	27	20	21	28	28	28	28	26
Bylong Oval	31	37	31	31	33	39	39	33	39	38
Bylong Community Hall	31	37	31	31	32	39	39	33	39	38
Bylong Quarry	26	24	33	26	28	32	35	35	35	34

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-3: Year 9 Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	20	20	<15	<15	21	21	<15	21	18
5	<15	20	20	<15	<15	21	21	<15	21	19
41A	15	22	22	15	16	23	23	16	23	20
41B	15	22	22	15	16	23	23	16	23	20
42	16	23	23	16	17	24	24	17	24	21
43	15	22	22	15	16	23	23	16	23	20
44	16	23	23	20	17	25	25	22	25	22
47	16	23	23	18	17	24	24	18	24	21
49	17	24	24	21	18	25	25	23	25	23
50	18	25	25	22	19	26	26	24	26	24
56	26	32	32	23	27	34	34	23	34	33
57A	24	30	30	20	25	32	32	21	32	30
57B	24	30	30	20	25	32	32	21	32	30
57C	23	30	30	19	25	32	32	21	32	30
58	26	33	32	22	28	35	34	24	35	33
60	31	36	36	27	32	38	38	29	38	38
61A	30	36	36	27	31	38	38	28	38	37
61B	30	36	36	27	31	38	38	28	38	37
65A	30	36	36	27	32	38	38	28	38	37
63	30	36	36	27	32	38	38	29	38	37
68	30	36	36	27	31	38	38	29	38	37
69	33	39	39	32	35	41	41	33	41	41

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
141	31	27	37	38	33	29	39	40	40	39
146	27	23	23	33	28	24	24	34	35	28
151	30	32	26	26	32	28	28	28	39	32
158	29	26	25	25	30	26	26	26	37	30
161	24	21	21	21	26	22	22	22	33	26
162	22	18	18	18	23	19	19	19	30	23
165	22	20	18	18	24	19	19	19	31	24
168	22	22	18	18	24	19	19	19	31	24
349	18	16	<15	<15	19	15	15	15	26	19
348	19	17	15	15	20	16	16	16	28	20
181A	22	29	27	18	23	31	29	19	31	29
181B	22	29	27	18	23	31	29	19	31	29
181C	22	29	27	18	23	31	29	19	31	29
181D	22	29	27	18	24	31	29	19	31	29
225	23	30	19	19	25	32	21	21	32	32
226	21	28	17	17	22	29	18	18	30	29
242	18	24	<15	<15	19	18	15	15	27	19
292	21	28	17	17	23	30	19	19	30	30
317	<15	<15	<15	<15	<15	<15	<15	<15	21	<15
17	19	26	26	25	20	27	27	27	27	25
Bylong Oval	30	36	36	27	32	38	38	28	38	37
Bylong Community Hall	30	36	36	27	31	38	38	28	38	37
Bylong Quarry	26	26	33	33	27	32	34	34	34	33

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-4: Underground Only Noise Modelling Results

Period	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	17	17	<15	<15	18	18	<15	18	15
5	<15	17	17	<15	<15	18	18	<15	18	15
41A	<15	19	19	<15	<15	20	20	<15	20	17
41B	<15	19	19	<15	<15	20	20	<15	20	17
42	<15	20	20	<15	<15	21	21	<15	21	18
43	<15	19	19	<15	<15	20	20	<15	20	17
44	<15	20	20	17	<15	22	22	<15	22	19
47	<15	20	20	14	<15	21	21	<15	21	18
49	<15	21	21	18	15	23	23	15	23	20
50	15	22	22	19	16	24	24	16	24	21
56	25	30	30	21	26	31	31	26	31	30
57A	21	27	26	17	22	29	28	22	29	28
57B	21	27	26	17	22	29	27	22	29	27
57C	20	27	26	16	22	29	27	22	29	27
58	23	30	29	19	25	32	30	25	32	31
60	29	34	34	26	30	36	36	30	36	36
61A	28	34	34	25	30	35	35	30	35	35
61B	28	34	34	25	30	35	35	30	35	35
65A	28	34	34	25	30	36	36	30	36	35
63	29	34	34	25	30	36	36	30	36	36
68	28	34	34	25	29	35	35	29	35	35
69	32	37	37	30	33	39	39	33	39	39

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
141	24	21	26	31	26	22	27	26	33	29
146	23	19	19	29	24	20	20	24	31	24
151	19	19	15	15	21	16	16	21	28	21
158	18	16	15	15	20	16	16	20	27	20
161	17	<15	<15	<15	18	<15	<15	18	26	18
162	16	<15	<15	<15	17	<15	<15	17	25	17
165	15	<15	<15	<15	16	<15	<15	16	24	16
168	<15	<15	<15	<15	15	<15	<15	15	23	15
349	<15	<15	<15	<15	<15	<15	<15	<15	19	<15
348	<15	<15	<15	<15	<15	<15	<15	<15	20	<15
181A	18	25	20	<15	19	27	21	19	27	25
181B	18	25	19	<15	19	27	21	19	27	25
181C	18	25	19	<15	19	27	21	19	27	25
181D	18	25	19	<15	20	27	21	20	27	25
225	16	23	<15	<15	17	19	<15	17	25	19
226	<15	21	<15	<15	15	16	<15	15	22	16
242	<15	<15	<15	<15	<15	<15	<15	<15	19	<15
292	15	22	11	11	16	20	12	16	23	20
317	<15	<15	<15	<15	<15	<15	<15	<15	16	<15
17	16	23	23	23	17	25	25	17	25	22
Bylong Oval	29	34	34	25	30	36	36	30	36	35
Bylong Community Hall	28	34	34	25	29	35	35	29	35	35
Bylong Quarry	24	21	31	31	25	28	32	25	32	31

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

D.2 C-WEIGHTED NOISE MODELLING RESULTS

Table D-5: Year 3 C-Weighted Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	36	39	39	34	36	35	39	34	39	40
5	37	40	40	35	37	35	39	35	39	40
41A	38	41	41	37	38	36	40	36	40	41
41B	38	41	41	37	38	36	40	37	40	41
42	38	41	41	38	38	37	41	38	41	41
43	38	41	41	38	38	36	40	38	40	41
44	39	41	41	40	39	37	41	40	41	42
47	39	41	41	39	39	37	41	39	41	42
49	39	42	42	41	39	38	42	41	42	42
50	40	43	43	42	40	39	43	42	43	43
56	51	52	52	46	51	49	52	45	52	52
57A	47	48	48	42	47	45	48	41	48	48
57B	46	48	47	41	47	45	47	41	48	48
57C	44	47	47	40	45	43	47	40	47	47
58	47	49	49	43	47	45	49	42	49	49
60	53	54	54	49	53	51	54	49	54	54
61A	53	54	54	49	53	51	54	48	54	54
61B	53	54	54	49	53	51	54	48	54	54
65A	54	53	53	48	54	50	53	48	53	53
63	55	54	54	49	55	51	54	49	54	54

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
68	53	52	52	48	53	49	52	47	52	52
69	56	55	55	51	56	51	54	51	54	55
141	45	42	45	49	45	46	47	50	50	48
146	43	39	39	46	43	43	39	46	46	43
151	42	40	39	39	42	43	40	40	47	43
158	42	42	42	44	42	47	44	46	50	47
161	41	40	40	43	41	46	42	45	49	46
162	40	36	36	38	40	40	37	39	44	40
165	40	36	36	36	40	40	37	37	44	40
168	39	35	35	35	39	39	36	36	43	39
349	36	32	32	32	36	36	32	32	40	36
348	37	33	33	33	37	37	33	33	41	37
181A	43	46	43	39	43	42	43	39	46	46
181B	43	46	43	39	43	42	43	39	46	46
181C	43	46	42	39	43	42	43	39	46	46
181D	43	46	43	39	43	42	43	39	46	46
225	41	43	36	36	41	40	36	36	44	40
226	39	42	35	35	39	38	34	34	42	38
242	37	36	32	32	37	37	33	33	41	37
292	40	43	36	36	40	40	36	36	44	41
317	34	33	29	29	34	33	29	29	37	33
17	42	43	43	43	42	39	43	43	43	43
Bylong Oval	54	54	54	49	54	51	54	49	54	54
Bylong Community Hall	55	54	54	49	55	52	54	49	54	55

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
Bylong Quarry	46	42	48	48	46	44	48	48	48	48

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-7: Year 5 C-Weighted Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	35	39	35	35	35	35	39	35	39	41
5	36	40	35	36	36	36	40	35	40	41
41A	37	41	37	37	37	37	41	37	41	42
41B	37	41	37	37	37	37	41	37	41	42
42	37	41	39	37	37	37	41	39	41	42
43	37	41	39	37	37	37	41	39	41	42
44	38	42	40	38	38	38	42	40	42	42
47	38	41	40	38	38	38	42	40	42	42
49	38	42	41	38	38	38	42	41	42	43
50	39	43	42	39	39	39	43	42	43	43
56	49	52	46	49	49	49	52	46	52	52
57A	45	49	42	45	45	45	48	42	49	49
57B	45	49	42	45	45	45	48	42	49	49
57C	44	48	41	44	44	44	47	41	48	48
58	46	49	43	46	46	46	49	43	50	49
60	51	54	49	51	51	51	54	49	54	54
61A	50	53	48	50	50	50	53	48	53	53

