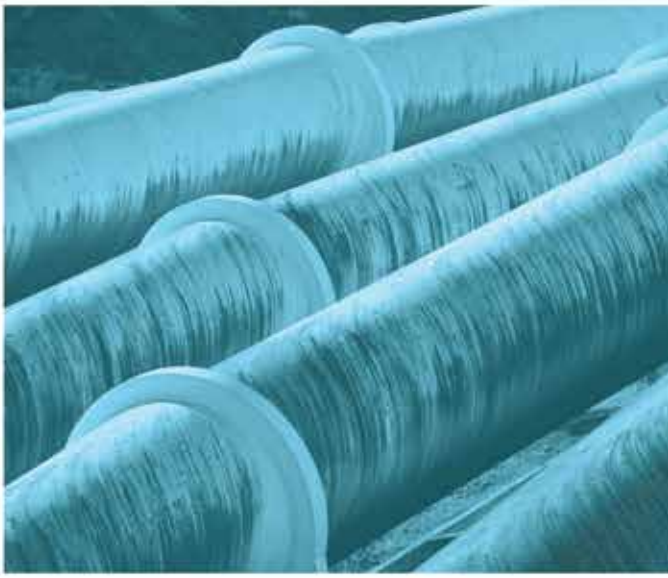



Wongawilli Colliery Modification Report

PA 09_0161 MOD 2 - North West Mains Development
Volume 3 - Appendices A to E

Prepared for Wollongong Coal Limited
December 2020

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Appendix A

Department of Planning, Industry and Environment correspondence regarding MOD 2

Planning, Industry & Environment

Mr Ron Bush
Group Environment and Approvals Manager
Wongawilli Coal Pty Ltd
PO Box 281
Fairy Meadow NSW 2519

09/04/2020

Dear Mr Bush

Wongawilli Colliery (09_0161) Modification 2

I refer to your letter dated 3 March 2020 concerning a proposed modification to the Wongawilli Colliery.

The Department confirms that the appropriate approval pathway for the proposed modification would be under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

The Department is satisfied with the issues identified in your application to be addressed in a Modification Report. The Department also requests that a stability assessment of the proposed roadway configuration is included within the assessment of subsidence impacts.

Your next step will be to lodge your Modification Report through your dashboard on the Department's major projects website (http://www.planningportal.nsw.gov.au/major-projects).

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This approval would be in addition to any approvals required under NSW legislation and it is your responsibility to contact the Commonwealth Department of Agriculture, Water and Environment to determine if an approval under the EPBC Act is required (http://www.environment.gov.au or 6274 1111).

If you require further information, please contact Gen Lucas on 9274 6489 or gen.lucas@planning.nsw.gov.au.

Yours sincerely,

Stephen O'Donoghue
Director
Resource Assessments

Appendix B

Legal advice

MinterEllison

29 October 2020

BY EMAIL

Richard Sheehan
Group Environmental & Approvals Manager
Wollongong Coal Limited
Russell Vale Colliery
7 Princes Highway
Corrimal NSW 2518

Dear Richard

Wollongong Coal Limited and Wongawilli Mine Nebo Area Project 09-0161

We act for Wollongong Coal Limited (**WCL**) the owner and operator of the Wongawilli Colliery (**WWC**).

The consent for the carrying out of the operations at WWC was granted on 2 November 2011 under the former Part 3A provisions of the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**) - Wongawilli Mine Nebo Area Project MP 09-0161 (**Consent**). A modification of the Consent was granted on 27 November 2015 (**MOD 1 Consent**).

We have been instructed to provide advice on whether WCL's proposed realignment of the approved North West Mains Driveage (**NWMD**) is in accordance with the conditions of the MOD1 Consent.

MOD1 Consent

Condition 2 of Schedule 2 of the MOD1 Consent states:

> *The Proponent shall carry out the project: … (c) in accordance with the conditions of this approval.*

Condition 1 of Schedule 2 to the MOD1 Consent states:

> *… the Proponent shall implement all **reasonable** and **feasible** measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.*
>
> (our emphasis)

We consider that this Condition 1 is a type of condition based on outcomes or objectives, validly imposed under section 4.17(4) (*Imposition of conditions*) of the EP&A Act. Section 4.17(4) states:

> ***Conditions expressed in terms of outcomes or objectives** A consent may be granted subject to a condition expressed in a manner that identifies both of the following—*
>
> *(a) one or more express outcomes or objectives that the development or a specified part or aspect of the development must achieve,*
>
> *(b) clear criteria against which achievement of the outcome or objective must be assessed.*

Condition 1 expressly provides that the *objective* is to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project, and that the *criteria against* which the achievement of the objective is to be measured is that all reasonable and feasible measures must be implemented.

