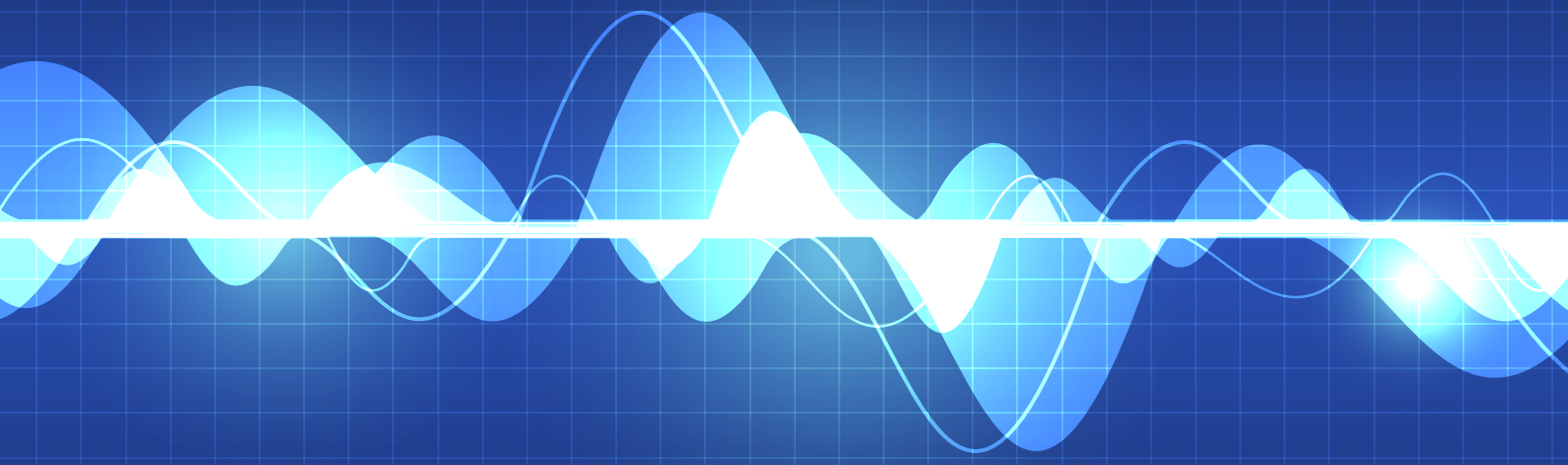
Rasp Mine Modification 6

Kintore Pit TSF3 | Noise Impact Assessment

Prepared for Broken Hill Operations Pty Ltd
May 2021



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Kintore Pit TSF3 | Noise Impact Assessment

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Client

Broken Hill Operations Pty Ltd

Date

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Prepared by	**Approved by**
	
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Executive Summary

ES1 Introduction

Broken Hill Operations Pty Ltd (BHOP) is seeking to modify (MOD6) their Rasp Mine's Project Approval PA 07_0018 (PA) to allow for naturally dried tailings and excess underground waste rock to be deposited into the Kintore Pit as Tailings Storage Facility 3 (TSF3) to allow for production at the site to continue beyond December 2022. This will require relocation of the underground mine portal and access decline, construction of a boxcut, utilising Blackwood Pit Tailings Storage Facility 2 (TSF2) for drying and harvesting of deposited tailings and rehabilitation capping.

This report presents an assessment of noise from the proposed construction works and future operations, and identifies potential impacts on the surrounding community. The report also provides recommended construction and operation noise management and mitigation measures, where relevant.

ES2 Proposed MOD6 description

ES2.1 Future mining operations

BHOP is proposing to develop the Kintore Pit into a new tailings storage facility (TSF3) for naturally dried tailings co-disposed with excess waste rock. This will involve several changes to existing mining operations at the Rasp Mine.

The underground mine portal which is currently located at the base of the Kintore Pit will be relocated. The new underground mine portal (the new portal) will require the construction of a boxcut and new access decline at the new location. The current underground mine portal will be sealed to transform Kintore Pit into TSF3 and the new portal and new decline will be used to access the underground mine workings. The proposed location for the new portal will significantly reduce the length of the haul route to the Run-of-Mine (RoM) pad.

BHOP is proposing to utilise TSF2 to naturally dry (using solar and wind) tailings produced by the milling process to reduce the risk of inrush or inundation to underground mining operations from the proposed TSF3. When sufficiently dried, tailings will be harvested and transported to TSF3 for permanent storage. Harvest and transport of dried tailings from TSF2 to TSF3 is proposed to occur during the day period only, from 7 am to 6 pm Monday to Saturday and from 8 am to 6 pm Sundays.

Progressive rehabilitation capping will be completed using suitable waste rock from underground mining. Following initial transfer to BHP Pit or Kintore Pit Tipple for lead (Pb) content testing, waste rock with a lead content of <0.5% will be used for capping of 'free areas' (ie any non-active mining areas on-site) on a progressive basis. Waste rock with a lead content of 0.5% or more will be either returned underground, stored in the infill area of BHP Pit or co-disposed with tailings in TSF3. Progressive rehabilitation capping will be undertaken during the day period Monday to Friday.

This assessment addresses future site noise from existing and future mining operations combined.

ES2.2 Construction

The proposed new portal will require the construction of a boxcut and new decline. The boxcut will be constructed at a depth to reach competent hard rock material and will consist of an exposed boxcut slope with approximately 10 m wide benches and 10 m high batters. Material from the boxcut construction will be

transferred to Little Kintore Pit and BHP Pit for permanent storage. Surface activities associated with the new decline development (eg trucking of waste rock) will start following breakthrough to the new portal from underground workings. The use of a temporary ventilation fan system will be required during the construction of the new decline and will be located at the base of the completed boxcut.

The use of the Kintore Pit as TSF3 will require the closure of the current underground mine portal and decline. These will be sealed using a concrete plug seal and waste rock backfill. Other TSF3 preparation works in the Kintore Pit will include the construction of a shaping layer and bridging layer, before starting the deposition of waste rock and harvested (naturally dried) tailings.

To prepare TSF2 for tailings harvesting, TSF2 will be divided into three bays (Cell A, Cell B and Cell C) and separated by intermediate bunds.

The proposed MOD6 will allow for current mining operations at the site to continue beyond 2022 through to December 2026 (PA expiry).

Construction works will be completed in several stages and is expected to take approximately 42 weeks. The majority of the proposed construction works will be completed during the ICNG's standard hours between 7 am and 6 pm Monday to Friday, 8 am to 1 pm on Saturdays, and no work on Sundays or public holidays. Proposed construction works will also occur outside the ICNG's recommended standard hours, out-of-hours (OOH) (7 am to 8 am and 1 pm to 6 pm Saturdays and 24 hours 7 days per week for works within Kintore Pit).

ES3 Criteria

ES3.1 Construction noise

The MOD6 construction noise management levels (NMLs) for all residential assessment locations have been based on the rating background levels (RBLs) determined during previous noise assessments or recent ambient noise monitoring completed for the Rasp Mine, and application of the EPA's Noise Policy for Industry (NPfI) (2017).

For the purpose of this assessment, the existing PA (Condition 17B(c)) noise limit of 65 dB $L_{Aeq,day}$ for approved construction noise at the site has also been adopted for all MOD6 construction activities proposed to occur during the day period. Construction NMLs adopted for this assessment for standard hours works and day, evening and night OOH works were derived in accordance with the ICNG for all assessment locations.

ES3.2 Operational noise

Since the MOD4 noise assessment, the EPA's Industrial Noise Policy (INP) (2000) has been superseded by the NPfI (EPA 2017). In accordance with the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry (2017)*, this assessment has adopted the NPfI approach and hence assessment requirements for operational noise (eg criteria) and modelling methodologies (eg modelled meteorological conditions) have been updated where applicable.

The aim of this assessment is to demonstrate that site can achieve contemporary noise trigger levels in accordance with the NPfI during future operations. The objectives of noise trigger levels for industry are to protect the community from excessive intrusive noise and preserve amenity for specific land uses. The NPfI provides project specific noise trigger levels, namely intrusiveness and amenity noise levels.

The NPfI's project noise trigger level (PNTL) is the lower of the calculated intrusiveness or amenity noise level. The adopted PNTLs are largely unchanged from the existing limits stated in the PA and Environment Protection Licence 12559 (EPL). The only changes are for the less sensitive daytime period due to NSW EPA policy changes

and assessment location A7 (based on ambient noise monitoring and updated RBL). EMM recommends that site noise limits (in the PA and EPL) be adjusted in accordance with the findings of this assessment (updated ambient noise monitoring) and the NPfI.

ES3.3 Sleep disturbance

The site will continue to operate during the night period and therefore the potential for sleep disturbance has been assessed.

A maximum noise level event assessment was undertaken for all residential assessment locations based on the following night-time screening criteria as per the NPfI:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater); and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

ES4 Noise modelling methodology

ES4.1 Noise modelling software

Quantitative modelling of construction and operational noise was completed using DGMR iNoise noise prediction software. This software applies the EPA accepted ISO 9613 approach and calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources.

Three-dimensional digitised ground contours of the site and surrounding land were incorporated to model topographic effects. Equipment was modelled at locations and heights representative of proposed construction activities and future operations.

ES4.2 Modelling scenarios

ES4.2.1 Construction

The construction noise modelling was based on information received from BHOP including the locations of works, the list of activities, the list of plant and equipment items and approximate schedule. To determine the worst-case noise from the proposed construction activities, construction noise levels predicted for each activity were added to noise levels from existing site operations. Noise from existing site operations was modelled and validated based on site noise contributions determined during recent attended compliance monitoring completed in 2018 and 2019.

Each construction scenario was carefully reviewed to identify constructions works that would result in worst-case noise levels at offsite locations. Worst-case construction scenarios were modelled for all relevant ICNG assessment periods.

Modelled construction activities, associated noise sources and sound power levels for the relevant scenarios are based on on-site measurement data or otherwise have been supplemented using EMM's database of equipment used for similar projects. The positions of sources represent typical worst-case noise conditions (ie at the highest and most exposed topographical points).

ES4.2.2 Future operation

The future MOD6 operational noise modelling was based on information provided by BHOP. This included a detailed description of the proposed harvesting and storage operations, future haul routes (eg new portal to RoM pad), mobile crusher/screen location and progressive rehabilitation locations.

Modelled operational noise sources for proposed future operations (including existing noise sources) and associated sound power levels are based on on-site measurements or otherwise have been supplemented using EMM's database of plant and equipment used for similar projects.

ES4.3 Modelled meteorological conditions

Winds and temperature inversions were not identified applicable to the project area in accordance with the NPfI. As a conservative approach however, this assessment has adopted the meteorological conditions within the international standard ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors'. As per Section 1 of ISO 9613:

> The method predicts the equivalent continuous A-weighted sound pressure level (as described in parts 1 to 3 of ISO 1996) under meteorological conditions favourable to propagation from sources of known sound emission.
>
> These conditions are for downwind propagation, as specified in 5.4.3.3 of ISO 1996-2:1987 or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

Further, this assessment has adopted stability category F temperature inversion with 2 m/s wind speed (source-to-receiver) for the most critical night period and hence is considered worst-case.

ES5 Assessment results

ES5.1 Construction noise

Site noise levels for each worst-case construction scenarios were predicted during noise-enhancing weather conditions for the relevant ICNG assessment periods.

For construction works proposed during standard hours and day OOH on Saturday, modelling predictions satisfy the adopted 65 dB $L_{Aeq,day}$ noise limit in the PA at all assessment locations. Noise levels from proposed construction and existing operations (combined) were also assessed against the ICNG NMLs for standard hours and day OOH on Saturday. Noise levels during standard hours are predicted to exceed (by up to 3 dB) the relevant NML during stage 1 of the boxcut construction (scenario 1) at assessment location A13. During day OOH on Saturday, noise levels are predicted to exceed the relevant NMLs during stage 1 and/or stage 2 of the boxcut construction (scenarios 1 and 2) by up to 2 dB at A1 and A3, by up to 4 dB at A2, by up to 5 dB at A14 and by up to 8 dB at A13.

For evening and night OOH TSF3 preparation works, modelling results show that noise levels from proposed construction and existing operations (combined) during 2 m/s wind are predicted to satisfy the ICNG NMLs at all assessment locations. During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, construction noise levels from proposed construction and existing operations (combined) are predicted to be negligibly (up to 2 dB) above the relevant ICNG NMLs at assessment locations A1, A2, A10, A13 and A14. It is noted that at assessment location A13, there will be no increase to noise levels from site as a result of proposed night OOH construction.

Noise management and mitigation measures will be implemented by BHOP during the MOD6 construction works.

ES5.2 Future operational noise

Future operational noise levels (following the completion of MOD6 construction works) have been predicted based on noise-enhancing weather conditions and assessed against adopted PNTLs. Furthermore, future operational noise levels have been compared to noise levels from existing site operations (pre MOD6).

Modelling results showed that site noise levels for future operations during 2 m/s wind are predicted to satisfy the adopted PNTLs at all assessment locations for the day, evening and night periods.

During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, site noise levels for future operations are predicted to be negligibly above the adopted PNTLs at assessment location A13 (by 2 dB) and A14 (by 1 dB). A 1 to 2 dB change in noise levels in the environment is generally not perceptible by the human ear and therefore noise impacts from future operations is unlikely at these locations.

When comparing future site noise levels to existing site noise levels, no material increase is predicted at any location for the day, evening and night periods.

Noise management measures will continue to be implemented at Rasp Mine.

ES5.3 Sleep disturbance

Maximum noise levels from future night operations with the potential to cause sleep disturbance at nearby residences have been assessed in accordance with the NPfI. This included maximum night-time noise levels from proposed MOD6 night-time construction works (ie TSF3 preparation works).

Maximum $L_{Aeq,15min}$ noise levels represent worst-case noise levels predicted based on TSF3 preparation works and future night operations including the CBP, primary crusher, processing plant, haul truck movements (eg new portal to RoM pad) and other mobile plant (eg watercart, concrete agitator truck etc) movements.

Night operations considered for the assessment of maximum L_{Amax} noise levels included events from the proposed TSF3 preparation works and existing site operations such as the CBP FEL loading aggregate in the CBP hopper or the FEL loading material in the primary crusher at the RoM pad. Maximum noise level events from proposed future night operations will be consistent with those from existing site operations given that they will remain unchanged. Notwithstanding, worst-case predicted maximum L_{Amax} noise levels were assessed against contemporised sleep disturbance screening criteria in accordance with the NPfI.

Noise modelling results show that maximum L_{Aeq} and L_{Amax} noise levels are predicted to satisfy the NPfI screening criteria for sleep disturbance at all residential assessment locations during noise-enhancing meteorological conditions. Therefore, it is unlikely that proposed future night operations will cause sleep disturbance at any residential receivers.

ES6 Noise management and mitigation

Existing noise management and mitigation measures currently adopted at Rasp Mine will continue to be implemented including the following:

- best management practices;
- noise mitigation measures implemented on-site to achieve noise limits;

- noise monitoring management plan (eg annual attended noise monitoring); and
- noise complaints management.

Similarly to how MOD4 construction works (ongoing) has been managed by BHOP, additional noise management measures will be considered by BHOP during the proposed construction works. It is recommended that specific detailed noise management and mitigation measures be reviewed once the construction activities for each task are clearly defined and contractors for the work have been selected or engaged.

ES7 Conclusion

EMM has completed a noise impact assessment for the proposed MOD6 construction and operational activities at Rasp Mine.

Construction noise levels from proposed worst-case construction works during standard hours and day OOH on Saturday are predicted to satisfy the PA 65 dB $L_{Aeq,day}$ noise limit at all assessment locations. When compared to the ICNG derived NMLs, noise levels during standard hours are predicted to exceed (by up to 3 dB) the relevant NML during stage 1 of the boxcut construction (scenario 1) at assessment location A13. During day OOH on Saturday, noise levels are predicted to exceed (by up to 8 dB) the relevant NMLs during stage 1 and/or stage 2 of the boxcut construction (scenarios 1 and 2) at assessment locations A1, A2, A3, A13 and A14.

Construction noise levels from worst-case construction works proposed during evening and night OOH on any day of the week, noise levels are predicted to satisfy the ICNG NMLs at all assessment locations during 2 m/s wind. During the unlikely worst-case night-time temperature inversion (stability category F) and 2 m/s wind speed, construction noise levels are predicted to be negligibly (up to 2 dB) above the relevant NMLs at assessment locations A1, A2, A10, A13 and A14.

Future operational $L_{Aeq,15min}$ noise levels following the completion of the MOD6 construction works are predicted to satisfy the adopted PNTLs at all assessment locations during 2 m/s wind for the day, evening and night periods. During the unlikely worst-case night-time temperature inversion (stability category F) and 2 m/s wind speed, future operational $L_{Aeq,15min}$ noise levels are predicted to be negligibly above the relevant adopted PNTLs at assessment locations A13 and A14. However, no material increase is predicted between existing and future site noise levels at assessment locations A13 and A14. Therefore, no additional noise impacts from future MOD6 operations are predicted at surrounding residential receivers as a result of proposed future MOD6 operations.

Predicted maximum noise level events from the proposed MOD6 operations are not predicted to cause sleep disturbance impact at any of the residential assessment locations during worst-case night-time meteorological conditions for construction works within TSF3 and future operations.

It is recommended that noise management and mitigation measures currently used at Rasp Mine be continued. In addition, it is recommended that standard construction noise management measures including operational strategies, source noise control strategies, noise barrier controls, and community consultation are implemented for the duration of the construction works.

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1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by Broken Hill Operations Pty Ltd (BHOP) to complete a noise assessment for the proposed Modification 6 (MOD6) of Project Approval PA 07_0018 (PA) for the Rasp Mine, Broken Hill, NSW.

BHOP is seeking to modify its PA to allow for the establishment of the Kintore Pit as Tailings Storage Facility 3 (TSF3) for naturally dried tailing co-disposed with excess underground waste rock. This will require the relocation of the underground mine portal and access decline, construction of a boxcut, utilising Blackwood Pit Tailings Storage Facility 2 (TSF2) for drying and harvesting of deposited tailings and transport by trucks to TSF3 and rehabilitation capping.

This report presents an assessment of noise from the proposed construction works and future operations, and identifies potential impacts on the surrounding community. The report also provides recommended construction and operation noise management and mitigation measures, where relevant.

This assessment references the project approval and noise guidelines as follows:

- NSW Department of Planning, Industry and Environment (DPIE), Consolidated Project Approval *PA 07_0018 Mod 7*, July 2019;
- NSW Environment Protection Authority (EPA), Environment Protection Licence 12559, 26 August 2019;
- NSW EPA, *Industrial Noise Policy*, 2000;
- NSW EPA, *Noise Policy for Industry*, 2017;
- NSW EPA, *Implementation and transitional arrangements for the Noise Policy for Industry (2017)*, 2017;
- NSW Department of Environment and Climate Change (DECC), *Interim Construction Noise Guideline*, 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), *Road Noise* Policy, 2011; and
- BHOP, approved *Noise Monitoring Management Plan* (NMMP), updated June 2019.

A number of technical terms are required for the discussion of noise. These are explained in the glossary of acoustic terms in Appendix A.

2 Existing operations and proposed modification

2.1 Existing mining operations

The Rasp Mine is located in the centre of the City of Broken Hill and mining has been occurring at the site for over 130 years. Existing approved mining operations at the Rasp Mine consist mainly of underground operations, surface ore haulage to the Run-of-Mine (RoM) pad, waste rock haulage to in-pit storage areas and periodic in-pit crushing (on a needs basis up to four times a year), processing of ore, storage of tailings and dispatch of concentrate products.

Most recent attended noise monitoring assessments have shown that existing site noise complies with the relevant limits.

2.1.1 Recent PA modifications

Construction and operation of the site Concrete Batching Plant (CBP) and the extension of TSF2 were approved in September 2017 as part of Modification 4 (MOD4) of the site PA. The CBP is currently operational. The extension of TSF2 is currently being constructed and is to be completed by mid-2021.

Construction of a cement silo and warehouse extension were approved in October 2018 as part of Modification 5 (MOD5) of the site PA. The cement silo has been constructed at the backfill plant and the warehouse extension has been completed.

Crushing and screening activities in the BHP Pit to support the construction of TSF2 embankments during standard construction hours were approved as part of Modification 7 (MOD7). BHOP is seeking approval as part of MOD6 operations to continue crushing and screening activities in the BHP Pit.