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
61B	50	53	48	50	50	50	53	48	53	53
65A	51	54	49	51	51	51	54	49	54	54
63	50	53	49	50	50	50	53	49	53	53
68	50	52	49	50	50	50	53	49	53	53
69	53	55	52	53	53	53	55	52	55	56
141	47	44	50	47	47	47	49	50	50	49
146	43	40	47	43	43	43	40	47	47	43
151	51	51	48	51	51	51	48	48	54	51
158	48	45	46	48	48	48	45	46	51	48
161	48	45	47	48	48	48	45	47	51	48
162	42	38	40	42	42	42	38	40	46	42
165	42	40	39	42	42	42	39	39	46	42
168	42	40	38	42	42	42	38	38	45	42
349	38	35	35	38	38	38	34	34	42	38
348	39	36	35	39	39	39	35	35	43	39
181A	43	47	40	43	43	43	46	40	47	47
181B	43	47	40	43	43	43	46	40	47	47
181C	43	47	40	43	43	43	46	40	47	47
181D	43	47	40	43	43	43	46	40	47	47
225	42	46	39	42	42	42	39	39	46	44
226	40	44	37	40	40	40	37	37	44	42
242	39	41	35	39	39	39	35	35	43	39
292	42	46	39	42	42	42	39	39	46	44
317	34	34	30	34	34	34	30	30	38	34
17	40	43	43	40	40	40	44	44	44	44

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
Bylong Oval	50	53	48	50	50	50	53	48	53	53
Bylong Community Hall	51	53	49	51	51	51	53	49	53	54
Bylong Quarry	44	42	48	44	44	44	48	48	48	48

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-8: Year 9 C-Weighted Noise Modelling Results

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	35	39	39	34	35	35	39	34	39	40
5	35	39	39	34	35	35	39	34	39	40
41A	36	40	40	36	36	36	40	36	40	41
41B	36	40	40	36	36	36	40	36	40	41
42	37	40	40	37	37	37	40	37	40	41
43	36	40	40	36	36	36	40	36	40	41
44	37	41	41	39	37	37	41	39	41	42
47	37	41	41	38	37	37	41	38	41	41
49	38	42	42	40	38	38	42	40	42	42
50	38	42	42	40	38	38	42	40	42	43
56	48	51	51	45	48	48	51	45	51	52
57A	44	47	46	40	44	44	46	40	47	47
57B	44	47	46	40	44	44	46	40	47	47
57C	42	46	45	38	42	42	45	38	46	46

	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
58	44	47	46	40	44	44	47	40	47	47
60	51	53	53	48	51	51	54	48	54	54
61A	51	53	53	48	51	51	53	48	53	53
61B	51	53	53	48	51	51	53	48	53	53
65A	50	53	53	48	50	50	53	48	53	53
63	50	53	53	47	50	50	53	47	53	53
68	49	52	52	47	49	49	52	47	52	52
69	51	54	54	50	51	51	54	50	54	54
141	48	45	51	52	49	49	51	52	52	51
146	43	40	40	46	43	43	40	46	47	43
151	47	48	44	44	47	47	44	44	51	47
158	45	43	42	42	45	45	42	42	49	45
161	41	39	38	38	41	41	38	38	45	41
162	39	36	36	36	39	39	36	36	43	39
165	39	38	36	36	39	39	36	36	44	39
168	41	40	37	37	41	41	37	37	45	41
349	38	36	34	34	38	38	34	34	42	38
348	39	37	35	35	39	39	35	35	43	39
181A	41	45	43	37	41	41	44	37	45	45
181B	41	45	44	37	41	41	44	37	45	45
181C	41	45	43	37	41	41	43	37	45	45
181D	41	45	43	38	41	41	44	38	45	45
225	42	45	38	38	42	42	38	38	45	45
226	40	44	37	37	40	40	37	37	44	43
242	38	42	35	35	38	38	35	35	42	38

Predicted Noise Level $L_{Aeq,15min}$ dB(C)										
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
292	40	44	37	37	40	40	37	37	44	44
317	33	33	29	29	33	33	29	29	37	33
17	39	43	43	42	39	39	43	42	43	43
Bylong Oval	51	53	53	48	51	51	53	48	53	54
Bylong Community Hall	50	53	53	48	50	50	53	48	53	53
Bylong Quarry	44	43	47	47	44	44	48	48	48	47

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-9: Underground Only C-Weighted Noise Modelling Results

Predicted Noise Level $L_{Aeq,15min}$ dB(C)										
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	31	35	35	31	31	31	35	31	35	36
5	32	35	35	29	31	31	35	31	35	36
41A	33	36	36	33	33	33	37	33	37	37
41B	33	37	37	33	33	33	37	33	37	37
42	33	37	37	33	33	33	37	33	37	37
43	32	36	36	32	32	32	36	32	36	37
44	34	38	38	35	34	34	38	34	38	38
47	33	37	37	34	33	33	37	33	37	37
49	35	38	38	36	35	35	38	35	38	39
50	35	39	39	37	35	35	39	35	39	39
56	48	50	50	44	48	48	50	48	50	51

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
57A	42	45	43	39	42	42	43	42	45	45
57B	42	45	43	39	42	42	43	42	45	45
57C	38	42	40	35	38	38	41	38	42	42
58	40	44	42	37	40	40	43	40	44	44
60	50	52	52	47	50	50	52	50	52	53
61A	50	52	52	47	50	50	52	50	52	52
61B	50	52	52	47	50	50	52	50	52	52
65A	49	51	51	46	49	49	51	49	51	52
63	49	52	52	46	49	49	52	49	52	52
68	47	50	50	44	47	47	50	47	50	50
69	50	52	52	47	50	50	52	50	52	53
141	41	38	40	45	41	41	40	41	45	42
146	39	36	36	42	39	39	36	39	43	39
151	37	35	33	33	37	37	33	37	41	37
158	36	33	33	33	36	36	33	36	40	36
161	35	32	32	32	35	35	32	35	39	35
162	35	31	31	31	35	35	31	35	39	35
165	34	31	31	31	34	34	31	34	38	34
168	33	31	30	30	33	33	30	33	38	33
349	31	28	27	27	31	31	27	31	35	31
348	32	28	28	28	32	32	28	32	36	32
181A	37	40	37	33	37	37	37	37	41	40
181B	37	40	37	33	37	37	37	37	41	40
181C	37	40	36	33	37	37	36	37	41	40
181D	37	41	36	33	37	37	36	37	41	40

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level $L_{Aeq,15min}$ dB(C)									
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
225	35	39	31	31	35	35	31	35	39	36
226	34	38	30	30	34	34	30	34	38	34
242	31	32	28	28	31	31	27	31	36	31
292	34	38	31	31	34	34	31	34	38	36
317	30	30	26	26	29	29	26	29	34	29
17	36	40	40	40	36	36	40	36	40	40
Bylong Oval	50	52	52	47	50	50	52	50	52	53
Bylong Community Hall	49	51	51	46	49	49	51	49	51	51
Bylong Quarry	42	39	45	45	42	42	45	42	45	45

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

D.3 SLEEP DISTURBANCE MODELLING RESULTS

Table D-10: Year 3 Predicted Sleep Disturbance Modelling Results

Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
	Predicted Noise Level L_{Amax} dB(A)					
Condition ID	5	6	7	8	9	10
Receiver ID						
4	17	24	24	24	24	21
5	17	24	24	24	25	22
41A	19	26	26	26	26	23
41B	19	26	26	26	26	23
42	20	27	27	27	27	25

Period Condition ID Receiver ID	Predicted Noise Level L_{Amax} dB(A) Eve/Night 5	Eve/Night 6	Eve/Night 7	Eve/Night 8	Eve/Night 9	Eve/Night 10
43	19	26	26	25	26	24
44	21	27	27	25	28	25
47	20	27	27	26	28	25
49	22	28	28	26	29	26
50	23	29	29	27	30	27
56	32	39	39	33	39	38
57A	29	38	38	31	37	35
57B	29	38	38	31	36	35
57C	29	38	38	31	37	35
58	32	41	41	35	39	38
60	38	43	43	42	44	43
61A	37	43	43	41	43	42
61B	37	42	42	41	43	42
65A	36	43	43	41	42	42
63	38	43	43	42	43	43
68	36	42	42	41	42	42
69	40	45	45	45	46	46
141	32	26	31	36	39	33
146	30	24	24	34	37	30
151	29	25	25	29	37	29
158	29	25	25	33	36	29
161	27	23	23	31	34	27
162	25	21	21	32	33	25
165	25	20	20	25	32	25
168	23	19	19	23	31	23