The *criteria against* which the *objective* is to be measured is qualified by the relevant Definitions of the MOD1 Consent:

> *Reasonable - the application of judgement in arriving at a decision, taking into account:* ***mitigation*** *benefits, cost of* ***mitigation*** *versus benefits provided, community views and the nature and extent of potential improvements*
>
> *Feasible - engineering considerations and what is practical to build or to implement*
>
> *Mitigation - Activities associated with reducing the impacts of the project prior to or during those impacts occurring*
>
> (our emphasis)

Realignment

Our understanding is that WCL's proposed realignment of the approved NWMD consists of moving the north east heading of the NWMD to the south west by approximately 35m. The realignment has been proposed so as to provide adequate standoff from the Upper Avon Pumping Station and to ensure mining operations are located outside of the prescribed protection barrier.

Based on our reading of the above conditions of the MOD1 Consent, we are of the view that it is ***reasonable*** and ***feasible*** to realign the north east heading of the NWMD, if documentation substantiates the position that if the heading was not realigned (and it was constructed in its current proposed position) it would result in possible *harm to the environment*, and that this could possibly be harm cause to the *built feature* of the Upper Avon Pumping Station and the areas located inside the prescribed protection barrier. Further, we are of the view that it would be considered ***reasonable*** and ***feasible*** if the heading was realigned to ***mitigate*** against any possible *harm*.

Yours faithfully
MinterEllison

Simon Ball
Partner

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MinterEllison

29 October 2020

BY EMAIL

Richard Sheehan
Group Environmental & Approvals Manager
Wollongong Coal Limited
Russell Vale Colliery
7 Princes Highway
Corrimal NSW 2518

Dear Richard

Wongawilli Colliery - Proposed Modification 2

1. Introduction

1.1 Wollongong Coal Limited (**WCL**) is the owner and operator of the Wongawilli Colliery (**WWC**).

1.2 The consent for the carrying out of the operations at WWC was granted on 2 November 2011 under the former Part 3A provisions of the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**) - Wongawilli Mine Nebo Area Project 09-0161 (**Consent**). A modification of the Consent was granted on 27 November 2015 under the former section 75W of the EP&A Act (**MOD 1 Consent**).

1.3 The transitional arrangements for former Part 3A projects has closed and the MOD 1 Consent for the project has transitioned into a State Significant Development (**SSD**) consent.

1.4 We understand that WCL is now considering lodging a modification application under section 4.55(2) (*Other modifications of consents*) of the EP&A Act for WWC. The application proposes to modify the MOD 1 Consent to:

(a) extend the time limitation for mining operation to 31 December 2025;

(b) extend the North West (**NW**) Mains headings to access the existing Wongawilli Ventilation Shaft 1;

(c) make minor improvements to coal conveyance infrastructure;

(d) improve access to the NW Mains via two existing portals; and

(e) change the mining method from both longwall and first workings to just first workings.

(**Proposed Modification**)

1.5 You seek our advice as to whether the Proposed Modification is 'substantially the same development' as the development approved by the MOD 1 Consent.

2. Summary

2.1 In our view, the Proposed Modification is 'substantially the same development' as the development approved by the MOD 1 Consent because the Proposed Modification will not alter the essence of the development or result in any significant qualitative or quantitative differences or any significant environmental impacts. Accordingly, the consent authority has the power to assess and grant consent to the Proposed Modification.

2.2 We explain our reasoning as follows.

3. Statutory Requirement For Modification

3.1 Section 4.55(2) (*Other modifications of consents*) of the EP&A Act provides a consent authority with the power to grant a modification to a development consent. That sub section states:

'A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:

> *(a) it is satisfied that the development to which the consent as modified relates is **substantially the same development** as the development for which consent was [originally granted and before that consent as originally granted was modified] …'*
>
> (our emphasis)

3.2 However, clause 3BA(6) of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* (NSW) provides that in the application of section 4.55(2) of the EP&A Act to a development that was previously a transitional Part 3A project and whose approval was modified under section 75W (ie the Proposed Modification application), the consent authority need only be satisfied that the development to which the consent as modified relates is 'substantially the same development' as the development authorised by the ***last modification made under section 75W*** of the EP&A Act (ie the MOD 1 Consent).