Therefore, MOD4, MOD5 and MOD7 construction activities are not considered relevant to the assessment of MOD6 and noise from these activities have not been included in this assessment.

2.2 Proposed future MOD6 mining operations

BHOP is seeking to modify its PA (MOD6) to allow for the development of a new tailings storage facility. The prediction for the end of the life of TSF2 following the construction of embankments (MOD4) is late 2022, which means that mining will cease at that time if no other tailings storage facility is available. BHOP is proposing to develop the Kintore Pit into a new tailings storage facility (TSF3) for naturally dried tailings co-disposed with excess waste rock. This will involve several changes to existing approved mining operations at the Rasp Mine.

The underground mine portal which is currently located at the base of the Kintore Pit will be relocated. The new underground mine portal (the new portal) will require the construction of a boxcut and new access decline at the new location, in an area to the west of the primary crusher. The current underground mine portal will be sealed to transform Kintore Pit into TSF3. Subsequently, the new portal and new decline will be used to access the underground mine workings. The proposed location for the new portal will significantly reduce the length of the haul route to the RoM pad, which is a positive noise outcome of the proposed MOD6.

Tailings would need to be further dewatered from the current moisture content achieved by the milling process to reduce the risk of inrush or inundation to underground mining operations from the proposed TSF3. To achieve

this, BHOP is proposing to utilise TSF2 to naturally dry (using solar and wind) tailings. When sufficiently dried, tailings will be harvested and transported to TSF3 for permanent storage. Harvest and transport of dried tailings from TSF2 (Blackwood Pit) to TSF3 (Kintore Pit) is proposed to occur during the day period only, from 7 am to 6 pm Monday to Saturday and from 8 am to 6 pm Sundays.

Progressive rehabilitation capping over 'free areas' (ie any non-active mining areas on-site) will be completed using excess waste rock from underground mining. Waste rock considered suitable for rehabilitation capping will initially be transferred to BHP Pit and Kintore Pit Tipple for lead (Pb) content testing. Waste rock with a lead content of <0.5% will be used for capping of 'free areas' on a progressive basis. Waste rock with a lead content of 0.5% or more will be either returned underground, stored in the infill area of BHP Pit or co-disposed with tailings in TSF3. Progressive rehabilitation capping will be undertaken during the day period Monday to Friday.

This assessment addresses future site noise from existing and future mining operations combined.

2.3 Proposed MOD6 construction

2.3.1 Description

The proposed new portal will require the construction of a boxcut and new decline. The boxcut will be constructed at a depth to reach competent hard rock material and will consist of an exposed boxcut slope with approximately 10 m wide benches and 10 m high batters. Material from the boxcut construction, predominantly made up of competent rock, waste and mixed rock fill, will be transferred to Little Kintore Pit and BHP Pit for permanent storage.

The new decline will be developed from underground mine workings and extend 400 m to the proposed new portal. Underground activities associated with the development of the new decline are considered part of MOD6 construction activities, however they are not anticipated to generate significant noise levels at offsite receivers. Surface activities associated with the new decline development (eg trucking of waste rock) will start following breakthrough to the new portal, and hence were included in the construction noise modelling. The use of a temporary ventilation fan system will be required during the construction of the new decline and will be located at the base of the completed boxcut.

The use of the Kintore Pit as TSF3 will require the closure of the current underground mine portal and decline, and will involve managing old workings and recent workings beneath and around the pit. Additionally, the current underground mine portal and decline will be sealed using a concrete plug seal and waste rock backfill. Other TSF3 preparation works in the Kintore Pit will include constructing a shaping layer with seepage collection and installing a bridging layer from waste rock currently stockpiled in the pit, before starting the deposition of waste rock and harvested (naturally dried) tailings.

To prepare TSF2 for tailings harvesting, preparation works will be required to divide TSF2 into three bays (Cell A, Cell B and Cell C). These will be separated by intermediate bunds.

The proposed MOD6 will allow current production at the site to continue beyond 2022 through to December 2026. The locations of the new portal, boxcut, TSF2 and TSF3 are shown on Figure 2.1.

Figure 2.1 **Indicative site layout showing the proposed new portal, boxcut, TSF2 and TSF3**

2.3.2 Duration

The construction phase for MOD6 will be completed in several stages and is expected to take approximately 42 weeks. The proposed construction works and approximate duration for associated activities are shown in Table 2.1.

Table 2.1 Proposed construction works, associated activities and duration

Construction works	Activities	Duration
Boxcut	Laydown area	1 week
	Stage 1 – excavation to first bench (10 m depth) and trucking	11 weeks
	Stage 2 – excavation to second bench (20 m depth) and trucking	7 weeks
	Stage 3 – excavation to base of boxcut (30 m depth) and trucking	2 weeks
New decline (surface activities only)	Trucking from boxcut to waste emplacement areas	9 weeks[1]
TSF3 preparation works	Decline plug	4 weeks
	Shaping layer with seepage collection	4 weeks
	Bridging layer	4 weeks
TSF2 tailings harvest preparation works	Bunding for bays separation	1 week[2]

Notes: 1. Will start after completion of the boxcut construction and access is gained through the new portal.
2. These works will overlap with the last week of the TSF3 preparation works (bridging layer).

2.3.3 Construction hours

The majority of the proposed construction works will be completed during the ICNG's standard hours between 7 am and 6 pm Monday to Friday, 8 am to 1 pm on Saturdays, and no work on Sundays or public holidays. Proposed construction works will also occur outside the ICNG's recommended standard hours, (ie during out-of-hours (OOH)).

The construction of the boxcut, new decline surface trucking (after completion of the boxcut construction and access is gained through the new portal) and TSF2 tailings harvest preparation works are proposed to be completed between 7 am and 6 pm Monday to Saturday (excluding public holidays). This is one hour (7 am to 8 am) and five hours (1 pm to 6 pm) of OOH construction work on Saturdays and will remain within the daylight hours.

The TSF3 preparation works are proposed to occur 24 hours seven days a week, with related activities occurring within the pit.

The proposed construction hours are shown in Table 2.2.

Table 2.2 Proposed construction hours

Construction works	Construction hours		
	Standard hours Mon to Fri 7 am – 6 pm Sat 8 am – 1 pm	Day OOH Sat 7 am – 8 am Sat 1 pm – 6 pm	24 hours seven days a week
Boxcut	Yes	Yes	No
New decline surface trucking[1]	Yes	Yes	No
TSF2 harvesting preparation works	Yes	Yes	No
TSF3 preparation works[2]	Yes	Yes	Yes

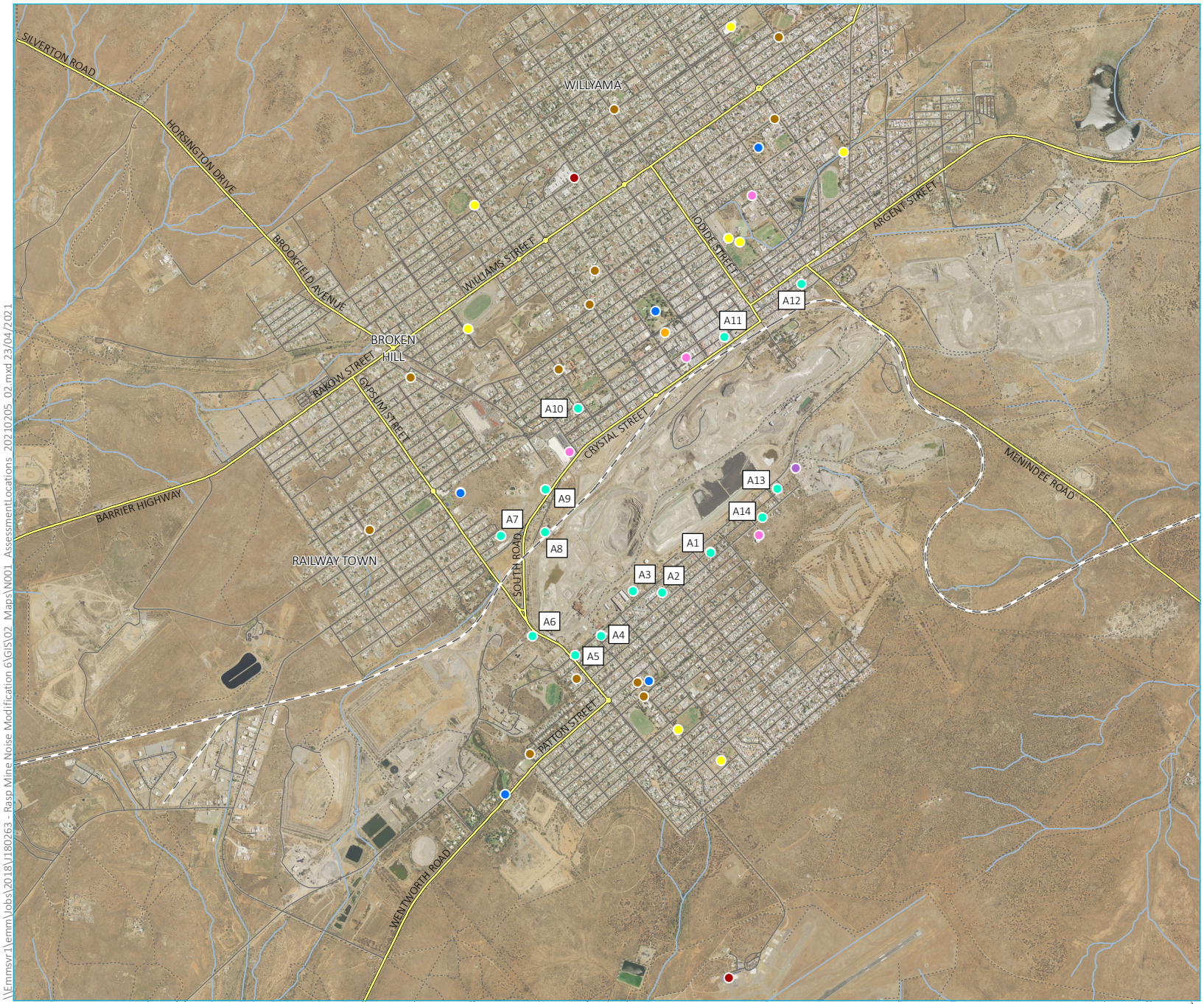
Notes: 1. After completion of the boxcut and access is gained through the new portal.
2. Restricted within TSF3.

2.4 Assessment locations

Representative assessment locations are provided in Table 2.3 and are shown on Figure 2.2. These are consistent with locations in previous noise assessments, the PA and EPL.

Table 2.3 Assessment locations

Assessment location ID	Location	Coordinates (MGA56)	
		Easting	Northing
A1	Piper St North	544110	6462598
A2	Piper St Central	543763	6462312
A3	Eyre St North	543555	6462322
A4	Eyre St Central	543324	6462003
A5	Eyre St South	543140	6461859
A6	Bonanza and Gypsum Streets	542833	6462000
A7	Carbon St	542604	6462718
A8	South Rd	542923	6462744
A9	Crystal St	542926	6463052
A10	Garnet and Blende Streets	543158	6463633
A11	Crystal St	544210	6464144
A12	Crystal St	544761	6464527
A13	Eyre St North	544592	6463059
A14	Piper St North	544532	6462860



Source: EMM (2021); DFSI (2017); GA (2011)

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Assessment locations

RASP mine modification 6
Noise impact assessment
Figure 2.2

EMM
creating opportunities

3 Existing environment

3.1 PA and EPL noise limits

Condition 17 of Schedule 3 of the project approval (PA 07_0018), modified (MOD7) and approved in July 2019, provides noise limits the project must meet during its operational phase and approved construction activities. These are consistent with the noise limits provided in the EPL. Extracts of PA and EPL are provided in Appendix B and Appendix C, respectively.

3.1.1 Current operational noise limits

The aim of this assessment is to demonstrate that site can achieve contemporary target noise levels in accordance with the Noise Policy for Industry (NPfI) (2017) and also largely meet current PA and EPL noise limits during future operations, including activities associated with the proposed TSF3, tailings harvesting, new portal location and progressive rehabilitation.

Current operational noise limits are based on project specific noise levels adopted in the noise impact assessment completed for the site in 2007. The project specific noise levels adopted in the 2007 noise impact assessment were derived based on measured or assumed minima rating background level (RBL) +5 dB for all assessment locations (residential), in accordance with the EPA's Industrial Noise Policy (now superseded by the NPfI).

Current operational noise limits as per the PA and EPL as well as the RBLs these are derived from are provided in Table 3.1.

Table 3.1 PA and EPL noise limits

Assessment location	Location	RBLs, dB(A)			PA/EPL operational noise limits, $L_{Aeq,15min}$, dB		
		Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
A1	Piper St North	33	32	30[4]	38	37	35
A2	Piper St Central	33	32	30[4]	38	37	35
A3	Eyre St North	39	36	34	44	41	39
A4	Eyre St Central	39	36	34	44	41	39
A5	Eyre St South	39	36	34	44	41	39
A6	Bonanza and Gypsum Streets	43	36	34	48	41	39
A7	Carbon St	30[4]	30[4]	30[4]	35	35	35
A8	South Rd	43	34	34	48	39	39
A9	Crystal St	41	34	34	46	39	39
A10	Garnet and Blende Streets	37	36	30	42	41	35
A11	Crystal St	41	34	34	46	39	39
A12	Crystal St	41	34	34	46	39	39
A13	419 Eyre St	33	30[4]	30[4]	38	35	35
A14	Piper St North	30[4]	30[4]	30[4]	35	35	35

Notes: 1. Day period: Monday to Saturday: 7 am to 6 pm, on Sundays and public holidays: 8 am to 6 pm.
2. Evening period: Monday to Saturday: 6 pm to 10 pm, on Sundays and public holidays: 6 pm to 10 pm.
3. Night period: Monday to Saturday: 10 pm to 7 am, on Sundays and public holidays: 10 pm to 8 am.
4. The EPA's minima RBL adopted based on policy as at 2007, where measurements indicate levels at or below minima.

3.1.2 Current PA construction noise limits

The operational noise limits provided in Table 3.1 do not apply to the following construction activities in accordance with Condition 17A of the PA:

- construction of the CBP and associated noise bund – completed;
- construction of TSF2 (MOD4) including:
  - embankment 2 – completed;
  - the spillway – completed;
  - embankment 3 – mostly completed;
  - embankment 1 – mostly completed;
- capping and rehabilitation of TSF2;
- construction of the cement silo and warehouse extension (MOD5) – completed; and
- crushing and screening activities associated with construction of TSF2 embankments (MOD7).

Noise limits for the aforementioned construction activities are provided in Condition 17B(c) of the PA, which states that BHOP must ensure that noise generated by the development does not cause exceedances of the amenity criterion of 65 dB $L_{Aeq,day}$ specified for an urban/industrial interface area under the INP. By extension of this condition, this assessment also adopts the same amenity criterion for the proposed MOD6 daytime construction works. A review of noise management and mitigation measures implemented for the Rasp Mine MOD4 construction works (undergoing) and associated monitoring data is discussed in Section 7.2.2.

3.2 Updated ambient noise monitoring at A7

A key element in assessing environmental noise impact from industry is to quantify the existing ambient acoustic environment. A review of the RBLs at assessment locations identified that the RBLs previously adopted for assessment location A7 (ie NPfI minimum threshold values) in previous noise impact assessments are relatively low compared to what is expected in that area of the community. Furthermore, an analysis of annual attended noise monitoring assessments completed by EMM for the site between 2017 and 2021 has identified that background noise levels at representative monitoring location A7 (refer to Figure 2.2) may have increased since the background noise monitoring that was originally completed for the site in 2007. The current site noise limits are based on the INP's minimum 30 dB night period rating background level (RBL). Hence, to verify the current background noise environment at A7 for the purpose of this assessment, ambient noise monitoring was completed at A7.

Both unattended and short-term operator-attended noise surveys were conducted at representative monitoring location A7. The ambient noise monitoring was completed in general accordance with the procedures described in Australian Standard 'AS 1055-1997 - Acoustics - Description and Measurement of Environmental Noise'. Monitoring results are discussed in the following sections.

To undertake long-term background noise monitoring (baseline noise survey using noise logging), the NPfI requires that the proposed development or existing site is not operational during the noise monitoring period. For the assessment of modifications to existing sites however, the NPfI provides an exception to this where long-term background noise monitoring can be undertaken whilst the site is operating. The exception is where the existing site has been operating for a significant period of time and is considered a normal part of the acoustic environment. The NPfI states that the operating site can be included in the background noise assessment under the following circumstances:

- the development must have been operating for a period in excess of 10 years in the assessment period/s being considered and is considered a normal part of the acoustic environment; and

- the development must be operating in accordance with noise limits and requirements imposed in a consent or licence and/or be applying best practice.

The Rasp Mine commenced with the decline development in 2007 to rework old mine workings. In 2011, BHOP gained project approval to re-open the mine and started mining operations in 2012. Several operational modifications have been approved since commencement. A number of management and mitigation measures have been implemented on-site since the original environmental assessment in 2007 as required, and to improve site noise levels at offsite receivers.

A review of historical attended noise monitoring and noise assessments prepared by EMM for the site (since 2013) indicated that site noise contributions during the attended noise monitoring have in all cases satisfied the relevant noise limit at A7. Furthermore, is it unlikely that noise influences background (L_{A90}) noise levels at A7. Given the aforementioned and in accordance with the NPfI, the background noise monitoring at A7 was completed with the site operating at the time of the monitoring.

3.2.1 Unattended noise monitoring at A7

Unattended noise monitoring using a noise logger was completed at assessment location A7, Carbon Street. The noise logger location was selected giving due consideration to other noise sources which may influence the readings (eg domestic air conditioning units or pumps), the proximity to the relevant assessment location, security issues for the noise logger and gaining permission from the residents or landowners to access the property.

The unattended measurements were carried out using a Svantek 979 noise logger (s/n 21094). The logger was in place between 6 and 19 June 2019 (approximately 14 consecutive days). The noise logger was programmed to record statistical noise level indices continuously in 15-minute intervals, including the L_{Amax}, L_{A1}, L_{A5} L_{A10}, L_{A25}, L_{A50}, L_{A75}, L_{A90}, L_{Amin} and L_{Aeq}. Calibration of all instrumentation was checked prior to and following measurements using a Brüel & Kjær (B&K) 4230 calibrator (s/n 1441415). All equipment carried appropriate and current NATA calibration certificates.

Weather data for the survey period was obtained from the Bureau of Meteorology (BoM) automatic weather station (AWS) located at the Broken Hill Airport (station ID 47048). Wind speed and rainfall data were used to exclude recorded noise data during periods when the average wind speed was in excess of 5 m/s and/or during rainfall events in accordance with NPfI methods.

A summary of the RBLs and ambient L_{Aeq} noise levels for A7 is given in Table 3.2. The previously adopted RBLs quoted are based on the monitoring data collected in 2007. Results are provided in a table form and graphically for each day of the monitoring period in Appendix D.

Table 3.2 Summary of existing background and ambient noise levels for A7

Monitoring location	Assessment period[1]	Previously adopted RBL[2], dB(A)	RBL, dB(A)[4]
A7	Day	30[3]	40
	Evening	30[3]	37
	Night	30[3]	31

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Morning shoulder: 6 am to 7 am Monday to Saturday, 6 am to 8 am Sundays and public holidays; Night: remaining periods.
2. The RBL is an INP/NPfI term and is used represent the background noise level.
3. Based on measured data collected in 2007.
4. Based on measured data collected in 2019.

3.2.2 Attended noise monitoring at A7

EMM completed two consecutive 15-minute attended noise measurements during the night period on 6 June 2019 at A7 to identify and quantify audible noise sources contributing to the ambient noise environment, including site noise contribution at the time.

Operator-attended noise measurements were conducted using a B&K 2250 integrating sound analyser (s/n 3008201). Field calibration of the instrument was completed using a B&K 4230 calibrator (s/n 1441415). Attended noise measurements were undertaken in accordance with AS 1055-1997. Meteorological conditions throughout the survey period were relatively calm with no winds above 5 m/s (at microphone height) and no rainfall.

A summary of results for the attended noise monitoring is provided in Table 3.3.