Predicted Noise Level L_{Amax} dB(A)						
Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
349	19	14	14	18	26	19
348	20	15	15	20	27	20
181A	27	36	31	29	35	33
181B	27	36	31	29	35	33
181C	27	36	31	29	35	33
181D	28	36	31	29	35	33
225	25	26	21	25	32	25
226	22	21	19	23	29	22
242	19	15	15	19	27	19
292	24	27	20	25	31	29
317	16	<15	<15	<15	23	16
17	24	31	31	28	31	29

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-11: Year 5 Predicted Sleep Disturbance Modelling Results

Predicted Noise Level L_{Amax} dB(A)						
Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
4	17	25	25	18	24	21
5	17	26	26	18	24	22
41A	18	27	27	20	26	23
41B	18	27	27	20	26	23
42	20	28	28	26	27	25
43	18	27	27	25	26	23
44	20	29	29	27	27	25

Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID	Predicted Noise Level L_{Amax} dB(A)					
47	20	29	29	26	27	25
49	20	30	30	28	28	25
50	21	31	31	30	29	27
56	32	40	40	29	38	37
57A	31	39	39	28	38	37
57B	31	39	39	28	38	36
57C	31	39	39	28	38	37
58	34	42	42	31	41	40
60	36	44	44	37	42	42
61A	34	43	43	36	41	41
61B	34	43	43	36	41	41
65A	35	43	43	37	41	41
63	35	43	43	37	41	41
68	34	42	42	39	41	41
69	37	45	45	42	44	44
141	34	29	37	40	40	39
146	30	27	27	38	37	30
151	34	30	30	30	40	34
158	33	29	29	30	40	33
161	30	27	27	29	37	30
162	27	24	24	27	34	27
165	27	24	24	24	34	27
168	26	23	23	23	34	26
349	21	18	18	18	29	21
348	22	19	19	19	30	22

Period	Predicted Noise Level L_{Amax} dB(A) Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
181A	29	38	37	26	37	35
181B	29	38	37	26	37	35
181C	29	38	37	26	36	35
181D	30	38	37	27	37	35
225	27	33	24	24	34	33
226	25	29	22	22	32	30
242	21	20	18	18	29	22
292	27	32	24	24	34	32
317	<15	<15	<15	<15	22	15
17	22	32	32	31	30	28

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-12: Year 9 Predicted Sleep Disturbance Modelling Results

Period	Predicted Noise Level L_{Amax} dB(A) Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
4	16	24	24	15	24	21
5	17	24	24	15	24	21
41A	18	25	25	18	25	23
41B	18	26	26	18	26	23
42	19	27	27	19	27	24
43	18	26	26	18	26	23
44	20	27	27	23	27	25

Period Condition ID Receiver ID	Predicted Noise Level L_{Amax} dB(A) Eve/Night 5	Eve/Night 6	Eve/Night 7	Eve/Night 8	Eve/Night 9	Eve/Night 10
47	20	27	27	21	27	24
49	21	28	28	24	28	26
50	22	29	29	25	29	27
56	31	37	37	27	37	36
57A	27	34	32	23	34	33
57B	27	34	32	23	34	32
57C	27	34	32	23	34	32
58	30	37	35	26	37	36
60	37	42	42	32	42	42
61A	36	42	42	32	42	41
61B	36	42	42	32	42	41
65A	35	41	41	31	41	40
63	35	41	41	31	41	41
68	35	41	41	31	41	40
69	39	44	44	35	44	44
141	37	30	39	41	43	43
146	29	25	25	35	36	29
151	33	29	28	28	40	33
158	31	27	27	27	38	31
161	27	23	23	23	34	27
162	24	20	20	20	31	24
165	24	20	20	20	32	24
168	25	20	20	20	33	25
349	21	15	15	15	28	21
348	22	16	16	16	29	22

	Predicted Noise Level L_{Amax} dB(A)					
Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
181A	25	33	30	21	33	30
181B	25	33	30	21	33	31
181C	25	33	30	21	33	30
181D	25	33	30	21	33	31
225	26	32	21	21	33	33
226	24	29	19	19	31	31
242	21	19	16	16	28	21
292	24	30	20	20	32	31
317	15	<15	<15	<15	23	15
17	23	31	31	30	31	28

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D-13: Underground Only Predicted Sleep Disturbance Modelling Results

	Predicted Noise Level L_{Amax} dB(A)					
Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
4	15	23	23	<15	22	19
5	15	24	24	<15	22	20
41A	17	25	25	18	24	21
41B	17	25	25	18	24	21
42	18	26	26	19	25	23
43	17	25	25	18	24	21
44	19	27	27	22	26	24

Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID	Predicted Noise Level L_{Amax} dB(A)					
47	18	27	27	20	26	23
49	20	28	28	23	27	25
50	21	29	29	24	28	26
56	30	37	37	27	36	35
57A	26	34	31	23	33	31
57B	26	34	31	23	32	31
57C	25	34	31	22	33	31
58	29	37	34	26	36	34
60	36	42	42	33	42	41
61A	35	42	42	32	41	41
61B	35	42	42	32	41	41
65A	34	41	41	31	40	40
63	34	41	41	31	40	40
68	34	41	41	31	40	40
69	38	45	45	36	44	44
141	31	27	31	38	37	32
146	27	24	24	33	34	27
151	23	20	20	20	30	23
158	23	20	20	20	30	23
161	21	18	18	18	28	21
162	21	18	18	18	28	21
165	20	17	17	17	27	20
168	18	15	15	15	26	18
349	15	<15	<15	<15	22	15
348	15	<15	<15	<15	23	15

	Predicted Noise Level L_{Amax} dB(A)					
Period	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	5	6	7	8	9	10
Receiver ID						
181A	23	31	25	20	30	28
181B	23	31	25	20	30	28
181C	23	31	25	20	30	28
181D	23	32	25	20	31	29
225	21	23	18	18	28	22
226	19	20	16	16	26	19
242	15	<15	<15	<15	22	15
292	19	23	16	16	27	22
317	<15	<15	<15	<15	20	13
17	22	30	30	30	29	27

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

D.4 CONSTRUCTION NOISE MODELLING RESULTS

Table D-14: Scenario 1 Construction Noise Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	16	16	<15	<15	17	17	10	17	17
5	<15	17	17	<15	<15	17	17	10	17	17
41A	<15	18	18	<15	<15	19	19	<15	19	19
41B	<15	18	18	<15	<15	19	19	<15	19	19
42	<15	19	19	<15	<15	20	20	<15	20	20
43	<15	18	18	<15	<15	19	19	<15	19	19
44	15	20	20	15	15	21	21	16	21	21
47	<15	19	19	<15	<15	19	19	<15	19	19
49	15	20	20	17	16	22	22	17	22	22
50	16	21	21	17	17	22	22	18	22	22
56	29	32	32	25	29	33	33	26	33	33
57A	20	25	22	16	21	27	24	17	27	27
57B	19	25	22	16	20	26	23	17	26	26
57C	19	25	22	16	21	27	23	17	27	27
58	22	28	25	19	24	30	26	20	30	30
60	31	35	35	28	32	36	36	29	36	36
61A	30	34	34	27	31	35	35	28	35	35
61B	30	34	34	27	31	35	35	28	35	35
65A	31	34	34	28	32	36	36	28	36	36
63	31	35	35	28	32	36	36	29	36	36
68	27	32	32	24	29	34	34	25	34	34
69	32	37	37	29	33	39	39	31	39	39

Predicted Noise Level $L_{Aeq,15min}$ dB(A)										
Period	**Day**	**Day**	**Day**	**Day**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**
Condition ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Receiver ID										
141	24	21	21	30	26	22	22	31	31	22
146	21	17	17	22	22	18	18	23	29	18
151	17	16	<15	<15	18	<15	<15	<15	24	<15
158	17	15	<15	<15	18	<15	<15	<15	24	<15
161	16	<15	<15	<15	17	<15	<15	<15	22	<15
162	16	<15	<15	<15	16	<15	<15	<15	22	<15
165	15	<15	<15	<15	16	<15	<15	<15	21	<15
168	<15	<15	<15	<15	<15	<15	<15	<15	20	<15
349	<15	<15	<15	<15	<15	<15	<15	<15	17	<15
348	<15	<15	<15	<15	<15	<15	<15	<15	17	<15
181A	17	23	17	<15	18	24	18	<15	24	22
181B	17	23	16	<15	18	24	17	<15	24	22
181C	17	22	16	<15	18	24	17	<15	24	22
181D	18	23	16	<15	19	24	17	15	24	22
225	16	21	<15	<15	16	16	<15	<15	22	12
226	<15	19	<15	<15	15	<15	<15	<15	20	11
242	<15	<15	<15	<15	<15	<15	<15	<15	17	<15
292	15	20	<15	<15	15	17	<15	<15	21	<15
317	<15	<15	<15	<15	<15	<15	<15	<15	15	<15
17	17	22	22	21	18	24	24	23	24	24
Bylong Oval	31	34	34	28	31	36	36	28	36	36
Bylong Community Hall	30	34	34	27	31	35	35	28	35	35
Bylong Quarry	24	22	30	30	25	29	31	31	31	31