Table 3.3 Summary of attended noise monitoring results – A7

Monitoring location	Date	Start time (hours)	Measured total noise levels (15-minute), dB			Site $L_{Aeq,15min}$ noise contribution, dB	Observations
			L_{A90}	L_{Aeq}	L_{Amax}		
A7	6/6/19	22:15	42	45	64	30	Site crusher and mill just audible during low road traffic noise, with haul trucks audible during the second half of the measurement period. Road traffic noise dominant.
		22:30	40	44	63	33	Site crusher and mill audible during low road traffic noise, with haul trucks audible during the first half of the measurement period. Road traffic noise dominant. Occasional dog barking.

The ambient noise environment at A7 was found to be dominated by road traffic noise during the night-time attended noise monitoring. Road traffic noise was also observed to be influential to the background noise (L_{A90}) environment. Attended noise monitoring also identified that site noise was audible at A7 at the time of the attended noise measurements. Audible site noise sources included the mill and crusher, as well as engine revs from haul trucks. The noise monitoring results demonstrated that site $L_{Aeq,15min}$ noise contributions (30 dB and 33 dB) at A7 during the two measurements satisfied the current 35 dB noise limit.

3.2.3 Adopted RBLs for A7

Based on the updated ambient noise monitoring results for assessment location A7, the RBLs provided in Table 3.2 have been adopted for the purpose of this assessment. The RBLs for assessment location A7 are more comparable to those at nearby locations A6, A8 and A9, particularly for the day and evening periods, indicating a more equitable assessment can now be completed for that area of the community. The construction noise management levels and operational noise trigger levels adopted for assessment location A7 were based on these RBLs as discussed further in Section 4.1 and Section 4.2.

3.3 Meteorology

Noise propagation over distance can be significantly affected by meteorological conditions. Of most interest are source-to-receiver winds, the presence of temperature inversions and drainage flow (katabatic winds), as these conditions can enhance noise propagation. To account for the influence of weather conditions in the noise impact assessment, the NPfI requires assessment of noise under standard and noise-enhancing weather conditions, if found relevant. The NPfI defines these as follows:

- Standard meteorological conditions: defined by stability categories A through to D with wind speeds up to 0.5 m/s at 10 m above ground level (AGL) for day, evening and night periods.

- Noise-enhancing meteorological condition: defined by stability categories A through to D with light winds (up to 3 m/s at 10 m AGL) for the day and evening periods; and stability categories A through to D with light winds (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL.

Fact Sheet D of the NPfI specifies the following two options to consider meteorological effects:

1. Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speed up to 2 m/s at night; or

2. Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the NPfI provisions. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.

This assessment considered the NPfI's second option above in assessing the significance of noise-enhancing conditions for modelling purposes. However, based on the findings, this assessment has conservatively adopted the NPfI's first option in adopting the noise-enhancing meteorological conditions for all assessment periods for the modelling as summarised in Section 3.3.1 and Section 3.3.2.

3.3.1 Winds

The NPfI recommends consideration of wind effects if they are "significant" for the project area. The NPfI defines significant as the presence of source-to-receiver wind speed (measured at 10 m AGL) of 3 m/s or less, occurring for 30% of the time in any assessment period and season. This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The NPfI states that where wind is identified to be a significant feature of the area, then the assessment of noise impacts should consider the highest wind speed up to 3 m/s that is considered to occur for at least 30% of the time.

An analysis of the vector components of half-hourly wind data recorded by the BoM automatic weather station (AWS) located at the Broken Hill Airport was undertaken for the period between 2014 and 2019 (5 years). No winds were identified to trigger the NPfI 30% threshold of occurrence.

3.3.2 Temperature inversions

Temperature inversions (ie where atmospheric temperature increases with altitude) typically occur during the night-time period in the winter months and can increase site noise levels at surrounding assessment locations. As per the NPfI, temperature inversions are to be assessed if they are found to occur for 30% of the time (about two nights per week) or greater during the winter months.

Drainage flow winds (katabatic winds, when localised cold air travel in a direction of decreasing altitude) can occur during temperature inversion conditions. The increase of noise levels caused by drainage flow winds need consideration if a development (ie noise source) is at a higher altitude to surrounding assessment locations, and where there is no intervening topography. Given the relatively short distance and abrupt topography between the site and the assessment locations, the potential for source-to-receiver drainage flow winds to occur is not considered relevant.

The NPfI states that the assessment of noise impact with influence from temperature inversions (stability category F or G) be confined to the night assessment period when they typically occur.

The frequency of occurrence of temperature inversions was determined based on sigma-theta data obtained from the BoM AWS located at the Broken Hill Airport between 2014 and 2019 (5 years). It was found from the analysis of the data that F and/or G stability class temperature inversions did not occur for 30% or greater of the night period and therefore does not trigger the NPfI assessment requirement.

3.3.3 Adopted meteorological conditions for modelling

The meteorological data analysis showed that the occurrence of winds and temperature inversions were not 30% of the time or greater in the project area. However, this assessment has conservatively adopted the NPfI's first option in adopting the noise-enhancing meteorological conditions for all assessment periods for the modelling.

4 Criteria

4.1 Construction noise assessment

Consistent with previous assessments and prior instructions from DPIE, the assessment of noise from construction works has been completed using the DECC's Interim Construction Noise Guideline (ICNG) (2009). The ICNG provides two methods for the assessment of construction noise emissions:

- quantitative: suited to major construction projects with typical durations of more than three weeks; and
- qualitative: suited to short term infrastructure maintenance (3 weeks or less).

The method for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest sensitive receivers, whilst the qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. Due to the type of construction works proposed for MOD6 and anticipated duration, this assessment has adopted a quantitative assessment approach.

The ICNG recommends standard hours for normal construction work which are Monday to Friday from 7 am to 6 pm, Saturdays from 8 am to 1 pm, and no work on Sundays or public holidays. The majority of the proposed construction works will be completed during the ICNG standard hours (refer to Table 2.2).

Where noise levels from construction works are predicted above the noise affected level during standard hours and/or OOH, all feasible and reasonable noise management and mitigation measures should be implemented.

4.1.1 ICNG noise management levels

Table 2 of the ICNG provides guidance on establishing noise management levels (NMLs) for residential receivers during standard hours and OOH and is reproduced in Table 4.1.

Table 4.1 ICNG residential NMLs

Time of day	NML $L_{Aeq,15min}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm; Saturday 8 am to 1 pm; No work on Sundays or public holidays	Noise affected RBL + 10 dB	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.

Table 4.1 ICNG residential NMLs

Time of day	NML $L_{Aeq,15min}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm; Saturday 8 am to 1 pm; No work on Sundays or public holidays	Highly noise affected 75 dB	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: i) 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. ii) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOH)	Noise affected RBL + 5 dB	• 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 above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements, see section 7.2.2 of the ICNG.

Source: ICNG (DECC 2009).

Further, the ICNG provides NMLs for other sensitive land uses (non-residential receivers) for standard hours or OOH and these are shown in Table 4.2.

Table 4.2 ICNG NMLs for other sensitive land uses (non-residential)

Land use	NML, $L_{Aeq,15min}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB
Hospital wards and operating theatres	Internal noise level 45 dB
Places of worship	Internal noise level 45 dB
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB
Community centres	Depends on the intended use of the centre Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses

Source: ICNG (DECC 2009).

The ICNG also provides NMLs for commercial and industrial land uses for standard hours or OOH and these are shown in Table 4.3.

Table 4.3 ICNG NMLs for commercial and industrial land uses (non-residential)

Land use	NML, $L_{Aeq,15min}$
Industrial premises	External noise level 75 dB (when in use)
Commercial (eg offices, retail outlets)	External noise level 70 dB (when in use)

Source: ICNG (DECC 2009).

4.1.2 MOD6 construction NMLs

Construction NMLs adopted for this assessment for standard hours and OOH were derived in accordance with the ICNG for all assessment locations and are presented in Table 4.4.

The MOD6 construction NMLs for most residential assessment locations have been based on the RBLs determined during previous noise assessments completed for the Rasp Mine and application of the NPfI. For assessment location A7, the RBLs were determined from the more recent ambient noise monitoring completed in June 2019 (refer to Section 3.2). As shown in Table 4.4, the RBLs for assessment location A7 are more comparable to those at nearby locations A8 and A9, indicating a more equitable assessment can now be completed for that area of the community.

The construction NMLs for standard hours are based on RBL + 10 dB. The existing PA noise limit of 65 dB $L_{Aeq,day}$ for approved construction noise at the site has also been adopted for all MOD6 construction activities proposed to occur during the day period (standard hours and day OOH). This is also shown in Table 4.4.

The construction NMLs for OOH periods are based on RBL + 5 dB. For the evening and night OOH periods, the construction NMLS are consistent with operational project noise trigger levels (PNTLs) for those periods (refer to Section 4.2.3). Therefore, if construction noise levels satisfy the NMLs for the evening and night OOH periods, adopted operational PNTLs for the evening and night periods will also be satisfied.

Given that most non-residential receivers (Table 4.2 and Table 4.3) are located further away from site than residential receivers (refer to Figure 2.2) and the relevant NMLs are less stringent than those for residential receivers, construction noise levels are anticipated to satisfy the relevant limits at all non-residential receivers.

Table 4.4 Site specific construction NMLs (as per ICNG) and PA day noise limit for residential assessment locations

Assessment location	Description	RBLs[1], dB(A)			NMLs, $L_{Aeq,15min}$, dB				PA limit[2], $L_{Aeq,day}$, dB
		Day	Evening	Night	Standard hours (RBL+10)	Day OOH (RBL+5)	Evening OOH (RBL+5)	Night OOH (RBL+5)	Day
A1	Piper St North	35[3]	32	30	45	40	37	35	65
A2	Piper St Central	35[3]	32	30	45	40	37	35	65
A3	Eyre St North	39	36	34	49	44	41	39	65
A4	Eyre St Central	39	36	34	49	44	41	39	65
A5	Eyre St South	39	36	34	49	44	41	39	65

Table 4.4 Site specific construction NMLs (as per ICNG) and PA day noise limit for residential assessment locations

Assessment location	Description	RBLs[1], dB(A)			NMLs, $L_{Aeq,15min}$, dB				PA limit[2], $L_{Aeq,day}$, dB
		Day	Evening	Night	Standard hours (RBL+10)	Day OOH (RBL+5)	Evening OOH (RBL+5)	Night OOH (RBL+5)	Day
A6	Bonanza & Gypsum Sts	43	36	34	53	48	41	39	65
A7	Carbon St	40[4]	37[4]	31[4]	50	45	42	36	65
A8	South Rd	43	34	34	53	48	39	39	65
A9	Crystal St	41	34	34	51	46	39	39	65
A10	Garnet & Blende Sts	37	36	30	47	42	41	35	65
A11	Crystal St	41	34	34	51	46	39	39	65
A12	Crystal St	41	34	34	51	46	39	39	65
A13	419 Eyre St	35[3]	30	30	45	40	35	35	65
A14	Piper St North	35[3]	30	30	45	40	35	35	65

Notes: 1. Referenced from EMM report *Rasp Mine Modification 4 – Concrete batching plant and TSF2 (Blackwood Pit) extension – Noise impact assessment* (2017) unless noted otherwise.
2. Existing PA noise limit for construction activities approved at the site (MOD4, MOD5 and MOD7) has also been adopted for all MOD6 construction activities proposed to occur during the day period.
3. Based on the NPfI minimum day period RBL of 35 dB, in accordance with the ICNG.
4. Determined from the ambient noise monitoring completed in June 2019 (refer to Table 3.2).
5. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Morning shoulder: 6 am to 7 am Monday to Saturday, 6 am to 8 am Sundays and public holidays; Night: remaining periods.

4.2 Operational noise

Noise from industrial sites or processes (eg onsite truck movements or material processing etc.) in NSW is regulated by the local council, DPIE and/or the EPA, and generally have a licence and/or development consent conditions stipulating noise limits. These limits are generally derived from project specific noise trigger levels or operational noise levels predicted at assessment locations. They are based on EPA guidelines (ie NPfI or previous INP) or noise levels that can be achieved by a specific site following the application of all reasonable and feasible noise mitigation.

The objectives of noise trigger levels for industry are to protect the community from excessive intrusive noise and preserve amenity for specific land uses. It should be noted that the audibility of a noise source does not necessarily equate to disturbance at an assessment location.

To ensure these objectives are met, the EPA provides project specific noise trigger levels, namely intrusiveness and amenity noise levels as described in the NPfI.

It is noted that since the MOD4 noise assessment, the INP (EPA 2000) has been superseded by the NPfI (EPA 2017). In accordance with the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry (2017)*, this assessment has adopted the NPfI approach and hence assessment requirements for operational noise (eg criteria) and modelling methodologies (eg modelled meteorological conditions) have been updated where applicable.

4.2.1 Intrusiveness noise levels

The intrusiveness noise levels require that $L_{Aeq,15min}$ noise levels from the site during the relevant operational periods do not exceed the RBL by more than 5 dB. The daytime RBLs for A1, A2, A13 and A14 have been updated to align with the NPfI minimum RBL for the day period (ie 35 dB). Furthermore, the RBLs for A7 have been updated based on ambient noise monitoring completed in June 2019 (refer to Table 3.2).

Table 4.5 presents the intrusiveness noise levels determined for the site based on the adopted RBLs. It is noted that intrusiveness noise levels are only applicable at residential assessment locations.

Table 4.5 Project intrusiveness noise levels

Assessment location[1]	Adopted RBL[2], dB(A)			Project intrusiveness noise level (RBL + 5 dB), $L_{Aeq,15min}$, dB		
	Day	Evening	Night	Day	Evening	Night
A1	35[3]	32	30	40	37	35
A2	35[3]	32	30	40	37	35
A3	39	36	34	44	41	39
A4	39	36	34	44	41	39
A5	39	36	34	44	41	39
A6	43	36	34	48	41	39
A7	40[4]	37[4]	31[4]	45	42	36
A8	43	34	34	48	39	39
A9	41	34	34	46	39	39
A10	37	36	30	42	41	35
A11	41	34	34	46	39	39
A12	41	34	34	46	39	39
A13	35[3]	30	30	40	35	35
A14	35[3]	30	30	40	35	35

Notes:
1. Residential assessment locations only.
2. Referenced from EMM report *Rasp Mine Modification 4 – Concrete batching plant and TSF2 (Blackwood Pit) extension – Noise impact assessment* (2017) unless noted otherwise.
3. Based on the NPfI minimum day period RBL of 35 dB.
4. Determined from most recent ambient noise monitoring completed in June 2019 (refer to Table 3.2).
5. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.

4.2.2 Amenity noise levels

The assessment of amenity is based on noise levels specific to the land use. The noise levels assessed relate only to industrial noise and exclude road or rail traffic noise. Where the measured existing industrial noise approaches recommended amenity noise levels, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level for a new industrial development is the recommended amenity noise

level (outlined in Table 2.2 of the NPfI) minus 5 dB. It is noted that this approach is based on a receiver being impacted by three or four individual industrial sites (or noise sources).

The noise amenity area for residential assessment locations surrounding the site have been conservatively categorised as 'suburban' or 'urban' amenity category based on existing background noise levels and contributing noise sources in accordance with the definitions provided in Table 2.3 of the NPfI. Arguably, the closest residences to site could be categorised as 'urban within an industrial interface'. As per Table 2.3 of the NPfI, 'suburban' and 'urban' residential areas are defined as follows:

- suburban – "an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry".
- urban – "an area with an acoustical environment that:
  - is dominated by 'urban hum' or industrial noise source;
  - has through-traffic with characteristically heavy and continuous traffic flows during peak periods;
  - is near commercial districts or industrial districts; and
  - has any combination of the above."

The corresponding project amenity noise levels for the project are given in Table 4.6. A conservative approach of adopting the minus 5 dB method was used for all assessment locations, although in reality only noise from site is likely to be experienced at most assessment locations and hence site could 'take up' the whole of the amenity target at some residences.

Table 4.6 Project amenity noise levels

Assessment locations	Indicative area[1]	Time period[2]	Project amenity noise level dB, $L_{Aeq,period}$ (Recommended amenity noise level minus 5 dB)
A1, A2, A7, A10, A13, A14	Suburban	Day	50
		Evening	40
		Night	35
A3, A4, A5, A6, A8, A9, A11, A12	Urban	Day	55
		Evening	45
		Night	40

Source: NPfI (EPA 2017).

Notes: 1. Based on existing background noise levels.
2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday; 10 pm to 8 am Sundays and public holidays.

4.2.3 Project noise trigger levels

The NPfI's PNTL are the lower of the calculated intrusiveness or amenity noise levels and are provided in Table 4.7 for all assessment locations.

It is commonly acknowledged and accepted amongst regulators and industry that average noise levels are typically 3 dB higher over a 15-minute worst-case assessment period when compared to an entire day (11 hour), evening (4 hour) and night (9 hour) assessment period. To standardise the time periods for the intrusiveness and amenity noise levels, the NPfI states that the $L_{Aeq,15min}$ is equivalent to the $L_{Aeq,period}$ + 3 dB, unless robust evidence is provided for an alternative approach for the particular project being considered. This approach has been adopted for this assessment.

Table 4.7 Adopted PNTLs

Assessment location	Intrusiveness noise levels $L_{Aeq,15min}$, dB			Amenity noise levesl[1] $L_{Aeq,15min}$, dB			Adopted PNTLs[2] $L_{Aeq,15min}$, dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
A1 (Residential)	40	37	35	53	43	38	40	37	35
A2 (Residential)	40	37	35	53	43	38	40	37	35
A3 (Residential)	44	41	39	58	48	43	44	41	39
A4 (Residential)	44	41	39	58	48	43	44	41	39
A5 (Residential)	44	41	39	58	48	43	44	41	39
A6 (Residential)	48	41	39	58	48	43	48	41	39
A7 (Residential)	45	42	36	53	43	38	45	42	36
A8 (Residential)	48	39	39	58	48	43	48	39	39
A9 (Residential)	46	39	39	58	48	43	46	39	39
A10 (Residential)	42	41	35	53	43	38	42	41	35
A11 (Residential)	46	39	39	58	48	43	46	39	39
A12 (Residential)	46	39	39	58	48	43	46	39	39
A13 (Residential)	40	35	35	53	43	38	40	35	35
A14 (Residential)	40	35	35	53	43	38	40	35	35

Notes:
1. Project amenity $L_{Aeq,15min}$ noise level is the project amenity noise level $L_{Aeq,period}$ + 3 dB as per the NPfI.
2. Adopted PNTLs are the lower of the calculated intrusiveness or amenity noise levels.
3. External level based on an external-to-internal noise reduction of 10 dB, in accordance with the NPfI.
4. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.

It is noted that the adopted PNTLs shown in Table 4.7 are based on the intrusiveness noise levels and largely unchanged from the existing PA and EPL limits. The only changes are for the less sensitive daytime period due to NSW EPA policy changes (for assessment locations A1, A2, A13 and A14) and updated RBLs for assessment location A7. EMM recommends that site noise limits (in the PA and EPL) be adjusted in accordance with the findings of this assessment (updated ambient noise monitoring at A7) and the NPfI.

The existing PA and EPL limits and PNTLs adopted for this assessment are shown in Table 4.8 for comparison, with changes in the PNTLs shown in bold font.

Table 4.8 Existing PA/EPL operational noise limits versus adopted PNTLs

Assessment location	PA/EPL operational noise limits $L_{Aeq,15min}$, dB			Adopted PNTLs $L_{Aeq,15min}$, dB		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
A1 (Residential)	38	37	35	**40**[4]	37	35
A2 (Residential)	38	37	35	**40**[4]	37	35
A3 (Residential)	44	41	39	44	41	39
A4 (Residential)	44	41	39	44	41	39
A5 (Residential)	44	41	39	44	41	39
A6 (Residential)	48	41	39	48	41	39
A7 (Residential)	35	35	35	**45**[5]	**42**[5]	**36**[5]
A8 (Residential)	48	39	39	48	39	39
A9 (Residential)	46	39	39	46	39	39
A10 (Residential)	42	41	35	42	41	35
A11 (Residential)	46	39	39	46	39	39
A12 (Residential)	46	39	39	46	39	39
A13 (Residential)	38	35	35	**40**[4]	35	35
A14 (Residential)	35	35	35	**40**[4]	35	35

Notes:
1. Day period: Monday to Saturday: 7 am to 6 pm, on Sundays and public holidays: 8 am to 6 pm.
2. Evening period: Monday to Saturday: 6 pm to 10 pm, on Sundays and public holidays: 6 pm to 10 pm.
3. Night period: Monday to Saturday: 10 pm to 7 am, on Sundays and public holidays: 10 pm to 8 am.
4. Based on the NPfI minimum day period RBL of 35 dB.
5. Updated based on ambient noise monitoring completed in June 2019 (refer to Table 3.2).