Table D.15: Construction Scenario 2 Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
5	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
41A	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
41B	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
42	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
43	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
44	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
47	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
49	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
50	<15	<15	<15	<15	<15	<15	<15	<15	12	10
56	19	22	22	16	20	24	24	16	24	24
57A	<15	17	<15	<15	<15	18	<15	<15	18	18
57B	<15	16	<15	<15	<15	18	<15	<15	18	17
57C	<15	17	<15	<15	<15	18	<15	<15	18	18
58	<15	18	<15	<15	15	21	16	<15	21	20
60	25	28	28	22	26	30	30	22	30	30
61A	24	28	28	21	25	29	29	22	29	29
61B	24	28	28	21	25	29	29	22	29	29
65A	25	28	28	22	26	30	30	22	30	30
63	25	29	29	22	26	30	30	23	30	30
68	20	25	25	16	22	27	27	18	27	27
69	26	31	31	22	28	33	33	23	33	33
141	<15	<15	<15	16	<15	<15	<15	18	18	<15
146	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15

Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
151	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
158	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
161	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
162	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
165	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
168	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
349	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
348	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
181A	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
181B	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
181C	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
181D	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
225	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
226	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
242	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
292	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
317	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
17	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
Bylong Oval	25	20	20	21	28	28	<15	22	30	30
Bylong Community Hall	25	20	20	21	28	28	<15	22	29	30
Bylong Quarry	<15	<15	<15	19	<15	19	<15	20	20	20

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D.16: Construction Scenario 3 Modelling Results

Period Condition ID Receiver ID	Predicted Noise Level $L_{Aeq,15min}$ dB(A) Day 1	Day 2	Day 3	Day 4
4	<15	<15	<15	<15
5	<15	<15	<15	<15
41A	<15	15	15	<15
41B	<15	15	15	<15
42	<15	17	17	<15
43	<15	16	16	<15
44	<15	17	17	17
47	<15	17	17	17
49	<15	18	18	18
50	15	19	19	19
56	21 – 27	18 – 31	18 – 26	18 – 24
57A	13 – 18	16 – 24	<15	14 – 16
57B	13 – 17	17 – 23	<15	14 – 16
57C	13 – 18	17 -24	<15	14 – 16
58	16 – 21	21 – 27	18 – 19	18 – 21
60	25 – 41	20 – 45	20 – 36	20 – 36
61A	25 – 42	19 – 47	19 – 40	19 – 38
61B	25 – 43	20 – 47	20 – 40	20 – 38
65A	26 – 46	20 – 50	20 – 44	20 – 42
63	26 – 45	21 – 49	21 – 43	21 – 41
68	26 – 61	21 – 62	21 – 61	21 – 60
69	32 – 48	25 – 44	25 – 44	25 – 46
141	<15	<15	<15	13 – 16
146	<15	<15	<15	<15

Period Condition ID Receiver ID	Predicted Noise Level $L_{Aeq,15min}$ dB(A) Day 1	Day 2	Day 3	Day 4
151	<15	<15	<15	<15
158	<15	<15	<15	<15
161	<15	<15	<15	<15
162	<15	<15	<15	<15
165	<15	<15	<15	<15
168	<15	<15	<15	<15
349	<15	<15	<15	<15
348	<15	<15	<15	<15
181A	<15	14 – 19	<15	<15
181B	<15	14 – 19	<15	<15
181C	<15	14 – 19	<15	<15
181D	<15	14 – 19	<15	<15
225	<15	<15	<15	<15
226	<15	<15	<15	<15
242	<15	<15	<15	<15
292	<15	<15	<15	<15
317	<15	<15	<15	<15
17	15	19	20	20
Bylong Oval	26 – 44	20 – 49	20 – 42	20 – 40
Bylong Community Hall	25 – 46	20 – 50	20 – 44	20 – 41
Bylong Quarry	15	<15	20	21

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D.17: Construction Scenario 4 Modelling Results

Period	Predicted Noise Level $L_{Aeq,15min}$ dB(A)			
	Day	Day	Day	Day
Condition ID	1	2	3	4
Receiver ID				
4	<15	<15	<15	<15
5	<15	<15	<15	<15
41A	<15	<15	<15	<15
41B	<15	<15	<15	<15
42	<15	<15	<15	<15
43	<15	<15	<15	<15
44	<15	<15	<15	<15
47	<15	<15	<15	<15
49	<15	<15	<15	<15
50	<15	<15	<15	<15
56	<15	<15	<15	<15
57A	<15	<15	<15	<15
57B	<15	<15	<15	<15
57C	<15	<15	<15	<15
58	<15	<15	<15	<15
60	11 – 15	<15	<15	<15
61A	<15	<15	<15	<15
61B	<15	<15	<15	<15
65A	11 – 15	<15	<15	<15
63	11 – 15	<15	<15	<15
68	10 – 15	<15	<15	<15
69	12 – 18	<15	<15	<15
141	27 – 19	22 – 25	22 – 25	22 – 25
146	23 – 15	20 – 28	20 – 28	20 – 28

Period Condition ID Receiver ID	Predicted Noise Level $L_{Aeq,15min}$ dB(A) Day 1	Day 2	Day 3	Day 4
151	<15	14 – 17	14 – 17	14 – 17
158	<15	14 - 17	14 – 17	14 – 17
161	<15	13 – 16	13 – 16	13 – 16
162	<15	13 – 16	13 – 16	13 – 16
165	<15	<15	<15	<15
168	<15	<15	<15	<15
349	<15	<15	<15	<15
348	<15	<15	<15	<15
181A	<15	<15	<15	<15
181B	<15	<15	<15	<15
181C	<15	<15	<15	<15
181D	<15	<15	<15	<15
225	<15	<15	<15	<15
226	<15	<15	<15	<15
242	<15	<15	<15	<15
292	<15	<15	<15	<15
317	<15	<15	<15	<15
17	<15	<15	<15	<15
Bylong Oval	10 – 15	<15	<15	<15
Bylong Community Hall	10 – 15	<15	<15	<15
Bylong Quarry	12 – 16	<15	<15	<15

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

Table D.18: Construction Scenario 5 Modelling Results

	Predicted Noise Level $L_{Aeq,15min}$ dB(A)									
Period	Day	Day	Day	Day	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night	Eve/Night
Condition ID	1	2	3	4	5	6	7	8	9	10
Receiver ID										
4	<15	18	18	<15	<15	19	19	<15	19	16
5	<15	18	18	<15	<15	19	19	<15	19	16
41A	<15	19	19	<15	<15	21	21	<15	21	18
41B	<15	19	19	<15	<15	21	21	<15	21	18
42	<15	21	21	<15	15	23	23	15	23	20
43	<15	20	20	<15	<15	21	21	15	21	18
44	<15	21	21	19	15	23	23	21	23	19
47	<15	21	21	19	15	23	23	21	23	20
49	<15	22	22	20	15	23	23	22	23	20
50	15	23	23	22	17	25	25	24	25	22
56	25	32	32	21	27	34	34	23	34	33
57A	23	30	30	19	25	32	32	21	32	31
57B	23	30	30	19	25	32	32	21	32	31
57C	23	30	30	19	25	33	33	21	33	31
58	27	34	34	24	29	36	36	25	36	36
60	31	38	38	29	33	39	39	30	39	39
61A	30	36	36	29	31	38	38	30	38	38
61B	30	36	36	29	31	38	38	31	38	38
65A	30	37	37	30	32	38	38	31	38	38
63	31	37	37	30	32	39	39	32	39	39
68	30	36	36	29	31	38	38	31	38	38
69	34	40	40	39	35	41	41	41	41	42
141	27	24	31	34	29	25	33	36	36	33
146	26	23	23	33	28	24	24	35	35	28

Predicted Noise Level $L_{Aeq,15min}$ dB(A)										
Period	**Day**	**Day**	**Day**	**Day**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**	**Eve/Night**
Condition ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Receiver ID										
151	21	22	17	17	22	19	18	18	30	22
158	20	19	16	16	22	18	18	18	30	22
161	19	16	15	15	20	16	16	16	28	20
162	18	<15	<15	16	19	15	15	17	27	19
165	16	<15	<15	<15	18	<15	<15	<15	26	18
168	16	<15	<15	<15	17	<15	<15	<15	25	17
349	<15	<15	<15	<15	<15	<15	<15	<15	21	<15
348	<15	10	9	<15	<15	<15	<15	<15	22	<15
181A	21	28	22	17	23	30	24	18	30	29
181B	21	28	22	17	23	30	24	18	30	29
181C	21	28	22	17	23	30	24	18	30	29
181D	21	29	22	17	23	31	24	19	31	29
225	18	25	<15	<15	20	23	16	16	28	23
226	16	23	<15	<15	18	20	<15	<15	26	21
242	<15	16	<15	<15	<15	<15	<15	<15	21	<15
292	17	24	<15	<15	19	22	<15	<15	26	22
317	<15	<15	<15	<15	<15	<15	<15	<15	16	<15
17	16	23	23	23	17	25	25	25	25	23
Bylong Oval	30	37	37	30	32	38	38	31	38	38
Bylong Community Hall	30	36	36	29	31	38	38	31	38	38
Bylong Quarry	23	22	30	30	25	30	32	32	32	31

Note: Cells are shaded light blue for negligible impacts, blue for moderate impacts and dark blue for significant impacts.

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Appendix E NOISE CONTOUR MAPS

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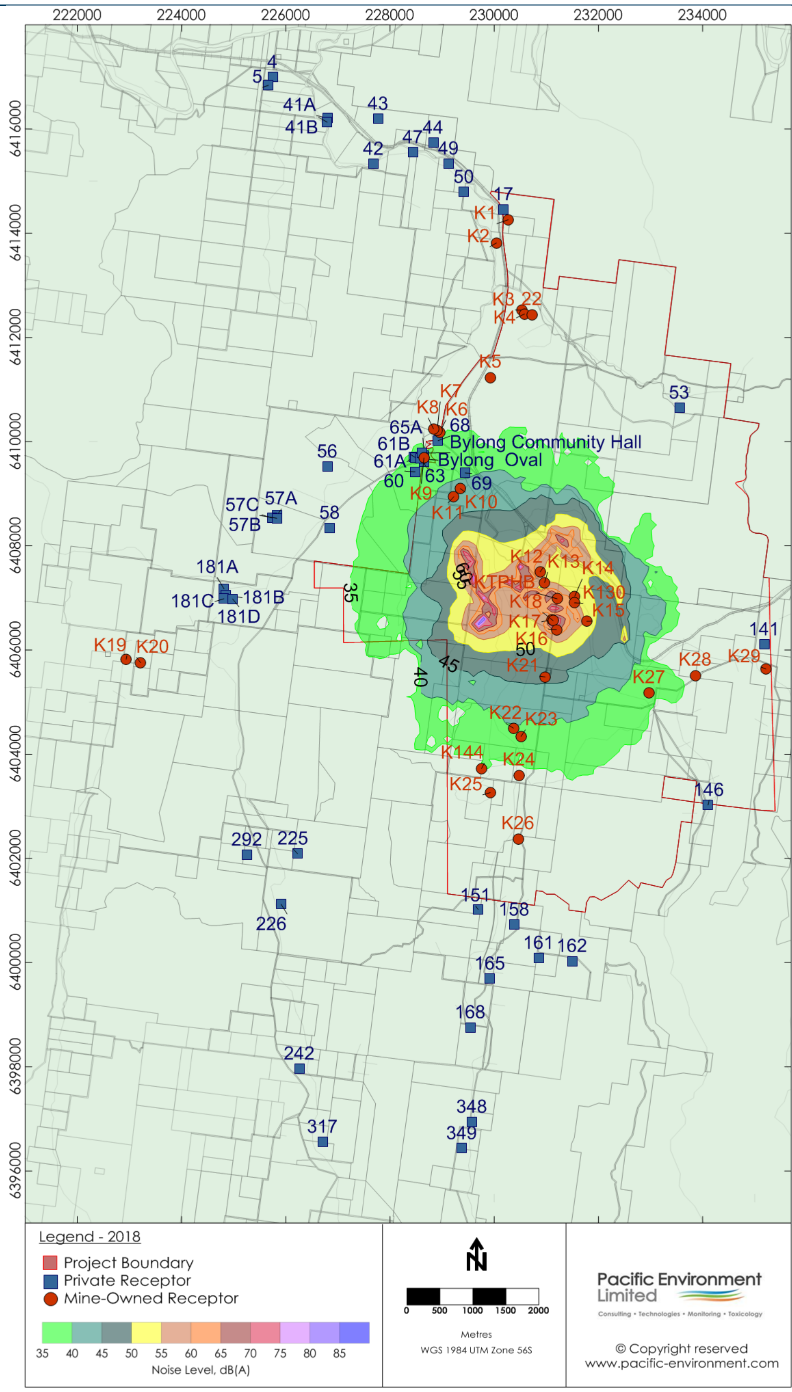
E.1 MAXIMUM EXTENT NOISE CONTOUR MAPS

The following noise contour maps show the predicted maximum extent noise contours. They present the greatest noise level modelled for each year under any of the meteorological condition considered in the assessment.



Scenario: 2018	Time Period: Day/Evening/Night	Conditions: Neutral	Descriptor: $L_{Aeq,15min}$ dB(A)