4.2.4 Sleep disturbance trigger levels

The site will continue to operate during the night-time period and therefore, in accordance with the NPfI, the potential for sleep disturbance has been assessed. It is noted that noise from proposed night-time construction works (ie TSF3 preparation works) have also been considered in the assessment of sleep disturbance.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where the development/premises night-time noise levels at a residential location exceed the following screening criteria:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater); and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

The sleep disturbance screening criteria for all residential assessment locations are provided in Table 4.9.

Table 4.9 Maximum noise level event screening criteria

Assessment location[1]	Adopted (night) RBL[2], dB(A)	Maximum noise level event screening criteria, dB	
		RBL +5 dB or standard[3]	RBL +15 dB or standard[3]
		$L_{Aeq,15min}$	L_{Amax}
A1	30	40	52
A2	30	40	52
A3	34	40	52
A4	34	40	52
A5	34	40	52
A6	34	40	52
A7	31[4]	40	52
A8	34	40	52
A9	34	40	52
A10	30	40	52
A11	34	40	52
A12	34	40	52
A13	30	40	52
A14	30	40	52

Notes: 1. Residential assessment locations only.
2. Referenced from EMM report *Rasp Mine Modification 4 – Concrete batching plant and TSF2 (Blackwood Pit) extension – Noise impact assessment* (2017) unless noted otherwise.
3. Whichever is greater.
4. Determined from the most recent ambient noise monitoring completed in June 2019 (refer to Table 3.2).

4.3 Road traffic noise

Road traffic volumes and routes, as well as rail traffic associated with MOD6 will not change from existing operations and hence noise impacts associated with road and rail traffic has not been assessed as part of this report.

5 Noise modelling methodology

5.1 Noise modelling software

Quantitative modelling of construction and operational noise was completed using DGMR iNoise noise prediction software (from the developers of the long standing Predictor product). This software applies the EPA accepted ISO 9613 approach and calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The model incorporated factors such as:

- the lateral and vertical location of plant and equipment;
- source-to-receiver distances;
- ground effects;
- atmospheric absorption;
- topography; and
- meteorological conditions.

Three-dimensional digitised ground contours of the site and surrounding land were incorporated to model topographic effects. Equipment was modelled at locations and heights representative of proposed construction activities and future operations.

5.2 Construction noise

5.2.1 Construction modelling scenarios

The construction noise modelling was based on information received from BHOP including the locations of works, the list of activities, the list of plant and equipment items and approximate schedule. To determine the worst-case noise from the proposed construction activities, construction noise levels predicted for each activity were added to noise levels from existing site operations. Noise from existing site operations was modelled and validated based on site noise contributions determined during recent attended compliance monitoring completed in 2018 and 2019 (refer to Section 6.2). The overarching approach is to model worst-case construction activities together with existing site operations as relevant.

Each construction scenario was carefully reviewed to identify constructions works that would result in worst-case noise at offsite locations for all relevant ICNG assessment periods.

During standard hours and day OOH on Saturdays (7 am to 8 am and 1 pm to 6 pm), activities proposed to be undertaken include the boxcut construction (Stage 1, Stage 2 and Stage 3), construction of the new decline (surface trucking), TSF3 preparation works and TSF2 harvesting preparation works. A review of the construction schedule identified that proposed construction works (excluding underground works) are anticipated to occur at different stages of construction and hence will not overlap. The exception will be during the TSF2 harvesting preparation works (one week in duration) which will overlap with the last week of the TSF3 preparation works (bridging layer) during the standard hours and day OOH periods. Therefore, activities associated with the TSF2 harvesting preparation works were modelled in combination with activities associated with the TSF3 bridging layer.

The construction of the TSF3 (TSF3 preparation works) is proposed to be undertaken 24 hours and 7 days a week and hence during the evening and night OOH periods. No other construction works are proposed during the evening or night OOH periods. Therefore, activities associated with the TSF3 preparation works were modelled as the worst-case scenario for the evening and night OOH periods.

Worst-case modelled MOD6 construction works are summarised in Table 5.1.

Table 5.1 Modelled worst-case construction works

ICNG assessment period	Modelled worst-case MOD6 construction scenarios
Standard hours[1]/Saturday day OOH[2]	1. Boxcut construction Stage 1
	2. Boxcut construction Stage 2
	3. Boxcut construction Stage 3
	4. New decline development surface trucking
	5. TSF3 preparation works (within Kintore Pit)
	6. TSF2 harvesting preparation works and TSF3 preparation works (bridging layer only – within Kintore Pit)
Monday to Sunday evening[3]/night[4] OOH	7. TSF3 preparation works (within Kintore Pit)

Notes: 1. Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm.
2. Saturday 7 am to 8 am and 1 pm to 6 pm.
3. Monday to Sunday 6 pm to 10 pm.
4. Monday to Saturday 10 pm to 7 am, Sunday 10 pm to 8 am.

5.2.2 Modelled plant and equipment

Plant and equipment items to be used for these construction works were modelled. Further, the positions of sources represent typical worst-case noise conditions (ie at the highest and most exposed topographical points).

Modelled construction activities, associated noise sources and sound power levels for the relevant scenarios are summarised in Table 5.2. These levels are based on on-site measurement data or otherwise have been supplemented using EMM's database of equipment used for similar projects.

Table 5.2 Modelled noise sources for construction

Construction works	Plant or equipment item	Quantity	Sound power level, dB(A)
Boxcut (Stage 1)	Excavator (65 t)	1	107
	Haul truck (43 t) (Cat 740 or Volvo A40E)	6	108
	Watercart	3	105[1]
	Dozer (Cat D9)	2	117
	Grader (Cat 12M)	1	104
Boxcut (Stage 2)	Excavator (65 t)	1	107
	Haul truck (43 t) (Cat 740 or Volvo A40E)	6	108
	Watercart	3	105[1]
	Dozer (Cat D9)	2	117
	Grader (Cat 12M)	1	104

Table 5.2 Modelled noise sources for construction

Construction works	Plant or equipment item	Quantity	Sound power level, dB(A)
Boxcut (Stage 3)	Excavator (65 t)	1	107
	Haul truck (43 t) (Cat 740 or Volvo A40E)	3	108
	Watercart	3	105[1]
	Dozer (Cat D9)	2	117
	Grader (Cat 12M)	1	104
New decline development surface trucking	Haul truck (43 t) (Cat 740 or Volvo A40E)	1	108
	Watercart	1	105[1]
TSF3 preparation works (shaping layer)	Excavator (30 t)	1	99
	Haul truck (43 t) (Cat 740 or Volvo A40E)	3	108
	Watercart	1	105[1]
	Front-end loader (eg Volvo 250G)	1	109
	Mobile crusher[3]	1	112
	Compactor (20 t)	1	116
	Dozer (Cat D8)	1	117
	Rigid body tip truck (24 t)	1	102
TSF3 preparation works (bridging layer)	Excavator (45 t)	1	107
	Haul truck (43 t) (Cat 740 or Volvo A40E)	4	108
	Watercart	1	105[1]
	Dozer (Cat D8)	1	117
TSF2 harvesting preparation works	Excavator (45 t)	1	107
	Haul truck (43 t) (Cat 740 or Volvo A40E)	1	108
	Roller	1	104

Notes: 1. Measured on-site by EMM.
2. Day period only.

5.3 Future operational noise

The future (MOD6) operational noise modelling was based on information provided by BHOP. This included a detailed description of the proposed harvesting and storage operations, future haul routes (eg new portal to RoM pad), mobile crusher/screen location and progressive rehabilitation locations. All plant and equipment items were modelled at locations and heights representative of typical operational activities.

Modelled operational noise sources for proposed future operations (including existing noise sources) and associated sound power levels are summarised in Table 5.3. The sound power levels are based on on-site measurements or otherwise have been supplemented using EMM's database of equipment used for similar projects. Single octave sound power levels are provided in Appendix E.

Table 5.3 Modelled worst-case noise sources for operations

Plant or equipment item	Proposed MOD6 indicative location	Quantity		Sound power level, dB(A)
		Existing	MOD6	
CBP (enclosed batching and slumping)	CBP area	1	1	43-53 (per m^2)
CBP front-end loader (CBP FEL)	CBP area	1	1	102
CBP conveyor drive	CBP area	2	2	94
CBP conveyor (covered)	CBP area	1	1	75 (per m)
Concrete agitator truck (driving)	CBP to new portal	1	1	103
Heavy vehicle – cement deliveries[1]	Train loadout facility to CBP	1	1	102
Heavy vehicle – aggregates deliveries[1]	Site gate to CBP	1	1	102
Ventilation fan exhaust	Immediately west of CBP area	1	1	84[2]
Primary crusher (enclosed)	Processing area/RoM pad	1	1	107[2]
Transfer station (primary crusher/mill)	Processing area	2	2	104[2]
Front-end loader (FEL)	Processing area/RoM pad	1	1	105
Processing plant (mill and filter plant)	Processing area	1	1	102[2]
Underground haul truck (55 t TH663) – ore	New portal to RoM pad	3	3	108[2]
Underground haul truck (43 t TH551) – waste	New portal to BHP Pit	2	2	108[2]
Watercart	Haul roads and other work areas	2	2	105[2]
Container forklift	Train loadout facility	1	1	104
Mobile crusher/screen[1,3]	BHP Pit or Kintore Pit Tipple	1	1	112
Front-end loader (FEL)[1]	BHP Pit	-	1	105
Excavator (65 t) – progressive rehabilitation[1]	BHP Pit	-	1	107
Haul truck – progressive rehabilitation[1]	BHP Pit to rehab locations ('free areas')	-	1	108
Dozer (eg D6)[1]	TSF3	-	1	111
Excavator (35 t) – tailings harvest	TSF2 cells	-	1	109
Dozer (eg D6) – tailings harvest	TSF2 cells	-	2	111
Grader	TSF2 Cells	-	1	104
Haul truck – tailings harvest [1]	Travelling between TSF2 and TSF3	-	1	108

Notes: 1. Day period only – Monday to Saturday between 7 am and 6 pm, Sundays and public holidays between 8 am to 6 pm.
2. Measured on-site by EMM.
3. Mobile crusher/screen has been modelled in BHP Pit as a worst-case scenario.

5.4 Modelled meteorological conditions

Winds and temperature inversions were not identified applicable to the project area in accordance with the NPfI (refer to Section 3.3). As a conservative approach however, this assessment has adopted the meteorological conditions within the international standard ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors'. As per Section 1 of ISO 9613:

> The method predicts the equivalent continuous A-weighted sound pressure level (as described in parts 1 to 3 of ISO 1996) under meteorological conditions favourable to propagation from sources of known sound emission.
>
> These conditions are for downwind propagation, as specified in 5.4.3.3 of ISO 1996-2:1987 or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

Furthermore, although stability category F temperature inversions were not found to be a significant feature of the project area (refer to Section 3.3.2), this assessment has adopted stability category F temperature inversion with 2 m/s wind speed (source-to-receiver) for the most critical night period and hence the modelling of night-time site operations is considered worst-case.

A summary of modelling conditions for which noise predictions have been provided for construction and operations are shown in Table 5.4.

Table 5.4 Meteorological parameters adopted for the noise impact assessment

Assessment period[1]	Meteorological conditions	Air temperature	Relative humidity	Wind speed[2]	Wind direction	Stability category
Day	Wind (as per ISO 9613)	20°C	70%		ISO 9613[2]	
Evening	Wind (as per ISO 9613)	10°C	90%		ISO 9613[2]	
Night	Wind (as per ISO 9613)	10°C	90%		ISO 9613[2]	
	Temperature inversion and wind	10°C	90%	2 m/s	All	F

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Morning shoulder: 6 am to 7 am Monday to Saturday, 6 am to 8 am Sundays and public holidays; Night: remaining periods.
2. Sections 5 and 8 of ISO 9613-2:1996.

6 Noise assessment results

6.1 Construction noise

6.1.1 Daytime construction

Predicted site noise levels for each worst-case construction scenarios (refer to Table 5.1) during noise-enhancing weather conditions (refer to Table 5.4) for the ICNG daytime assessment periods (standard hours and day OOH Saturday) are shown in Table 6.1. Noise levels predicted to be above day OOH NMLs are indicated in bold and noise levels predicted to be above the standard hours NMLs are indicated by grey shading and bold font. The levels presented include noise from approved operational activities.

A 65 dB $L_{Aeq,day}$ is equivalent to a 65 dB $L_{Aeq,15min}$ +3 dB as per the NPfI, and hence a 68 dB $L_{Aeq,15min}$ noise level has been adopted as the existing PA noise limit for the purpose of this assessment.

Table 6.1 Predicted construction noise levels (including operations) – day period

Assessment location	Predicted worst-case construction noise levels, $L_{Aeq,15min}$, dB						ICNG NMLs, $L_{Aeq,15min}$, dB		PA limit[1], $L_{Aeq,15min}$, dB
	Standard hours/day OOH Saturday Wind[2]						Standard hours	Day OOH Saturday	Standard hours/day OOH
	Scenario 1[3]	Scenario 2[4]	Scenario 3[5]	Scenario 4[6]	Scenario 5[7]	Scenario 6[8]			
A1	**42**	**41**	36	<35	<35	<35	45	40	68
A2	**43**	**44**	37	35	37	36	45	40	68
A3	44	**45**	40	39	40	39	49	44	68
A4	43	43	43	42	42	42	49	44	68
A5	37	37	35	<35	<35	<35	49	44	68
A6	<35	<35	<35	<35	<35	<35	53	48	68
A7	35	<35	<35	<35	<35	<35	50	45	68
A8	35	<35	<35	<35	<35	<35	53	48	68
A9	38	36	35	<35	<35	<35	51	46	68
A10	38	36	<35	<35	<35	<35	47	42	68
A11	42	35	<35	<35	<35	36	51	46	68
A12	41	39	38	37	37	40	51	46	68
A13	**48**	39	37	35	35	36	45	40	68
A14	**45**	**43**	38	35	36	36	45	40	68

Notes:
1. The amenity 68 dB $L_{Aeq,15min}$ noise level is equivalent to the amenity 65 dB $L_{Aeq,day}$ noise level as per the NPfI.
2. Downwind conditions in accordance with ISO 9613 algorithm (Sections 5 and 8 of ISO 9613-2:1996).
3. Scenario 1 – Boxcut construction Stage 1.
4. Scenario 2 – Boxcut construction Stage 2.
5. Scenario 3 – Boxcut construction Stage 3.
6. Scenario 4 – New decline development surface trucking.

7. Scenario 5 – TSF3 preparation works.
8. Scenario 6 –TSF2 harvesting preparation works and TSF3 preparation works (bridging layer only).

For worst-case construction works during standard hours and day OOH on Saturday (scenarios 1 to 6), modelling results show that noise levels from proposed construction and existing operations (combined) are predicted to satisfy the adopted 68 dB $L_{Aeq,15min}$ noise limit as per the PA (Condition 17B(c)) at all assessment locations.

Noise levels from proposed construction and existing operations (combined) were also compared to the ICNG NMLs for standard hours and day OOH on Saturday (scenarios 1 to 6). Noise levels during standard hours are predicted to exceed (by up to 3 dB) the relevant NML during stage 1 of the boxcut construction (scenario 1) at assessment location A13. During day OOH on Saturday, noise levels are predicted to exceed the relevant NMLs during stage 1 and/or stage 2 of the boxcut construction (scenarios 1 and 2) by up to 2 dB at A1 and A3, by up to 4 dB at A2, by up to 5 dB at A14 and by up to 8 dB at A13.

It is important to note that the modelled construction works represent worst-case scenarios for each relevant assessment period and activities. Therefore, noise levels from the proposed construction works would be for most of the times lower than the predicted levels shown in Table 6.1. It can also be said that predicted noise levels are considered worst-case for the duration of the relevant activities and will satisfy the relevant criteria during all other times. Furthermore, noise levels during the boxcut construction are predicted to progressively decrease from Stage 1 to Stage 3 (scenarios 1 to 3) at most assessment locations.

Notwithstanding, noise management and mitigation measures will be implemented by BHOP during the MOD6 construction works as discussed further in Section 7.

6.1.2 Evening and night OOH construction

Predicted site noise levels during TSF3 preparation works for the ICNG evening and night OOH periods during noise-enhancing weather conditions (refer to Table 5.4) are shown in Table 6.2. Noise levels predicted to be above the NMLs are indicated by grey shading and bold font (within 2 dB). The levels presented include noise from approved operational activities.

Table 6.2 Predicted construction noise levels (including operations) – ICNG evening and night OOH

Assessment location	Predicted worst-case construction noise levels, $L_{Aeq,15min}$, dB		ICNG NMLs, $L_{Aeq,15min}$, dB	
	Eve/Night OOH	Night OOH	Eve OOH	Night OOH
	Wind[1]	Wind + Inv.[2]		
	TSF3 preparation works (Scenario 7)[3]			
A1	<35	**36**	37	35
A2	<35	**37**	37	35
A3	36	39	41	39
A4	<35	36	41	39
A5	<35	<35	41	39
A6	<35	<35	41	39
A7	<35	<35	35	36
A8	<35	35	39	39
A9	<35	36	39	39

Table 6.2 Predicted construction noise levels (including operations) – ICNG evening and night OOH

Assessment location	Predicted worst-case construction noise levels, $L_{Aeq,15min}$, dB		ICNG NMLs, $L_{Aeq,15min}$, dB	
	Eve/Night OOH	Night OOH	Eve OOH	Night OOH
	Wind[1]	Wind + Inv.[2]		
	TSF3 preparation works (Scenario 7)[3]			
A10	<35	**36**	41	35
A11	<35	35	39	39
A12	37	39	39	39
A13	<35	**37**	35	35
A14	<35	**37**	35	35

Notes: 1. Downwind conditions in accordance with ISO 9613 algorithm (Sections 5 and 8 of ISO 9613-2:1996).
2. Stability category F temperature inversion with 2 m/s source-to-receiver wind.
3. Within Kintore Pit.

For worst-case evening and night OOH construction works (scenario 7), modelling results show that noise levels from proposed construction and existing operations (combined) during 2 m/s wind are predicted to satisfy the ICNG NMLs at all assessment locations. During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, construction noise levels from proposed construction and existing operations (combined) are predicted to be negligibly (up to 2 dB) above the relevant ICNG NMLs at assessment locations A1, A2, A10, A13 and A14. It is noted that at assessment location A13, predicted noise levels are no greater than existing night-time noise levels from site operations (ie worst-case noise level from existing site operations is 37 dB $L_{Aeq,15min}$ during the night period).

It is important to note that the modelled construction works represent worst-case scenarios for each relevant assessment period and activities. Therefore, noise levels from the proposed construction works would be for most of the times lower than the predicted levels shown in Table 6.2. It can also be said that predicted noise levels are considered worst-case for the duration of the relevant activities and will satisfy the relevant criteria during all other times.

Notwithstanding, noise management and mitigation measures will be implemented by BHOP during the MOD6 construction works as discussed further in Section 7.

6.2 Future operational noise

To assess potential noise impacts from the proposed MOD6 operations, future operational noise levels have been compared to the adopted PNTLs. Furthermore, future operational noise levels have been compared to noise levels from existing site operations (pre MOD6).

Noise from existing site operations was modelled and validated based on site noise contributions determined during most recent attended compliance monitoring completed in 2018 and 2019. Site noise contributions were all recorded during the night period monitoring. The attended noise monitoring results from the 2018 and 2019 attended compliance monitoring demonstrated that noise from existing site operations satisfied the relevant noise limits at all assessment locations.

Noise levels from existing site operations (pre MOD6) and Future operational noise levels (following the completion of the MOD6 construction works) are shown in Table 6.3. Noise levels have been predicted based on

noise-enhancing weather conditions (refer to Table 5.4). Noise levels predicted to be above the adopted PNTLs are indicated by grey shading and bold font (within 2 dB).