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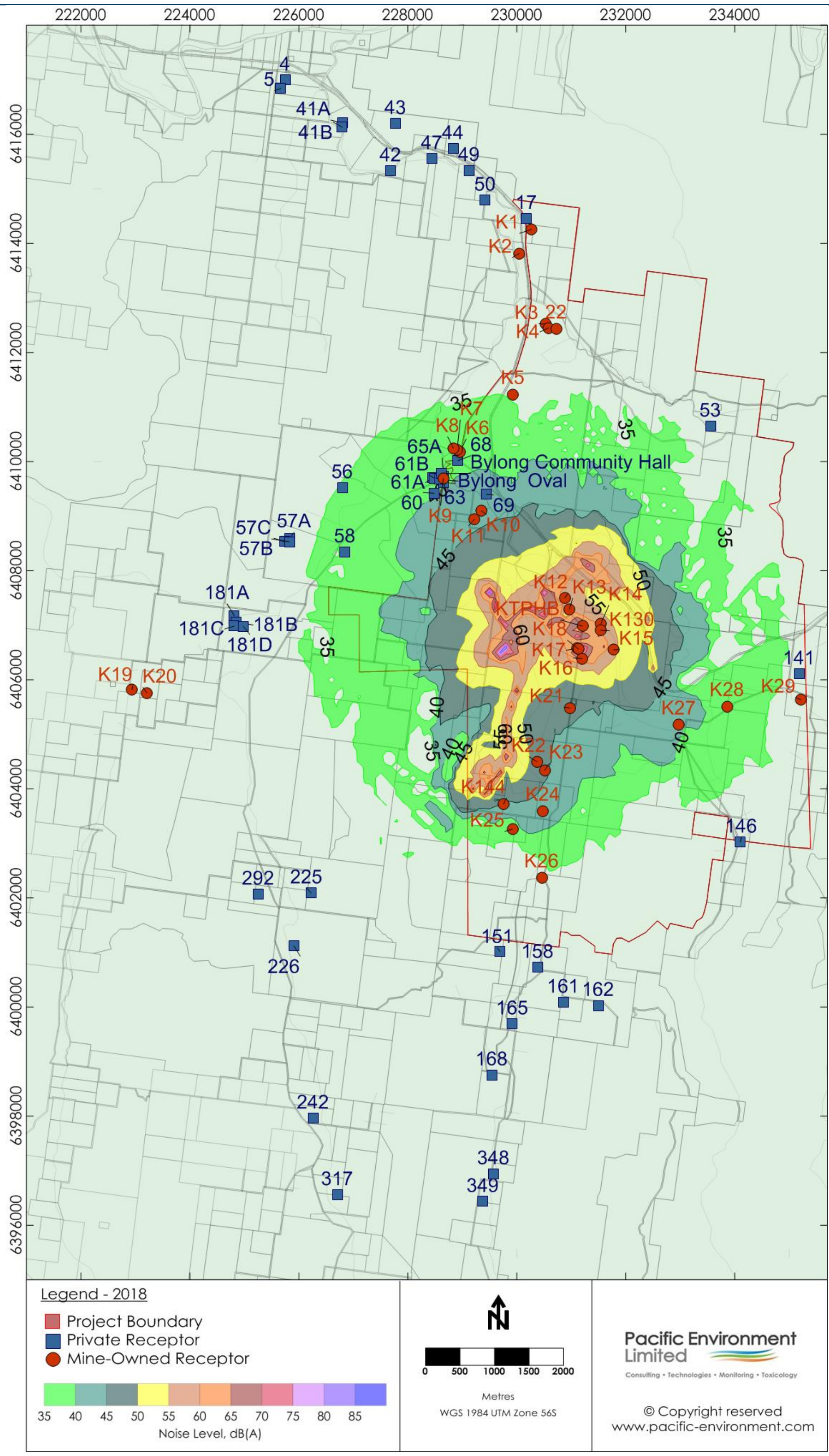
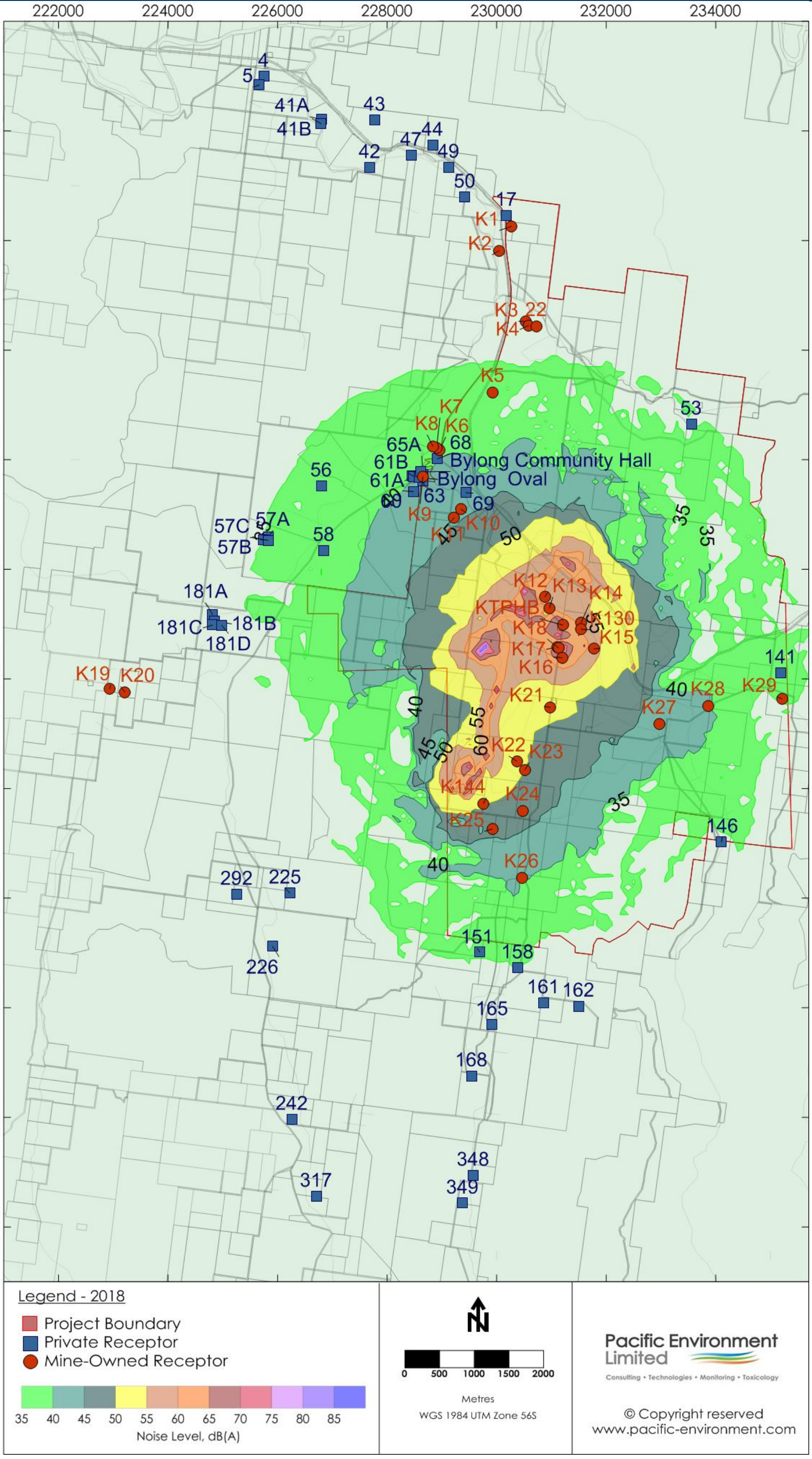
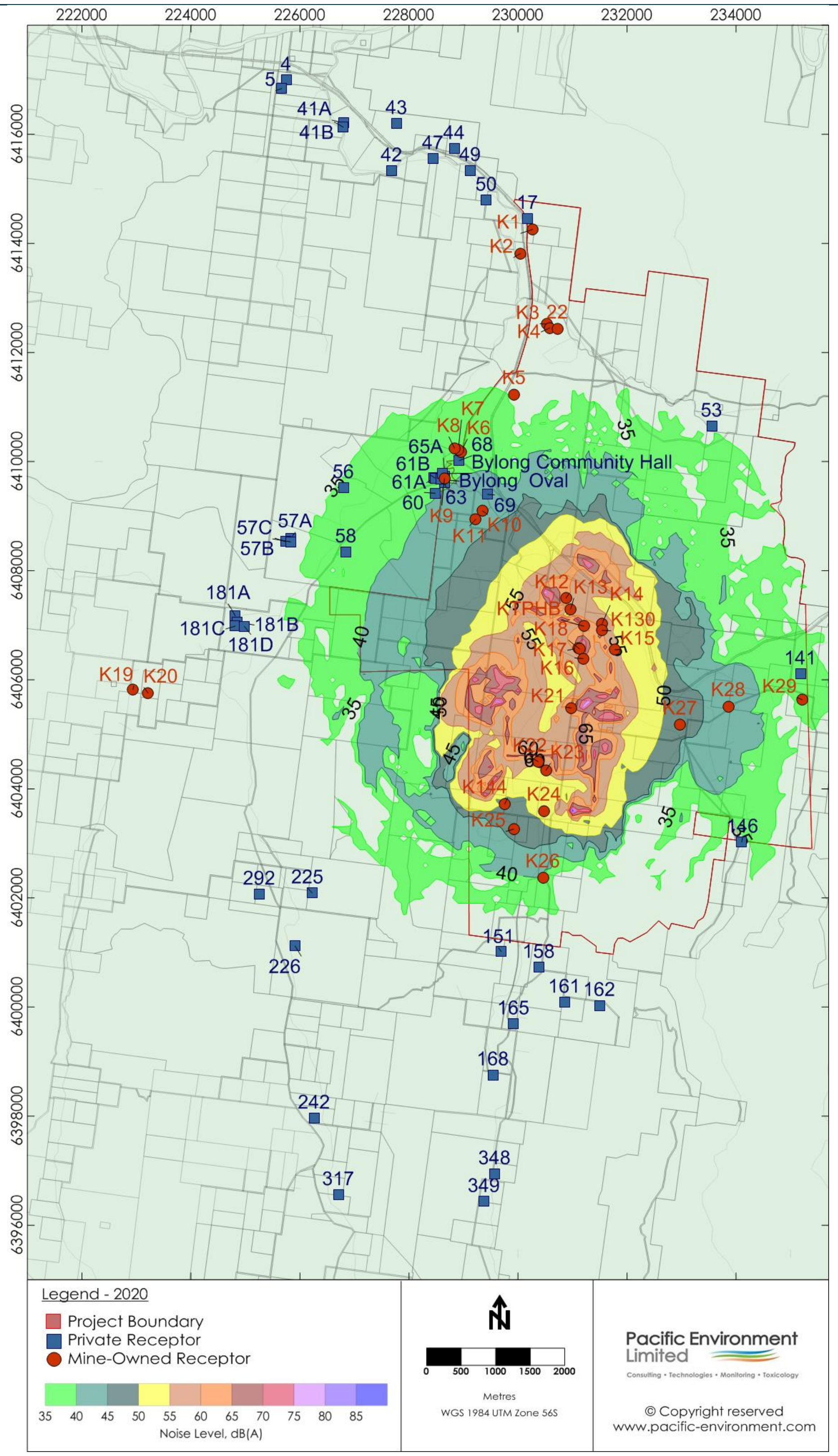


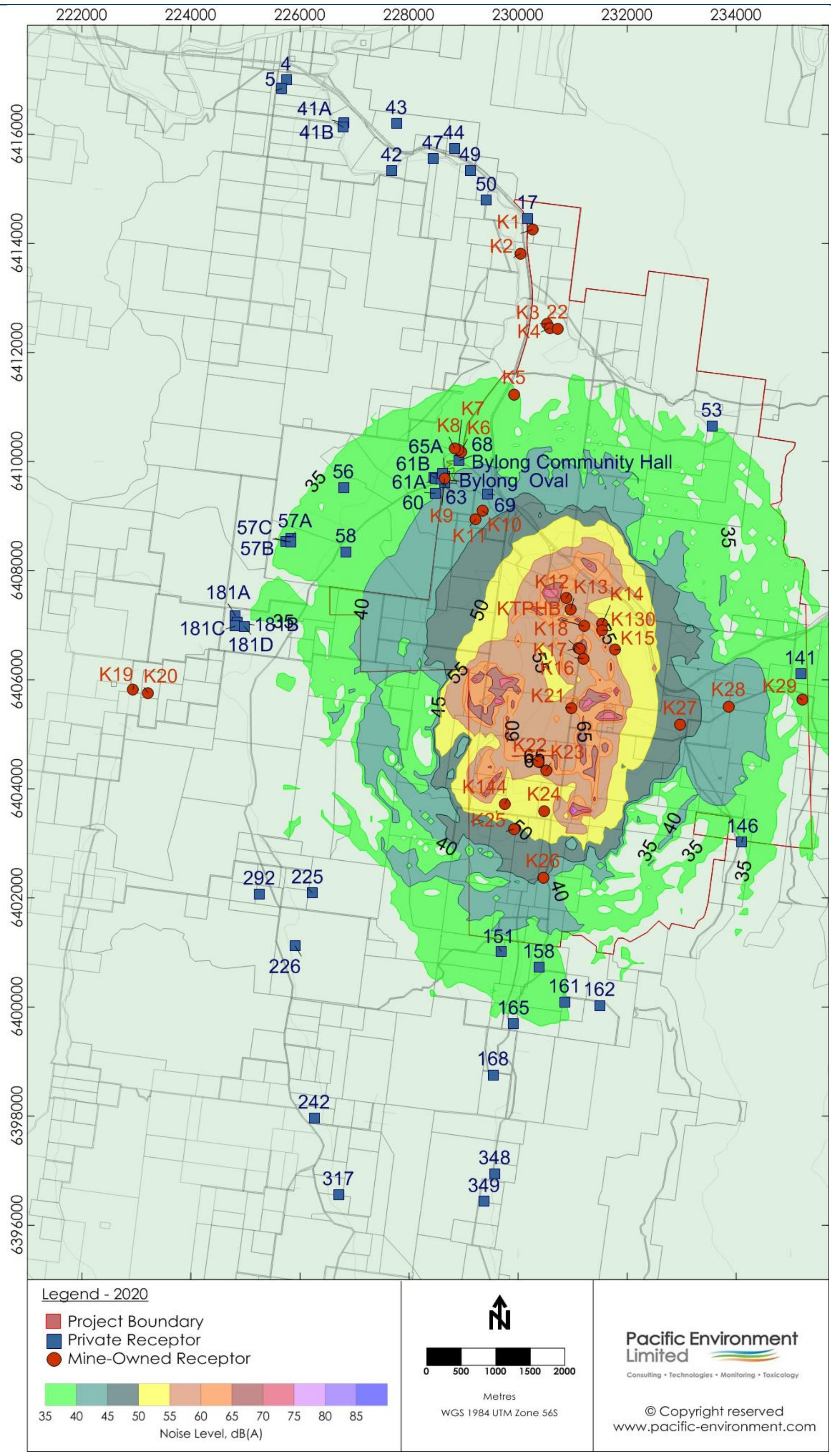
Scenario: 2018	Time Period: Day	Conditions: Adverse	Descriptor: $L_{Aeq,15min}$ dB(A)



Scenario: 2018	Time Period: Evening/Night	Conditions: Adverse	Descriptor: $L_{Aeq,15min}$ dB(A)



Scenario: 2020	Time Period: Day	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)



Scenario: 2020	Time Period: Evening/Night	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)

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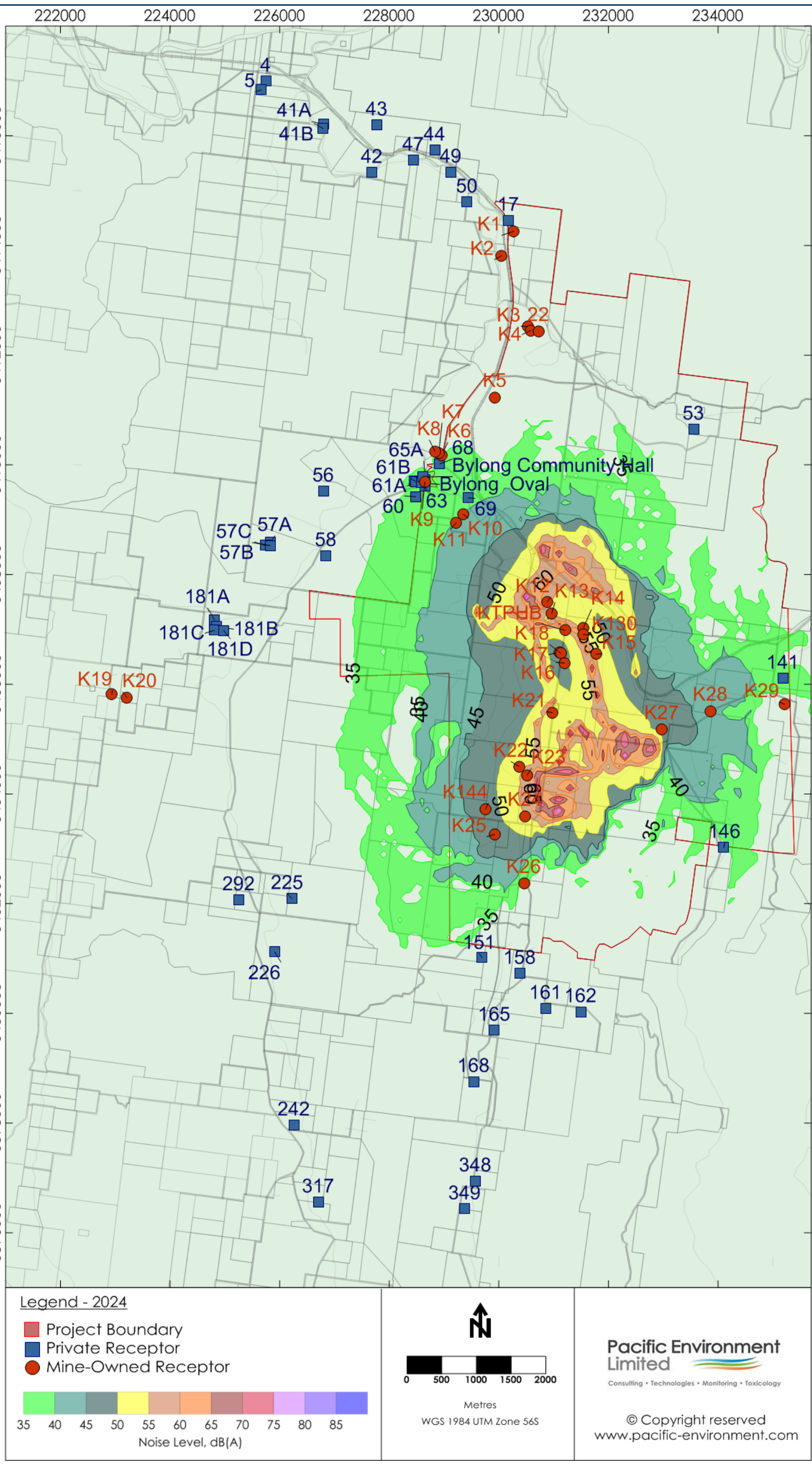

Scenario: 2024	Time Period: Day	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)

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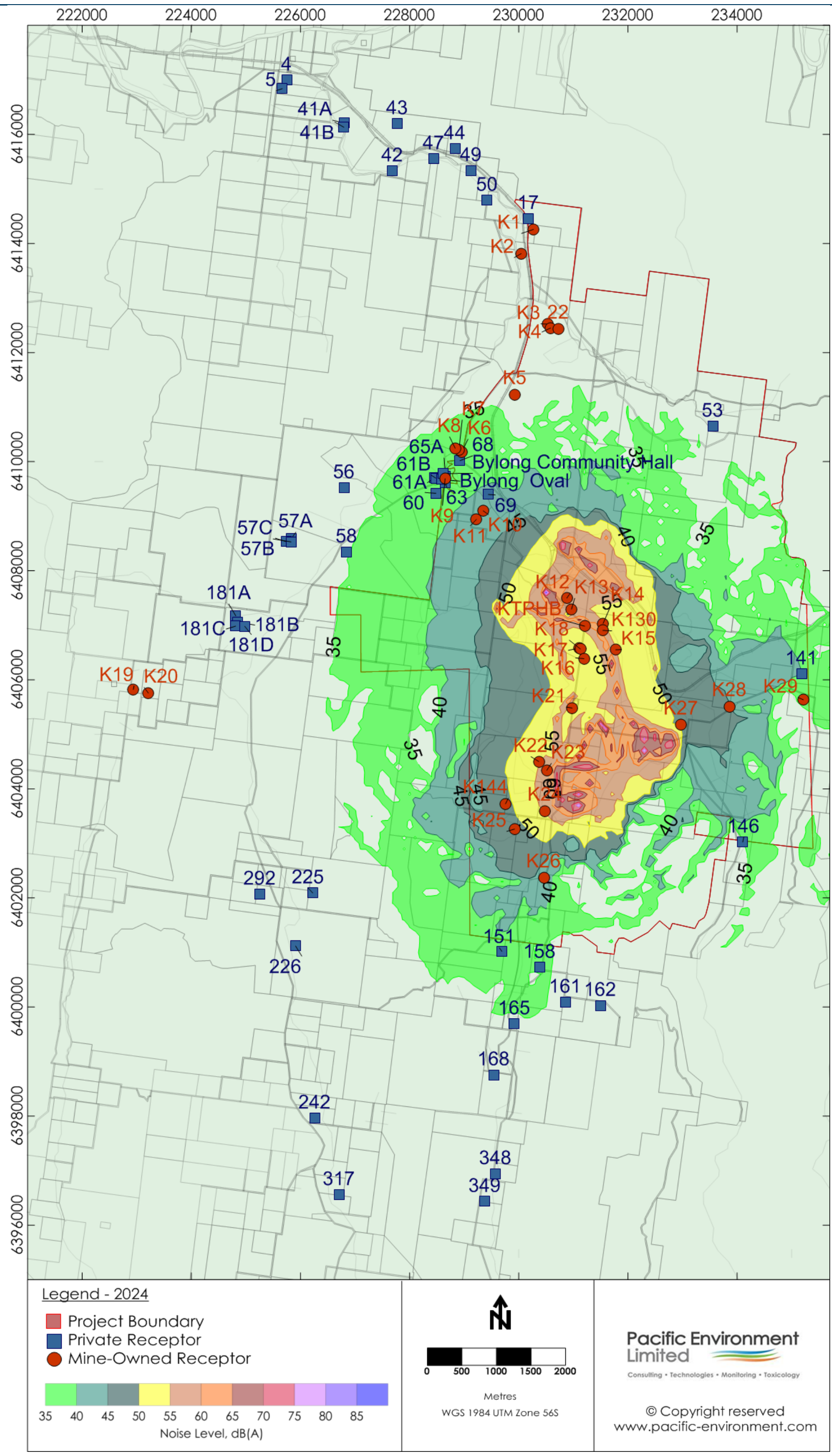