Table 6.3 Predicted future operational noise levels

Assessment location	Existing $L_{Aeq,15min}$ noise levels[1], dB			Future $L_{Aeq,15min}$ noise levels, dB			Adopted PNTLs, $L_{Aeq,15min}$, dB			Future exceedance, dB			
	Day	Evening /Night	Night	Day	Evening /Night	Night	Day	Evening	Night	Day	Evening	Night	Night
	Wind[2]	Wind[2]	Wind + Inv.[3]	Wind[2]	Wind[2]	Wind + Inv.[3]				Wind[2]	Wind[2]	Wind[2]	Wind + Inv.[3]
A1	<40	<37	35	<40	<37	<35	40	37	35	Nil	Nil	Nil	Nil
A2	<40	<37	<35	40	<37	<35	40	37	35	Nil	Nil	Nil	Nil
A3	<44	<41	<39	44	<41	<39	44	41	39	Nil	Nil	Nil	Nil
A4	<44	<41	<39	<44	<41	<39	44	41	39	Nil	Nil	Nil	Nil
A5	<44	<41	<39	<44	<41	<39	44	41	39	Nil	Nil	Nil	Nil
A6	<48	<41	<39	<48	<41	<39	48	41	39	Nil	Nil	Nil	Nil
A7	<45	<42	<36	<45	<42	<36	45	42	36	Nil	Nil	Nil	Nil
A8	<48	<39	<39	<48	<39	<39	48	39	39	Nil	Nil	Nil	Nil
A9	<46	<39	<39	<46	<39	<39	46	39	39	Nil	Nil	Nil	Nil
A10	<42	<41	35	<42	<41	<35	42	41	35	Nil	Nil	Nil	Nil
A11	<46	<39	<39	<46	<39	<39	46	39	39	Nil	Nil	Nil	Nil
A12	<46	<39	39	<46	<39	39	46	39	39	Nil	Nil	Nil	Nil
A13	<40	<35	37	40	35	**37**	40	35	35	Nil	Nil	Nil	**2**
A14	<40	35	36	<40	<35	**36**	40	35	35	Nil	Nil	Nil	**1**

Notes: 1. Modelled noise levels from existing site operations (pre MOD6).
2. Downwind conditions in accordance with ISO 9613 algorithm (Sections 5 and 8 of ISO 9613-2:1996).
3. Stability category F temperature inversion with 2 m/s source-to-receiver wind.

Modelling results showed that site noise levels for future operations (following MOD6 construction) are predicted to satisfy the adopted PNTLs at all assessment locations for the day, evening and night periods during 2 m/s wind.

During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, site noise levels for future operations are predicted to be negligibly (up to 2 dB) above the relevant adopted PNTLs at assessment locations A13 and A14. A 2 dB change in noise levels in the environment is generally not perceptible by the human ear and therefore noise impacts from future operations is unlikely at these locations.

When comparing future site noise levels to existing site noise levels, no material increase is predicted at any location for the day, evening and night periods.

It is important to note that predicted future operational site noise levels represent worst-case scenarios for each assessment period and operations. Furthermore, stability category F (and/or G stability class) temperature inversions and source-to-receiver winds were not found to occur for 30% or greater of the night period (refer to

Section 3.3). Therefore, it can be said that noise levels from proposed future operations would be for most of the times lower than the predicted levels shown in Table 6.3.

Notwithstanding, given operational noise levels are predicted to be negligibly (by up to 2 dB) above the adopted PNTLs at two assessment locations during worst-case night-time temperature inversion conditions (stability category F) and source-to-receiver wind speed of 2 m/s, noise management measures will continue to be implemented at Rasp Mine as discussed in Section 7.

6.3 Sleep disturbance

Maximum noise levels from proposed night operations with the potential to cause sleep disturbance at nearby residences have been assessed in accordance with the NPfI. This included maximum night-time noise levels from proposed MOD6 night-time construction works (ie TSF3 preparation works).

Maximum predicted $L_{Aeq,15min}$ noise levels for the night period were taken from Table 6.2 and Table 6.3 and compared against the relevant sleep disturbance trigger levels. These represent worst-case maximum $L_{Aeq,15min}$ noise levels predicted for the night period based on activities associated with the TSF3 preparation works and future operations including the CBP, primary crusher, processing plant, haul truck movements (eg new portal to RoM pad) and other mobile plant movements.

Maximum L_{Amax} noise events from proposed TSF3 preparation works and future night operations that were considered included an excavator loading a haul truck in TSF3, the CBP FEL loading aggregate in the CBP hopper or the FEL loading material in the primary crusher at the RoM pad. A sound power level 111 dB L_{Amax} was determined based on on-site measurements of the FEL loading material in the primary crusher at the RoM pad, however a conservative 120 dB L_{Amax} was adopted to cover any of these possible events in the prediction of sleep disturbance impacts at residential assessment locations during noise-enhancing meteorological conditions. Predicted maximum L_{Amax} noise levels are therefore considered conservative.

Noise modelling results are provided in Table 6.4. Maximum L_{Aeq} and L_{Amax} noise levels are predicted to satisfy the NPfI screening criteria for sleep disturbance at all residential assessment locations during noise-enhancing meteorological conditions and hence no further detailed assessment of sleep disturbance is required as per the NPfI. Therefore, it is unlikely that the project will cause sleep disturbance at any residential receivers.

Table 6.4 Predicted night-time maximum noise levels at residential assessment locations

Assessment location	Predicted night-time maximum noise levels, dB				Screening criteria, dB	
	$L_{Aeq,15min}$		L_{Amax}		$L_{Aeq,15min}$	L_{Amax}
	Wind[1]	Wind + Inv.[2]	Wind[1]	Wind + Inv.[2]		
A1	<40	<40	<52	<52	40	52
A2	<40	<40	<52	<52	40	52
A3	<40	<40	<52	<52	40	52
A4	<40	<40	<52	<52	40	52
A5	<40	<40	<52	<52	40	52
A6	<40	<40	<52	<52	40	52
A7	<40	<40	<52	<52	40	52
A8	<40	<40	<52	<52	40	52
A9	<40	<40	<52	<52	40	52
A10	<40	<40	<52	<52	40	52

Table 6.4 Predicted night-time maximum noise levels at residential assessment locations

Assessment location	Predicted night-time maximum noise levels, dB				Screening criteria, dB	
	$L_{Aeq,15min}$		L_{Amax}		$L_{Aeq,15min}$	L_{Amax}
	Wind[1]	Wind + Inv.[2]	Wind[1]	Wind + Inv.[2]		
A11	<40	<40	<52	<52	40	52
A12	<40	<40	<52	<52	40	52
A13	<40	<40	<52	<52	40	52
A14	<40	<40	<52	<52	40	52

Notes: 1. Downwind conditions in accordance with ISO 9613 algorithm (Sections 5 and 8 of ISO 9613-2:1996).
2. Stability category F temperature inversion with 2 m/s source-to-receiver wind.
3. Night: 10 pm to 7 am Monday to Saturday, 10 pm to 8 am Sundays and public holidays.

7 Noise management

7.1 Existing noise management

7.1.1 Adopted management and mitigation measures

Best management practices are currently used to minimise site noise offsite and include the following:

- independent noise audits are undertaken annually;
- noise awareness information is provided in employee and contractor inductions;
- filling of the RoM bin prior to night shift to minimise the use of the front-end loader at the RoM pad during the night period; and
- plant is properly maintained and serviced in accordance with original equipment manufacturer requirements to ensure rated noise emission levels are not exceeded;

To ensure that site noise levels achieve the limits at offsite locations, noise mitigation measures have been implemented at the site. These mitigation measures were included in the noise modelling and are as follow:

- the primary crusher has been located behind the RoM pad to minimise noise to nearest residences;
- cladding and insulation of the primary crusher;
- conveyors and transfer stations prior to the grinding circuit have been covered;
- construction of 6 m high noise bunds surrounding the CBP area;
- construction of a CBP building for batching and slumping processes;
- construction of noise bunding along the southern side of the haul road and the southern perimeter of the RoM pad mine haul route;
- modification of the processing plant filtration shed's piping system; and
- installation of two overlapping bunds at the northern side of the wagon stockpile area to shield Crystal Street residences.

7.1.2 Noise monitoring management plan

The Noise Monitoring and Management Plan (NMMP) established for the site provides noise monitoring and management procedures that are currently used on-site. These include, but are not limited to, the following measures:

- undertake compliance noise monitoring at all assessment locations and ensure that site noise satisfy the limits outlined in the project approval. The monitoring is completed in accordance with all relevant Australian Standards, policies and guidelines;

- take relevant actions to investigate and determine feasible and reasonable mitigation measures if site noise has been identified to exceed the relevant limits;
- monitoring results are reported to the Environmental Manager and kept on file for a minimum of 4 years;
- provide adequate and timely response to community noise complaints;
- review data and determine management actions to improve noise emissions from site over time;
- ensure actions are taken to prevent noise exceedances as per conditions in the project approval; and
- make noise reports available to EPA as required.

7.1.3 Noise complaints management

Noise complaints from the community are currently managed in accordance with the site's NMMP and recorded as per the site's complaints procedure. It is noted that the DPIE and other relevant agencies are notified of complaints from the community should one be received.

A review of the community noise complaint register for Rasp Mine showed that the last noise complaint received from a member of the community was due to an equipment reverse beeper during the construction stage of the CBP in 2018. The matter was addressed and resolved immediately following the noise complaint.

No noise complaints have been received in relation to MOD4 construction activities, with the majority of works (ie TSF2 embankments) almost complete.

This demonstrates a strong history of noise performance at offsite locations, in particular during typical mining operations and hence is consistent with attended noise monitoring results collected in the most recent three years of monitoring (2018, 2019 and 2020).

7.2 Additional noise management measures to consider during construction

7.2.1 Recommendations

Numerous practical recommendations to assist in mitigating construction noise emissions are provided in Australian Standard 'AS 2436-2010 – Guide to Noise and Vibration Control on Construction, Maintenance and Demolition Sites'. The recommendations provided in this standard include operational strategies, source noise control strategies, noise barrier controls, and community consultation. Examples of noise management strategies that will be considered during the proposed construction include the following:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise;
- regular identification of noisy activities (using continuous unattended noise logging) and adoption of improvement techniques;
- use of broadband audible reverse alarms on vehicles used on site;
- minimising the movement of materials and plant and unnecessary metal-on-metal contact;
- scheduling respite periods for intensive works;
- all plant will be driven in a conservative manner (no over-revving);

- machinery will not be permitted to ‘warm-up’ before the nominated working hours;
- where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers;
- where practicable adopt mobile barriers/screens or utilise the location of earth/rock stockpiles to shield neighbouring receivers;
- the quietest suitable machinery reasonably available will be selected for each work activity;
- where possible machinery will have efficient low noise muffler design and be well-maintained;
- the offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised;
- queuing of vehicles is not to occur adjacent to residential receivers. Where queuing is required, for example due to safety reasons, an area entry position will be selected that is well removed from receivers. Where this is not feasible, engines are to be switched off to reduce their overall noise impacts on receivers;
- where practicable, ensure the coincidence of noisy plant/machinery working simultaneously in close proximity to sensitive receivers is avoided;
- scheduling activities to minimise impacts by avoiding conflicts with other scheduled events;
- scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive;
- planning deliveries and access to the site to occur quietly and efficiently; and
- optimising the number of deliveries to the site by amalgamating loads where possible.

It is recommended that specific detailed noise management and mitigation measures be reviewed once the construction activities for each task are clearly defined and contractors for the work have been selected or engaged.

7.2.2 MOD4 construction noise data review

A detailed review of noise management and mitigation measures has been completed for the Rasp Mine MOD4 construction works (undergoing) and several of the aforementioned noise management measures have been implemented to ensure noise impacts are avoided or minimised at potentially most affected receivers. As a result, no noise complaints from the surrounding community have been received since the start of MOD4 construction works to date.

A review was undertaken of attended and unattended noise monitoring data collected during the MOD4 TSF2 embankment works (ICNG standard hours), including during the embankment 2 works (completed) and the embankment 1 works (mostly completed). The review included post-analysis of the noise data and the use of noise modelling (where required) to determine site noise levels at the nearest and potentially most affected residential receivers. The findings of this review are discussed in the following sections.

i Embankment 2 works

A noise logger was installed on-site to monitor site noise levels during the construction of embankment 2 between June and December 2019. Data from the noise logger was used to determine site noise levels during the construction of embankment 2 at the nearest and potentially most affected assessment location A12 (Crystal Street).

The review showed that site $L_{Aeq,day}$ noise levels at A12 and other surrounding residential receivers during the construction of embankment 2 would have been below the 65 dB $L_{Aeq,day}$ noise limit for construction as per the PA.

ii Embankment 1 works

A noise logger was also installed on-site to monitor site noise levels during the construction of embankment 1 between July and December 2020. Data from the noise logger was used to determine site noise levels during the construction of embankment 1 at the nearest and potentially most affected assessment location A11 (Crystal Street). Furthermore, attended noise monitoring was regularly undertaken at A11 during the construction of embankment 1 between August and December 2020, including a total of 13 lots of 15-minute surveys.

The review showed that site $L_{Aeq,day}$ noise levels at A11 and other surrounding residential receivers during the construction of embankment 1 would have been below the 65 dB $L_{Aeq,day}$ noise limit for construction as per the PA.

Similarly, the review of data from the attended noise monitoring undertaken at A11 between August and December 2020 showed that total ambient noise levels ($L_{Aeq,15min}$), that is inclusive of noise from non-site related sources (eg local traffic), were below the 68 dB $L_{Aeq,15min}$ noise level (equivalent to 65 dB $L_{Aeq,day}$) adopted as the PA $L_{Aeq,15min}$ noise limit for construction. In fact, the highest total $L_{Aeq,15min}$ noise level measured during the 13 attended noise monitoring surveys at A11 was 50 dB, which was well below the 68 dB $L_{Aeq,15min}$ noise level (equivalent to 65 dB $L_{Aeq,day}$) .

iii MOD4 noise predictions

The findings of the MOD4 construction noise data review are comparable to predictions presented in the Rasp Mine MOD4 noise impact assessment report prepared by EMM in 2017. In the 2017 noise impact assessment report, the highest $L_{Aeq,15min}$ prediction for the embankment 2 works was 54 dB at A12, and for the embankment 1 works, it was 49 dB at A11 and A12. This demonstrates a strong validation at offsite locations during the MOD4 construction works.

8 Conclusion

EMM has completed a noise impact assessment for the proposed MOD6 construction and operational activities at Rasp Mine. An assessment of future operational noise was completed for the proposed MOD6 operations including the development of TSF3, new portal, harvest and transport of tailings and daytime rehabilitation work.

8.1 Construction

Modelled construction works represent worst-case scenarios for each relevant construction assessment period and activities and therefore, it is anticipated that noise levels from the proposed MOD6 construction works would be for most of the times lower than the predicted levels. Proposed MOD6 construction works were modelled concurrently with existing site operations.

Noise levels from proposed worst-case construction works during standard hours and day OOH on Saturday are predicted to satisfy the PA 65 dB $L_{Aeq,day}$ noise limit at all assessment locations. When compared to the NMLs, noise levels during standard hours are predicted to exceed (by up to 3 dB) the relevant NML during stage 1 of the boxcut construction (scenario 1) at assessment location A13. During day OOH on Saturday, noise levels are predicted to exceed (by up to 8 dB) the relevant NMLs during stage 1 and/or stage 2 of the boxcut construction (scenarios 1 and 2) at assessment locations A1, A2, A3, A13 and A14.

Noise levels from proposed worst-case construction works during evening and night OOH on any day of the week are predicted to satisfy the ICNG NMLs at all assessment locations during 2 m/s wind. During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, construction noise levels are predicted to be negligibly (up to 2 dB) above the relevant NMLs at assessment locations A1, A2, A10, A13 and A14.

8.2 Operations

Future operational site $L_{Aeq,15min}$ noise levels following the completion of the MOD6 construction works are predicted to satisfy the adopted PNTLs at all assessment locations during 2 m/s wind for the day, evening and night periods. During the unlikely worst-case night-time temperature inversion conditions (stability category F) and wind speed of 2 m/s, future operational site $L_{Aeq,15min}$ noise levels are predicted to negligibly (by up to 2 dB) exceed the adopted PNTLs at two assessment locations (A13 and A14). However, when compared to existing site noise levels at these assessment locations, no material increase is predicted as a result of proposed future operations. Therefore, no additional noise impacts from future MOD6 operations are predicted at surrounding residential receivers.

Predicted night-time maximum noise level events from the proposed MOD6 construction and operations are not predicted to cause sleep disturbance impact at any of the residential assessment locations during worst-case night-time meteorological conditions.

8.3 Management and mitigation

Given the predicted limited exceedances during construction and operations, it is recommended that noise management and mitigation measures currently used at Rasp Mine be continued. In addition, it is recommended that standard construction noise management measures currently being implemented for construction works on-site (eg during MOD4 embankment works) including noise monitoring, operational strategies, source noise control strategies, noise barrier controls, and community consultation continue to be implemented for the duration of the proposed MOD6 construction works.

Appendix A

Glossary of acoustic terms

A.1 Glossary

Several technical terms are required for the discussion of acoustics. Acoustic terms and abbreviations used in this report are explained in Table A.1.

Table A.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	Description
ABL	The assessment background level (ABL) is defined in the NPfI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{A90} statistical noise levels or the measured L_{A90} statistical noise level for each entire monitoring period.
Amenity noise level	The amenity noise levels relate to the overall level of industrial noise subject to land zoning or use.
A-weighting	There are several different weightings utilised for describing noise, the most common being the 'A-weighting'. This attempts to closely approximate the frequency response of the human ear.
BHOP	Broken Hill Operations Pty Ltd
BoM	Bureau of Meteorology
CBP	Concrete batching Plant (on-site)
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
dB	Noise is measured in the unit called the decibel (dB).
DPIE	NSW Department of Planning, Industry and Environment
DECCW	NSW Department of Environment, Climate Change and Water
EA	Environmental assessment
EMM	EMM Consulting Pty Limited
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
EP&A Act	Environmental and Planning Assessment Act 1979 (NSW)
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
ICNG	NSW Interim Construction Noise Guideline (DECC 2009)
INP	NSW Industrial Noise Policy (EPA 2000) (superseded)
Intrusiveness noise level	The intrusiveness noise level refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness noise level is described in detail in this report.
ISO	International organisation for standardisation
$L_{A1,1min}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level exceeded for 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.

Table A.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	Description
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
NML	Noise management level (in accordance with the ICNG)
NMMP	Noise Monitoring and Management Plan
NPfI	NSW Noise Policy for Industry (EPA 2017)
Out-of-hours (OOH)	Outside the ICNG recommended standard hours for construction.
PA	Project Approval PA 07_0018
PNTL	The project noise trigger levels (PNTLs) are targets for a particular industrial noise source or industry. The adopted PNTLs are the lower of either the project intrusive or project amenity noise levels.
RBL	The Rating Background Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period.
RoM	Run-of-Mine
RNP	NSW Road Noise Policy (DECCW 2011)
Sound power level (Lw)	This is a measure of the total power radiated by a source. The sound power level of a source is a fundamental property of the source and is independent of the surrounding environment.
Standard hours	ICNG recommended standard hours for construction include Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm, no work on Sundays or Public Holidays.
Temperature inversion	A positive atmospheric temperature gradient where atmospheric temperature increases with altitude.
TSF	Tailings storage facility

It is useful to have an appreciation of the decibel (dB), the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels in the environment. Examples of common noise levels are provided in Figure A.1.

Table A.2 Perceived change in noise level

Change in sound pressure level (dB)	Perceived change in noise
1–2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

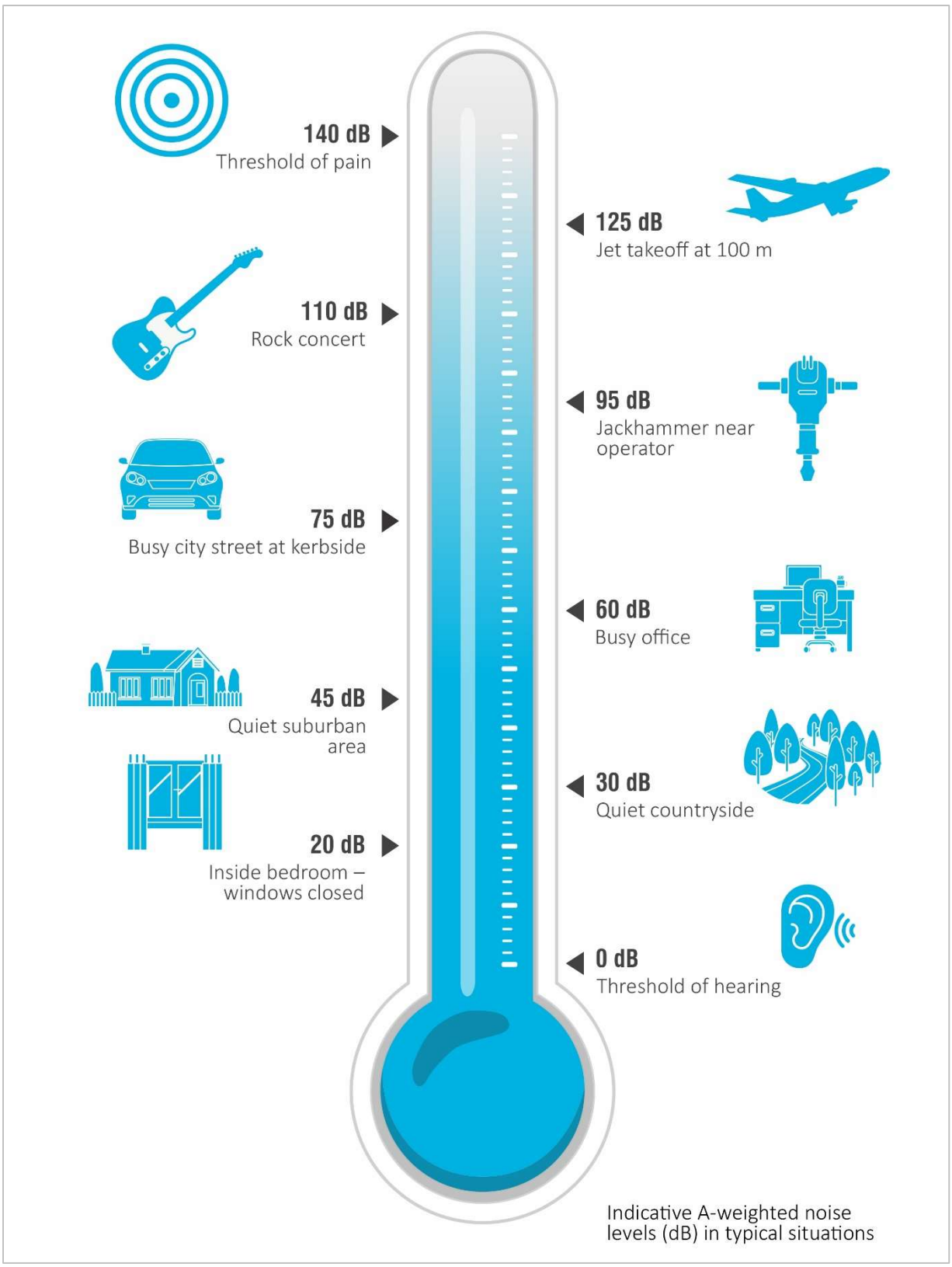


Figure A.1 Common noise levels

Appendix B

Project Approval (PA 07_0018)

(d) identify additional reasonable and feasible measures that could be implemented either on site or in the areas adjoining the site to minimise the potential lead impacts of the project and "free areas";
(e) include a program for the staged implementation of the measures identified in (d) above in the event that dust emissions are higher than predicted or the public health monitoring suggests further action is required to reduce blood lead levels in the environment surrounding the site; and
(f) include a detailed communication strategy, that outlines how the relevant dust and blood level monitoring data would be reported on the Proponent's website along with any relevant public education material.

Updated Human Health Risk Assessment

14. Within one year of the commencement of operation of the project, and every five years thereafter, unless otherwise agreed by the Secretary, the Proponent shall update the human health risk assessment prepared for the project and presented in the EA to the satisfaction of the Secretary. The updated risk assessment shall:
(a) be prepared by a suitably-qualified expert whose appointment has been endorsed by the Secretary;
(b) take into account monitoring data collected under this approval, and such other information as may be relevant to the assessment; and
(c) be submitted to the Secretary, EPA and the Western NSW Local Health District within one month of its completion.

NOISE AND VIBRATION

Hours of Operation

15. Unless the Secretary agrees otherwise, the Proponent must comply with the operating hours in Table 6.1.

Table 6.1: Operating Hours

Activity	Hours
Construction	7 am to 6 pm, Monday to Friday 8 am to 1 pm, Saturday No activities on Sundays or public holidays
Capping and rehabilitation of TSF2	
Shunting of concentrate wagons	7 am and 6 pm on any day
Production rock blasting	6:45am and 7:15pm on any day
Transporting cement to the cement silo	7 am to 7 pm on any day
Loading the cement silo	
All other activities	24 hours a day, 7 days a week

16. Deleted.

Noise Limits

17. The Proponent shall ensure that the noise generated by the project does not exceed the criteria in Table 7.

Table 7: Operational Noise Criteria

Location	[a] Day (dB(A))	[b] Evening (dB(A))	[c] Night (dB(A))
A1 – Piper Street North	38	37	35
A2 – Piper Street Central	38	37	35
A3 – Eyre Street North	44	41	39
A4 – Eyre Street Central	44	41	39
A5 – Eyre Street South	44	41	39
A6 – Bonanza and Gypsum Streets	48	41	39
A7 – Carbon Street	35	35	35
A8 – South Road	48	39	39
A9 – Crystal Street	46	39	39
A10 – Barnet and Blende Streets	42	41	35
A11 – Crystal Street	46	39	39
A12 – Crystal Street	46	39	39
A13 – Eyre Street North 2	38	35	35
A14 – Piper Street North	35	35	35

Notes to Condition 17:
- *Receiver locations are as identified in the noise assessments presented in the EA and PPR;*

- *Noise limits are to be measured in accordance with the NSW Industrial Noise Policy (EPA, 2000);*
- *[a] Day is defined as 7:00am to 6:00pm Mondays to Saturdays and 8:00am to 6:00pm on Sundays and public holidays;*
- *[b] Evening is defined as 6:00pm to 10:00pm on any day; and*
- *[c] Night is defined as 10:00pm to 7:00 am Mondays to Saturdays and 10:00pm to 8:00am on Sundays and public holidays.*

17A. The daytime criteria in Table 7 of this approval do not apply when the following activities are being carried out:
(a) construction of the concrete batching plant and associated noise bund;
(b) construction of TSF2, including:
- embankment 2;
- the spillway;
- embankment 3;
- embankment 1;

(c) capping and rehabilitation of TSF2;
(d) construction of the cement silo and warehouse extension; and
(e) crushing and screening activities associated with construction of TSF2 embankments.

17B. With regard to the activities specified in condition 17A(a)-(e) of this approval, the Proponent must:
(a) notify the Department prior to commencement and upon completion of each activity;
(b) minimise the noise generated by these activities in accordance with the best practice requirements outlined in the *Interim Construction Noise Guideline* (DECC, 2009), or its latest version; and
(c) ensure that the noise generated by the development does not cause exceedances of the amenity criteria of 65 dB $L_{Aeq,(day)}$ specified for an urban/industrial interface area under the *NSW Industrial Noise Policy*.

17C. The Proponent must not carry out any of the activities specified in condition 17A(a)-(c) concurrently.

Blasting Limits

18. The Proponent shall ensure that basting on the site does not cause exceedances of the criteria in Tables 8 and 9.

Table 8: Blasting Criteria (excluding Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	[a] Allowable Exceedance
Residence on privately owned land	115	5	[b] 5% of the total number of blasts over a 12-month period
	120	10	0%
Public Infrastructure	-	100	0%

Table 9: Blasting Criteria (Block 7)

Location	Airblast Overpressure (dB(Lin Peak))	Ground Vibration (mm/s)	[a] Allowable Exceedance
Residence on privately owned land	115	[c] 3 (interim)	5% of the total number of blasts over a 12-month period
	120	10	0%
Broken Hill Bowling Club, Italio (Bocce) Club, Heritage Items within CML7	-	50	0%
Perilya Southern Operations	-	100	0%
[d] Public Infrastructure	-	100	0%

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

Notes to Tables 8 and 9:
- *[a] The allowable exceedance must be calculated separately for development blasts and production blasts;*

Appendix C

Environment Protection Licence 12559

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L4 Noise limits

L4.1 Operational activities associated with the project are permitted to occur at any time, subject to compliance with the noise limits specified at condition L4.2 and subject to the following restrictions:

a) Shunting of the concentrate wagons must only occur between 7.00am and 6.00pm on any day; and
b) Production rock blasting must only occur between 6.45am and 7.15pm on any day.

L4.2 Noise from the Rasp Mine premises must not exceed the limits presented in the table below at the monitoring locations listed in column 1.

Location	Day [dB LAeq 15 minute]	Evening [dB LAeq 15 minute]	Night [dB LAeq 15 minute]
Point 15 - A1 Piper Street North	38	37	35
Point 16 - A2 Piper Street Central	38	37	35
Point 17 - A3 Eyre Street North	44	41	39
Point 18 - A4 Eyre Street Central	44	41	39
Point 19 - A5 Eyre Street South	44	41	39
Point 20 - A6 Bonanza & Gypsum Streets	48	41	39
Point 21 - A7 Carbon Street	35	35	35
Point 22 - A8 South Road	48	39	39
Point 23 - A9 Crystal Street	46	39	39
Point 24 - A10 Barnet & Blende Streets	42	41	35
Point 25 - A11 Crystal Street	46	39	39
Point 26 - A12 Crystal Street	46	39	39
Point 27 - A13 Eyre Street North 2	38	35	35
Point 28 - A14 Piper Street North	35	35	35

L4.3 Noise from the premises is to be measured at the most affected point within the boundary of

the nominated premises, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in Condition L4.2 unless otherwise stated.

Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy.

The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

L4.4 The noise limits set out in the Noise Limits table apply under all meteorological conditions except for the following:
a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
c) Stability category G temperature inversion conditions.

For the purposes of this condition:
a) Data recorded by the meteorological station identified as EPA Identification Point(s) 55 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW Industrial Noise Policy.

L5 Blasting

L5.1 The overpressure sound level and ground vibration peak particle velocity from blasting operations carried out in or on the premises, excluding Block 7, for the period 7am to 7pm must not exceed the limits in the table below unless expressly provided by a condition of this licence.

Location	Airblast Overpressure (dB - Lin Peak)	Ground Vibration (mm/s)	Allowable Exceedence
Residence on privately owned land	115	5	5% of the total number of blasts in any 12 month annual return reporting period
Residence on privately owned land	120	10	0%

Note:
- The allowable exceedence must be calculated separately for development blasts and production blasts;
- The 5% allowable exceedence does not apply to the production blasts until the licensee has completed a Pollution Studies and Reduction Program at condition U5.1 aimed at achieveing the limit or as otherwise agreed with the EPA; and
- Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

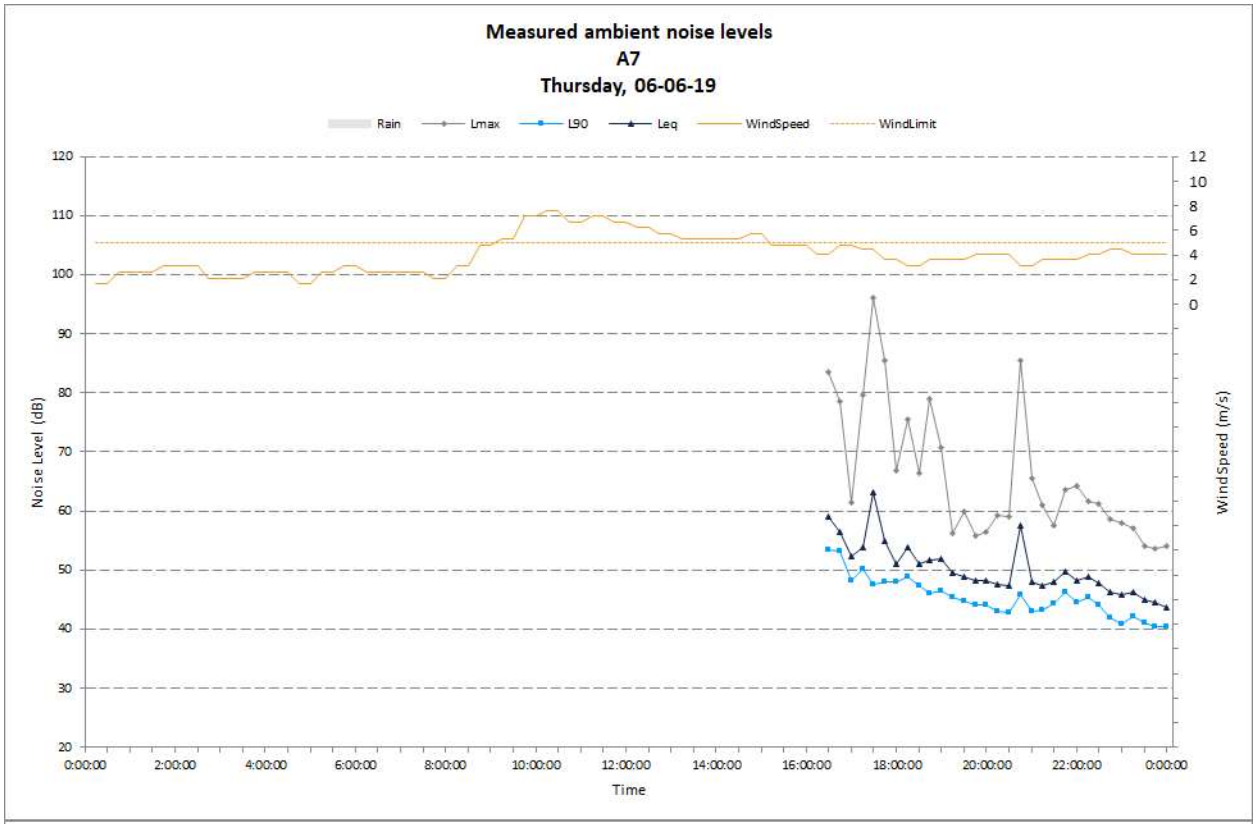
Appendix D

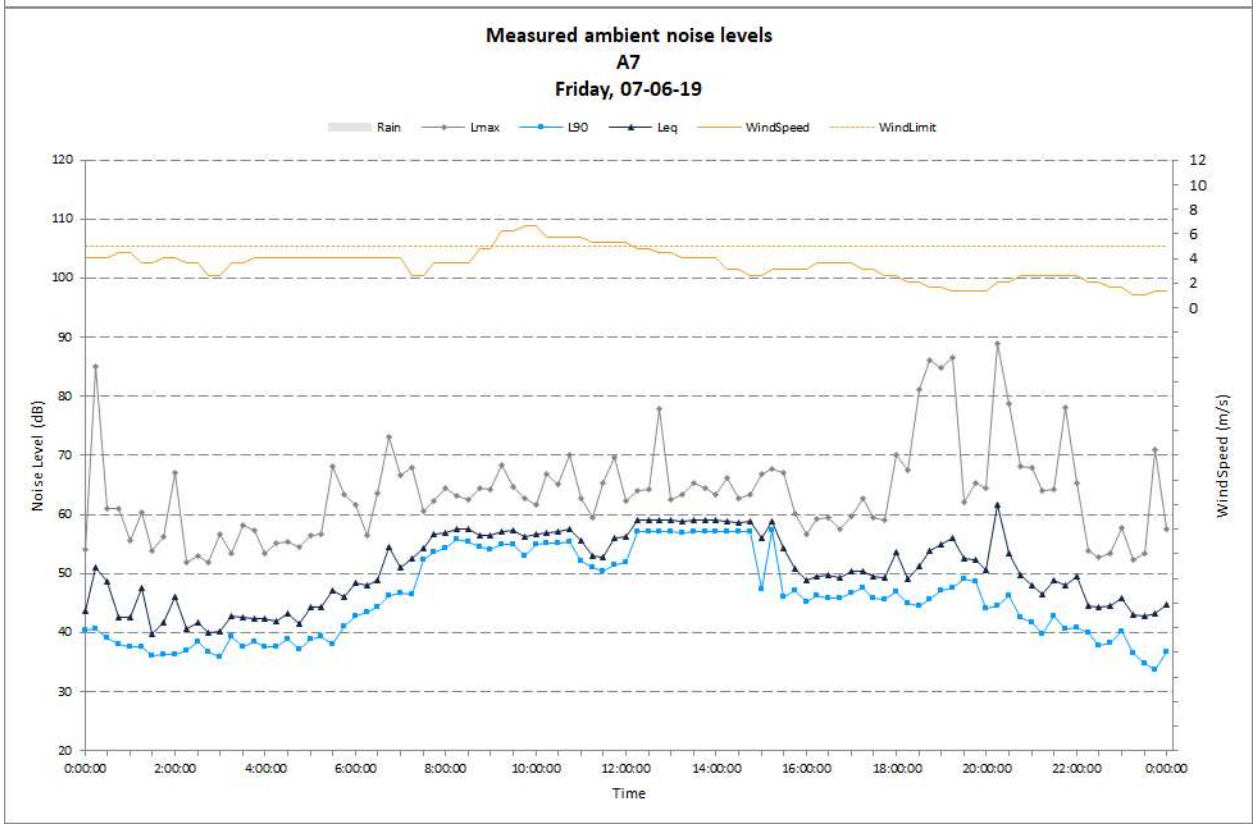
Unattended noise monitoring results (A7)

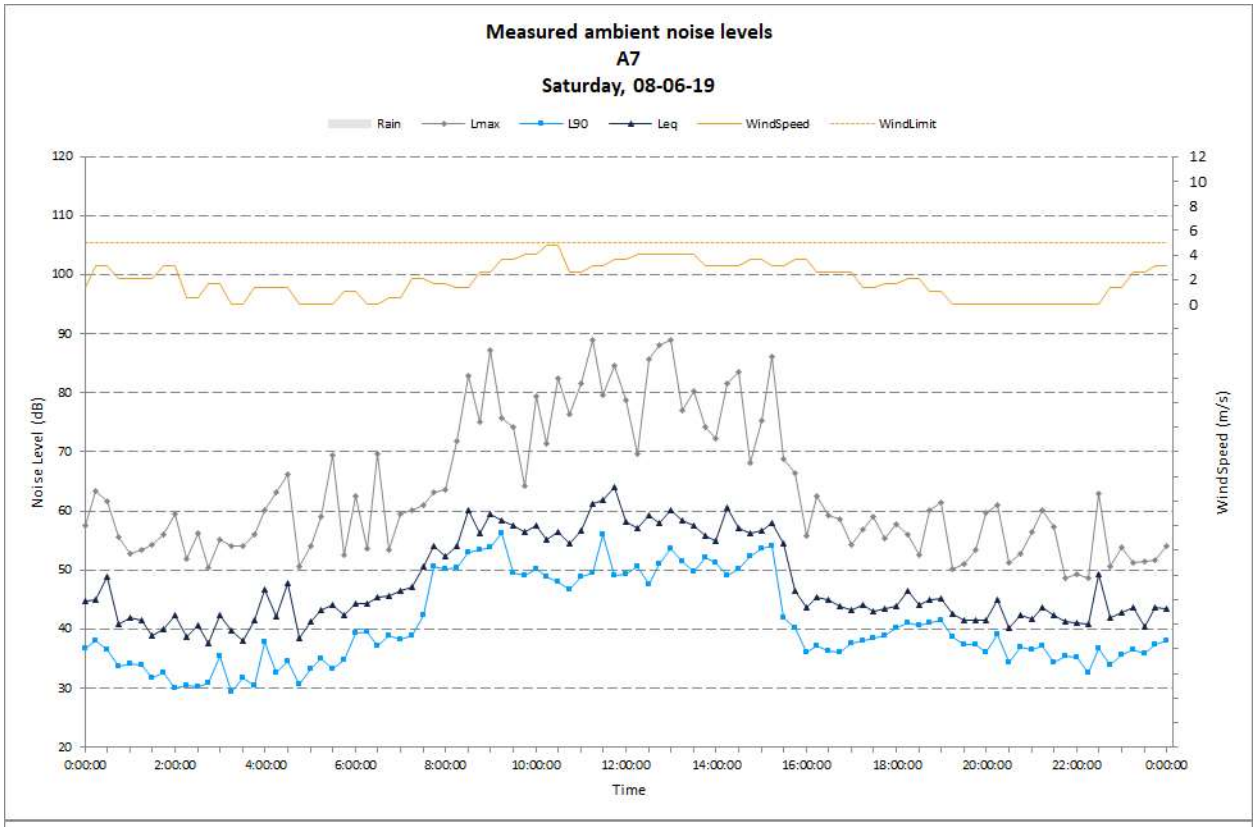
Table D.1 Unattended noise monitoring results – A7