Scenario: 2024	Time Period: Evening/Night	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)

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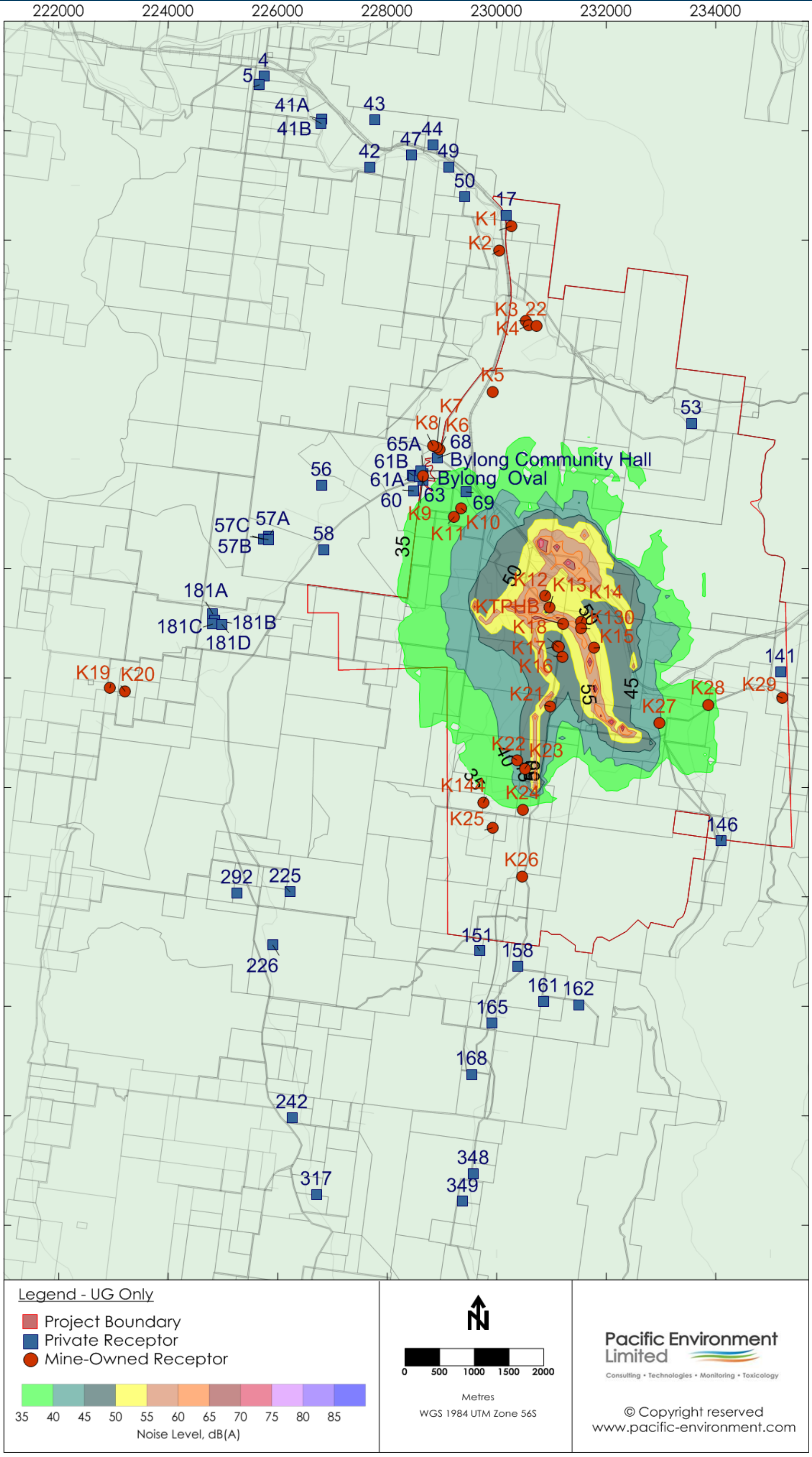
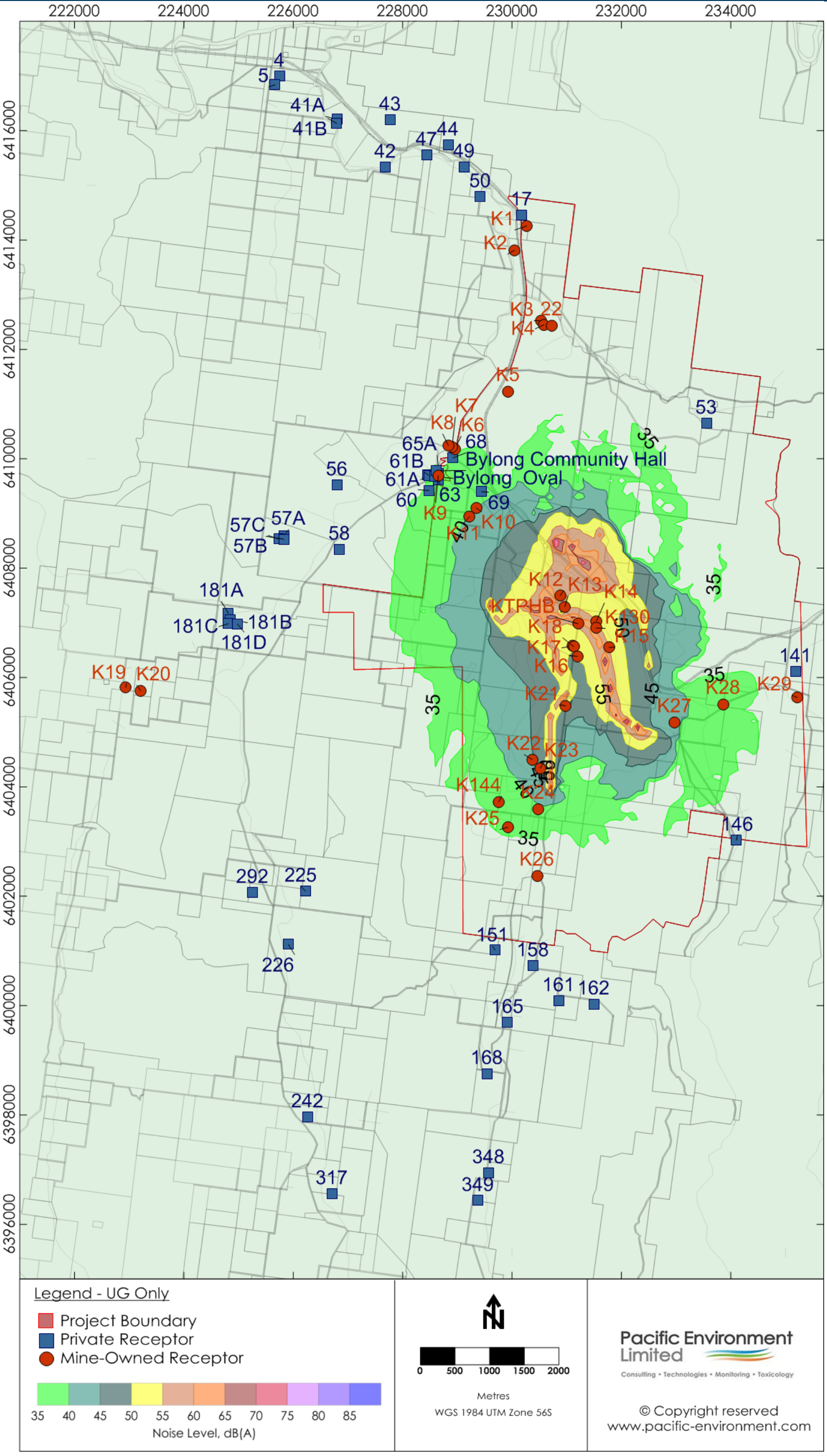


Scenario: UG Only	Time Period: Day	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)



Scenario: UG Only	Time Period: Evening/Night	Conditions: Worst-case	Descriptor: $L_{Aeq,15min}$ dB(A)