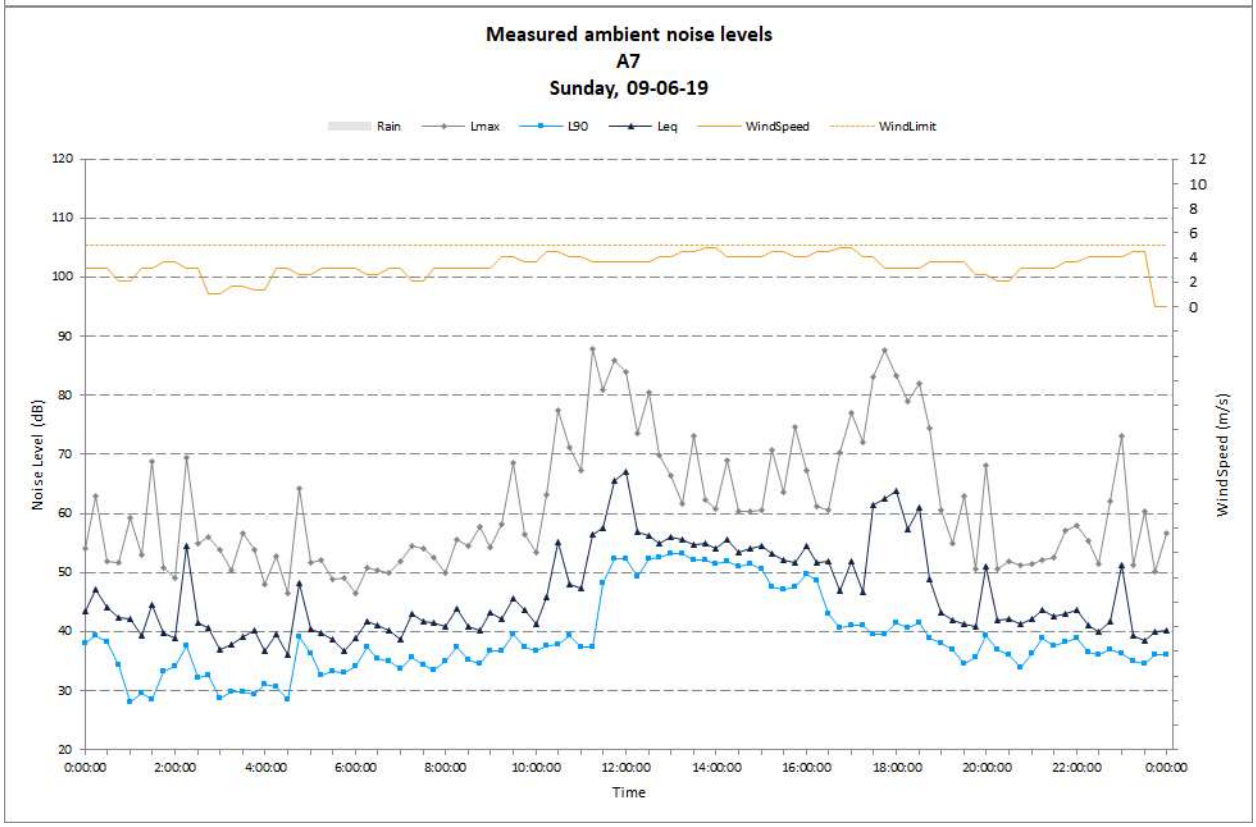
Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11\ hour}$ Day	$L_{Aeq,4\ hour}$ Evening	$L_{Aeq,9\ hour}$ Night
Thursday, 06-06-19	0	43	36	0	51	47
Friday, 07-06-19	0	41	31	0	54	44
Saturday, 08-06-19	38	34	29	57	43	44
Sunday, 09-06-19	35	35	0	57	51	0
Monday, 10-06-19	0	36	28	0	46	43
Tuesday, 11-06-19	40	37	0	50	44	0
Wednesday, 12-06-19	0	0	32	0	0	44
Thursday, 13-06-19	43	37	31	50	55	46
Friday, 14-06-19	43	39	31	56	48	45
Saturday, 15-06-19	40	42	28	57	59	54
Sunday, 16-06-19	35	33	29	46	45	42
Monday, 17-06-19	37	32	29	56	42	44
Tuesday, 18-06-19	0	41	39	0	48	47
Wednesday, 19-06-19	43	0	0	53	0	0
Summary Values	**40**	**37**	**31**	**55**	**52**	**47**

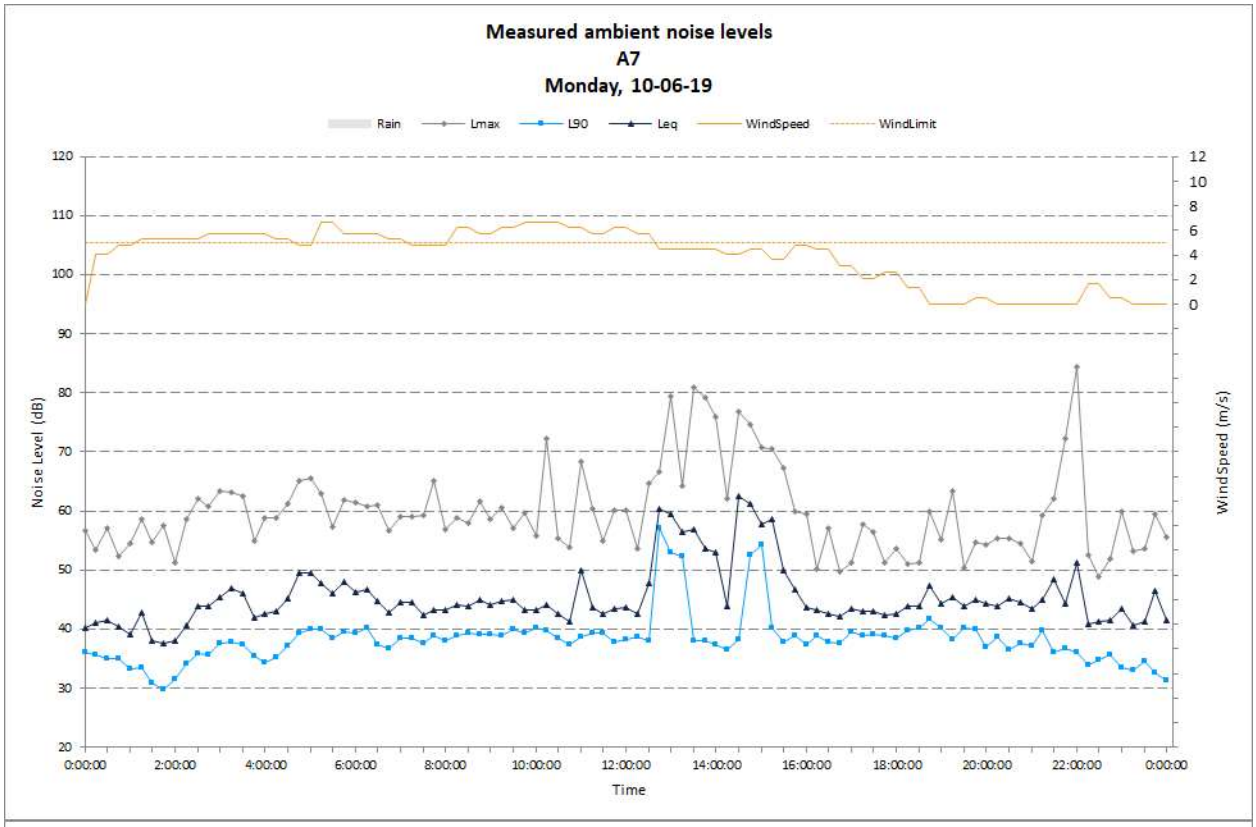
Notes: 1. “0” indicates periods with too few valid samples due to weather or logger operation.

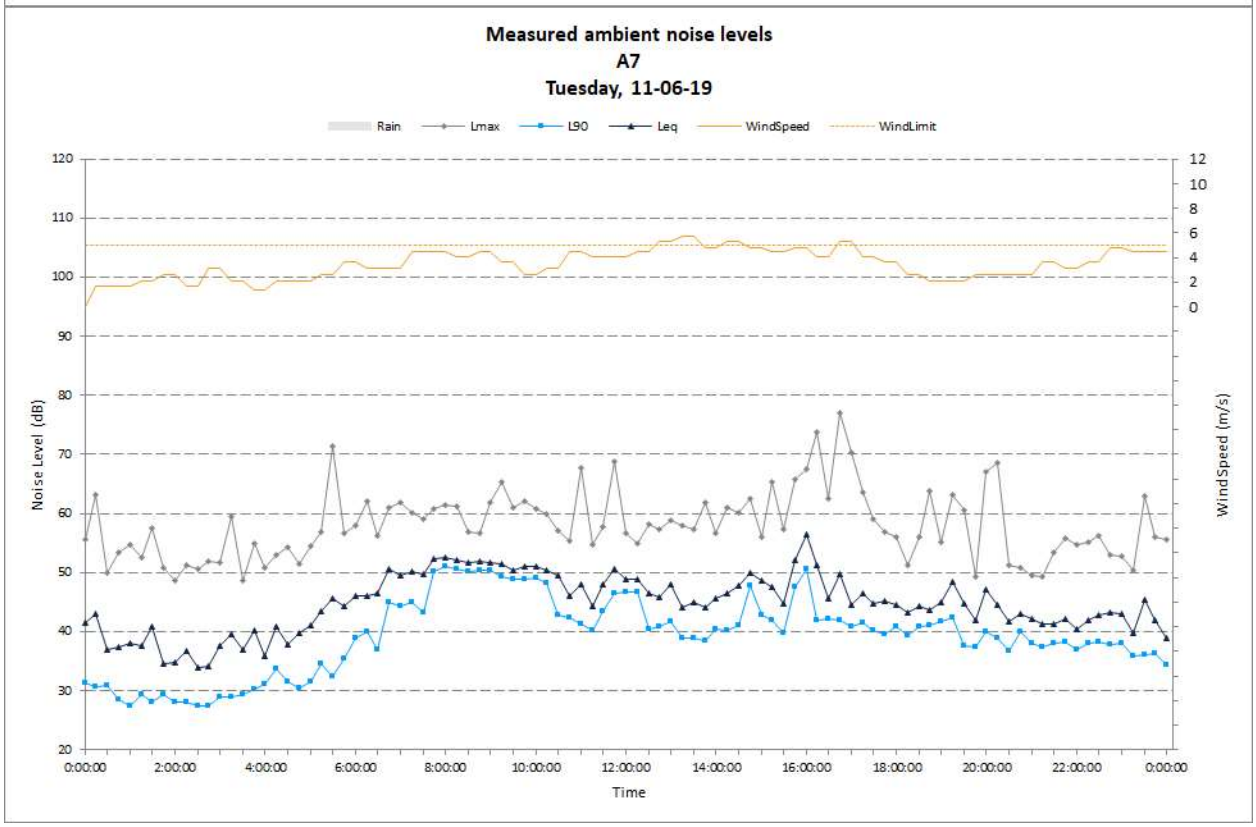

Measured ambient noise levels
A7
Thursday, 06-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time

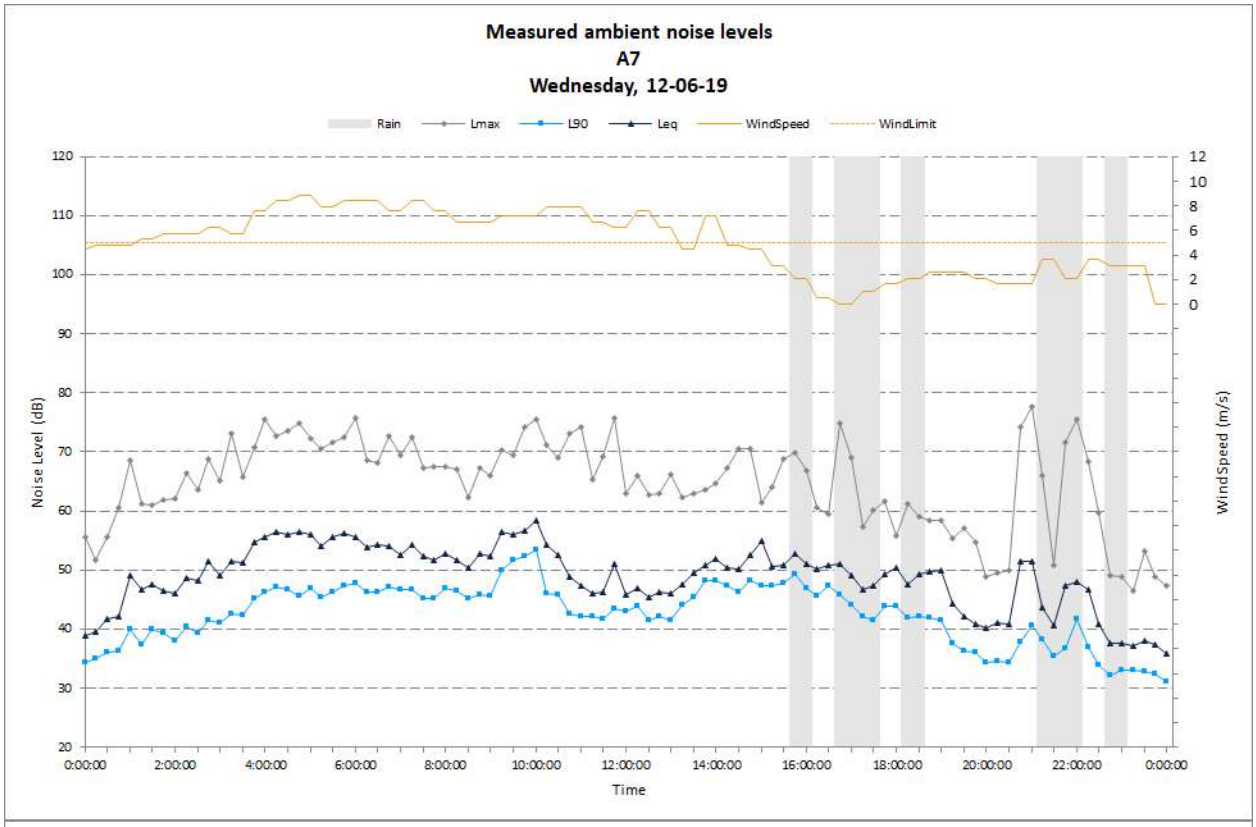

Measured ambient noise levels
A7
Friday, 07-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Saturday, 08-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Sunday, 09-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Monday, 10-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Tuesday, 11-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Wednesday, 12-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
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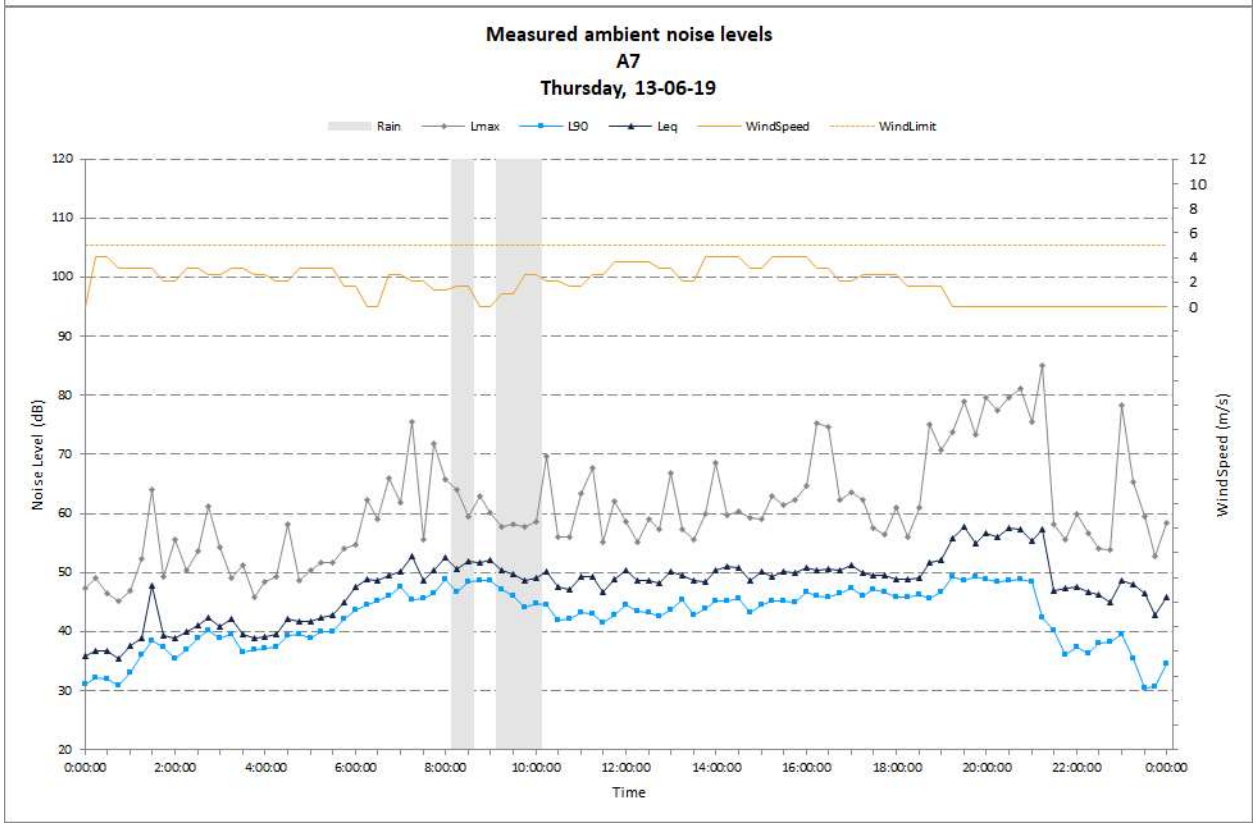
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
A7
Thursday, 13-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
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18:00:00
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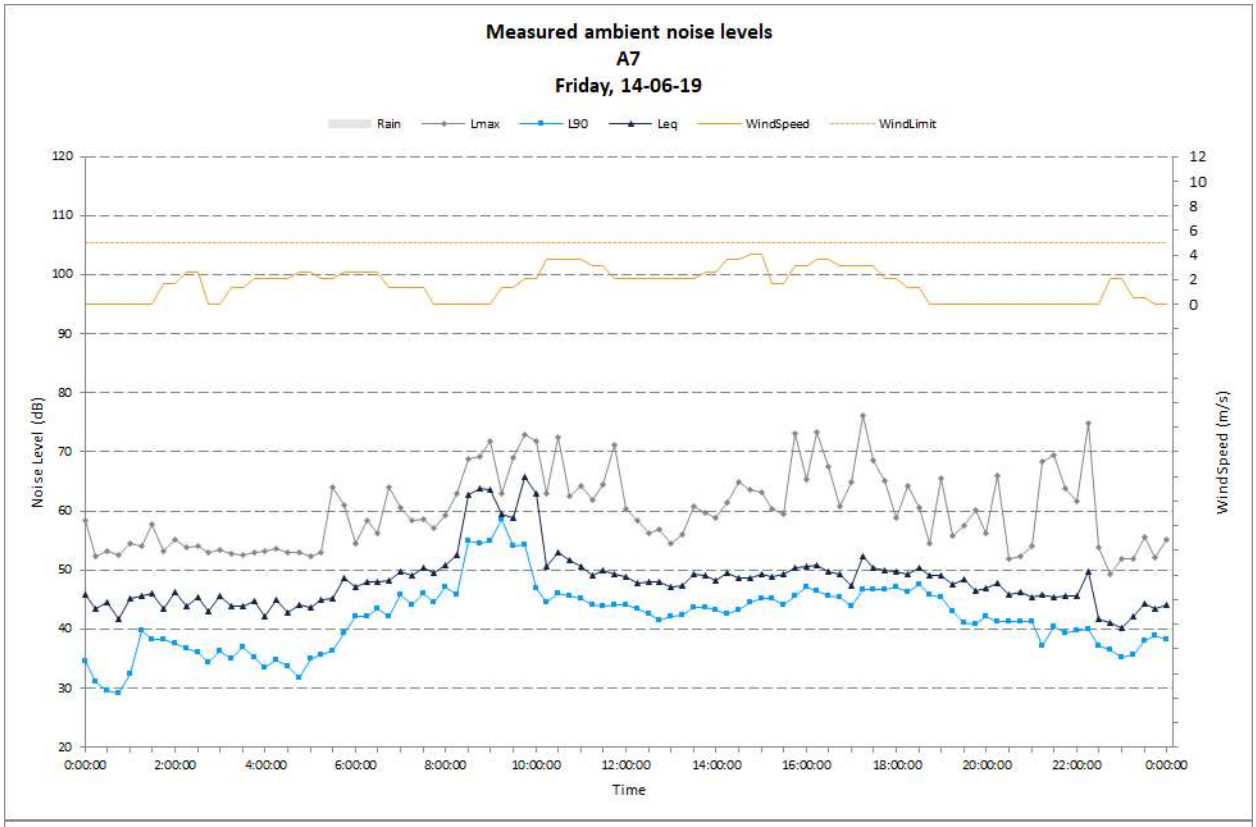
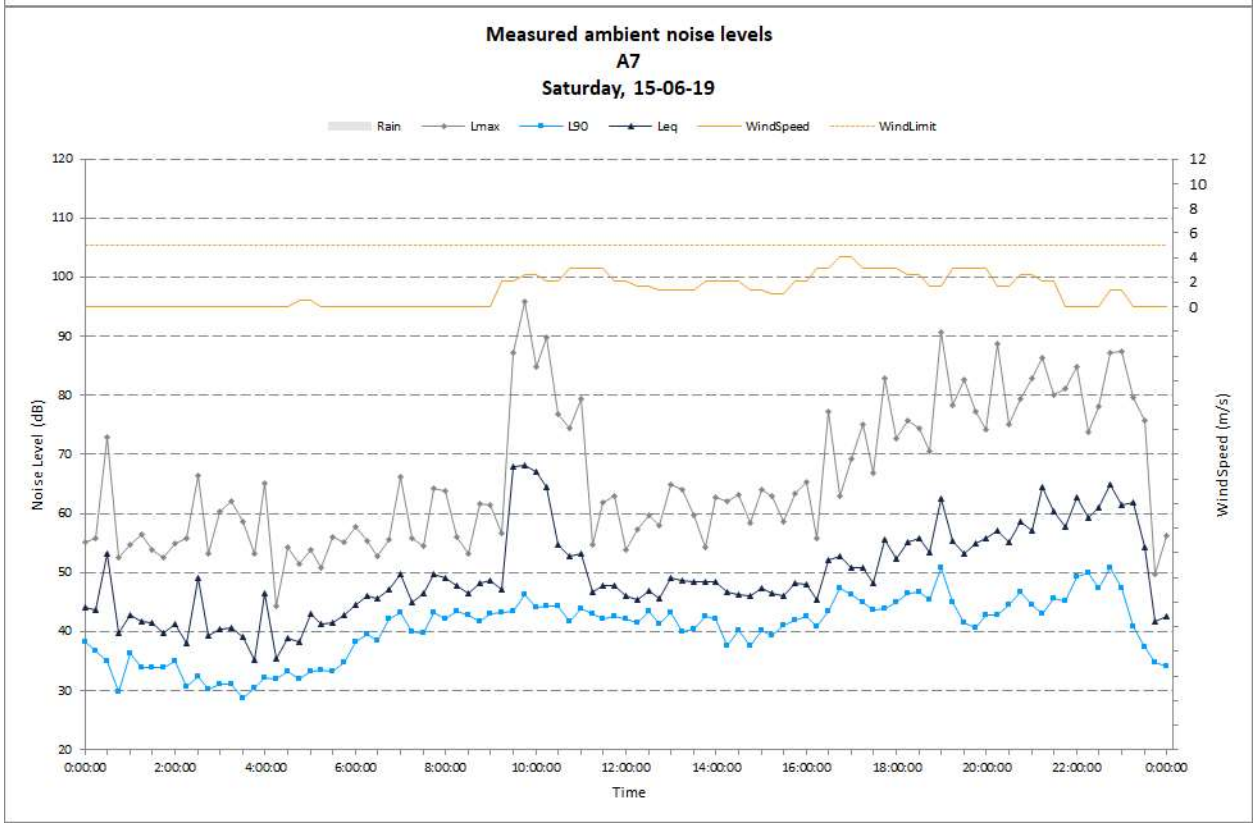
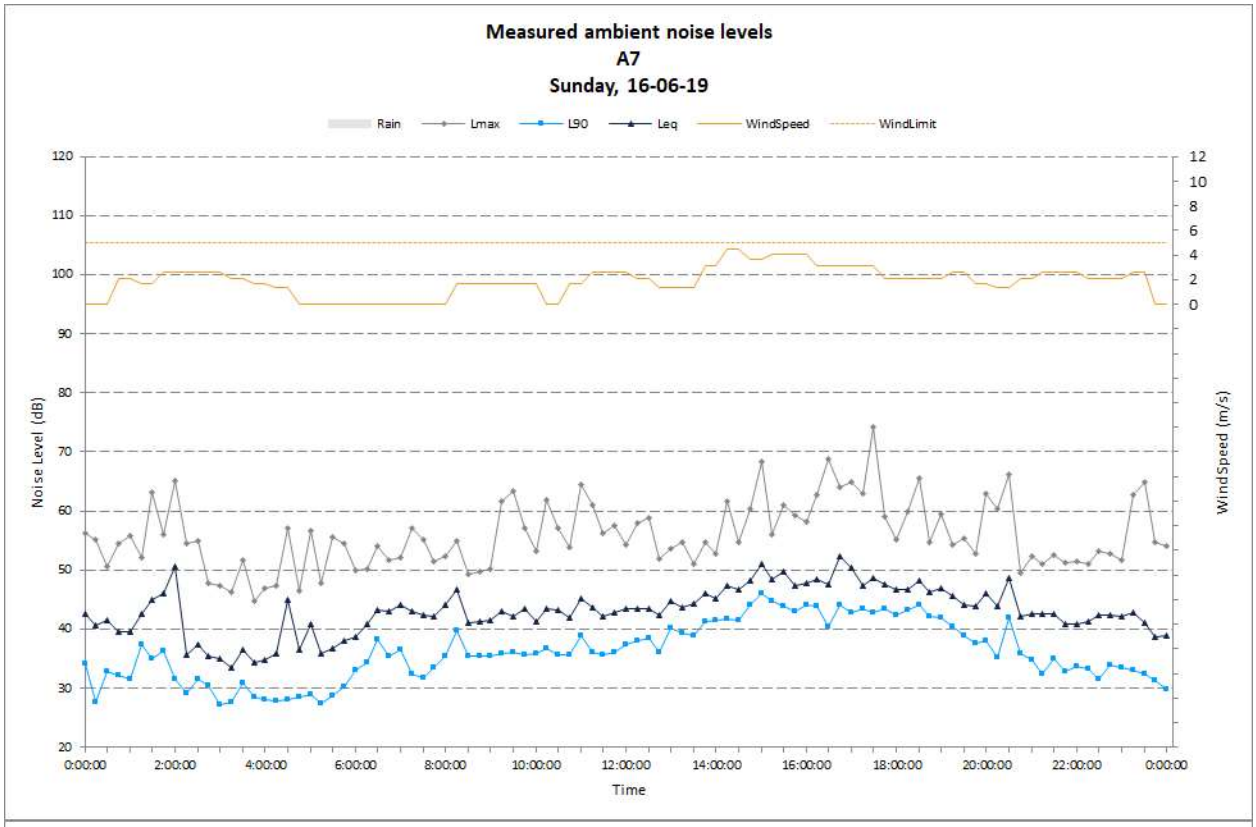
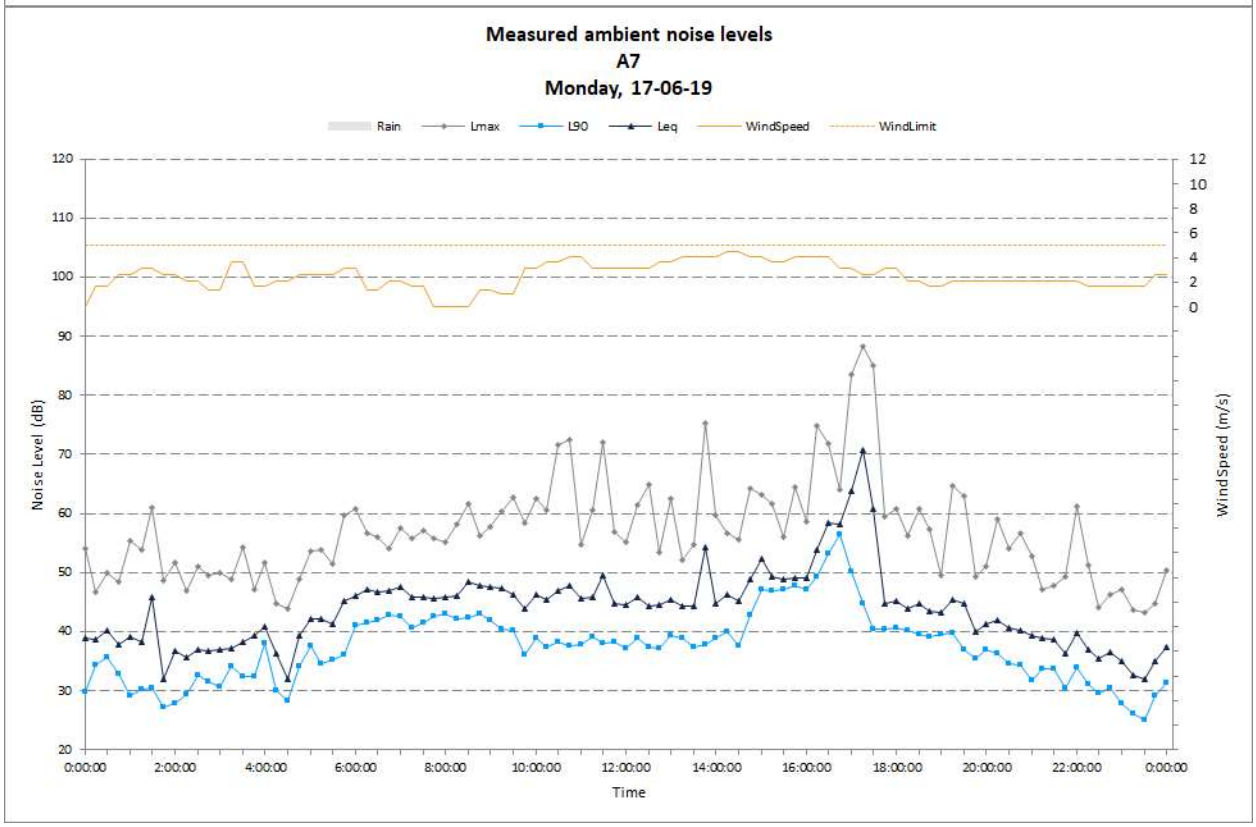
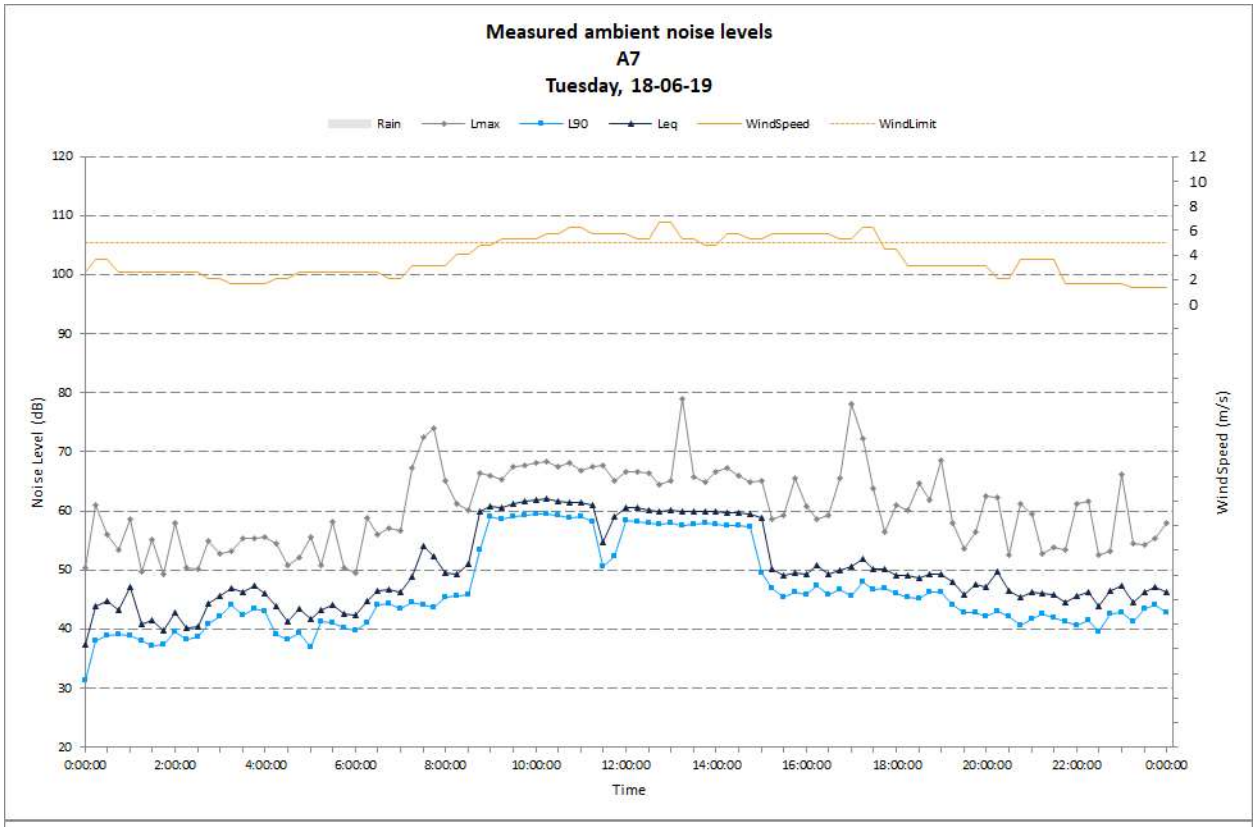
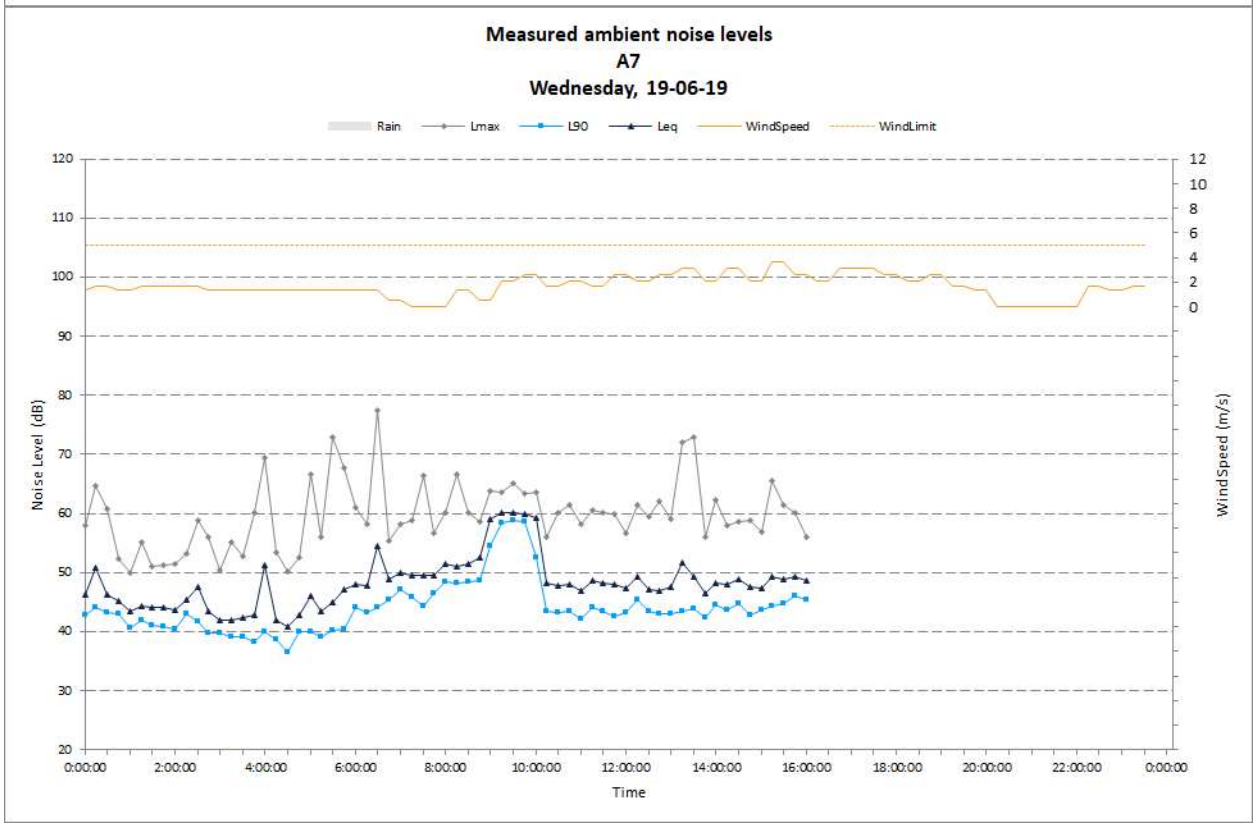

Measured ambient noise levels
A7
Friday, 14-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Saturday, 15-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Sunday, 16-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Monday, 17-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Tuesday, 18-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
A7
Wednesday, 19-06-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time

Appendix E

Sound power levels for modelled operational sources

Table E.1 Single octave sound power levels for modelled operational sources

Source	Single octave sound power level spectrum, dB(A)									Total, dB(A)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
CBP enclosure roof (batching/slumping)	-	40	48	48	46	44	36	34	33	53[1]
CBP enclosure facades (batching/slumping)	-	29	37	36	35	37	32	30	29	43[1]
CBP front-end loader (CBP FEL)	57	85	91	92	94	97	96	90	81	102
CBP conveyor drive	28	28	52	71	81	90	89	89	70	94
CBP conveyor (covered)	48	59	63	65	72	69	65	60	50	75[2]
Concrete agitator truck (driving)	67	85	89	90	96	99	97	92	84	103
Heavy vehicle – cement deliveries	-	89	95	90	89	93	97	92	85	102
Heavy vehicle – aggregates deliveries	-	89	95	90	89	93	97	92	85	102
Ventilation fan exhaust	68	74	75	73	80	76	73	70	63	84
Primary crusher (enclosed)	75	93	99	99	100	100	97	90	75	107
Transfer station (primary crusher/mill)	56	75	81	89	97	98	98	95	91	104
Front-end loader (FEL)	60	88	94	95	97	100	99	93	84	105
Processing plant (mill and filter plant)	76	86	93	95	98	94	89	82	75	102
Underground haul truck (55 t TH663) – ore	65	85	103	98	98	100	102	92	86	108
Underground haul truck (43 t TH551) – waste	65	85	103	98	98	100	102	92	86	108
Watercart	60	75	88	99	99	98	97	92	83	105
Container forklift	75	82	87	96	98	99	98	92	81	104
Mobile crusher/screen	79	97	96	97	109	106	104	98	90	112
Excavator (65 t)	65	84	93	95	101	103	100	93	83	107
Haul truck	65	85	103	98	98	100	102	92	86	108
Dozer (eg D6)	64	77	96	100	105	107	105	101	90	111
Excavator (35 t)	66	84	93	97	104	103	102	96	87	109
Grader	68	75	89	97	97	99	97	90	80	104

Notes: 1. Per square metre of enclosure.
2. Per linear metre.