3.3 Accordingly, the key test for the consent authority to determine whether it has the power to assess a modification application is to consider whether it is satisfied that the development is substantially the same development as the development authorised by the last modification made under section 75W (commonly referred to as the 'substantially the same test').

4. Legal principals governing power to modify consents

4.1 In *Agricultural Equity Investments Pty Ltd v Westlime Pty Ltd (No 3)* [2015] NSWLEC 75 at [173] Pepper J sets out the legal principles governing the power to modify consents as follows:

(a) first, the power contained in the provision is to “modify the consent”. Originally the power was restricted to modifying the details of the consent but the power was enlarged in 1985 (*North Sydney Council v Michael Standley & Associates Pty Ltd* (1998) 43 NSWLR 468 at 475 and *Scrap Realty Pty Ltd v Botany Bay City Council* [2008] NSWLEC 333; (2008) 166 LGERA 342 at [13]). Parliament has therefore “chosen to facilitate the modification of consents, conscious that such modifications may involve beneficial cost savings and/or improvements to amenity” (*Michael Standley* at 440);

(b) the condition precedent to the exercise of the power to modify consents is directed to “the development”, making the comparison between the development as modified and the development as originally consented to [or in our case as approved under the MOD 1 Consent] (*Scrap Realty* at [16]);

(c) the applicant for the modification bears the onus of showing that the modified development is substantially the same as the original development [or in our case as approved under the MOD 1 Consent] (*Vacik Pty Ltd v Penrith City Council* [1992] NSWLEC 8);

(d) the term “substantially” means “essentially or materially having the same essence” (Vacik endorsed in Michael Standley at 440 and Moto Projects (No 2) Pty Ltd v North Sydney Council [1999] NSWLEC 280; (1999) 106 LGERA 298 at [30]);

(e) the formation of the requisite mental state by the consent authority will involve questions of fact and degree which will reasonably admit of different conclusions (*Scrap Realty* at [19]);

(f) the term “modify” means “to alter without radical transformation” (*Sydney City Council v Ilenace Pty Ltd* [1984] 3 NSWLR 414 at 42, *Michael Standley* at 474, *Scrap Realty* at [13] and *Moto Projects* at [27]);

(g) in approaching the comparison exercise “one should not fall into the trap” of stating that because the development was for a certain use and that as amended it will be for precisely the same use, it is substantially the same development. But the use of land will be relevant to the assessment made under s 96(2)(a) [or in our case under section 4.55(2)] (*Vacik*);

(h) the comparative task involves more than a comparison of the physical features or components of the development as currently approved and modified. The comparison should involve a qualitative and quantitative appreciation of the developments in their “proper contexts (including the circumstances in which the development consent was granted)” (*Moto Projects* at [56]); and

(i) a numeric or quantitative evaluation of the modification when compared to the original consent [or in our case as approved under the MOD 1 Consent] absent any qualitative assessment will be “legally flawed” (*Moto Projects* at [52]).

4.2 Accordingly, the key issue in determining whether a modification can lawfully be the subject of a development application is whether it meets the test of being 'substantially the same' which is a condition precedent to the exercise of the power to modify a consent.

4.3 We consider the elements of the 'substantially the same' test and their application to the Proposed Modification in further detail as follows.

5. Judicial Consideration of the Substantially the Same Test

5.1 The leading authorities on the substantially the same test are *Vacik v Penrith City Council* [1992] NSWLEC 8 (**Vacik**) and *Moto Projects (No 2) Pty Ltd v North Sydney Council* (1999) 106 LGERA 298 (**Moto**).

5.2 In Vacik, Stein J held that the term 'substantially' means 'essentially have the same essence'. If a development as modified involves an additional and distinct use it is not substantially the same development. Specifically, Stein J stated [per Bignold J in Moto at 30]:

Turning to the issue of s102(1)(a). Is the proposed modified development substantially the same development as that in the development consent (as already amended)? In my opinion substantially when used in the section means essentially or materially or having the same essence.

5.3 In *North Sydney Council v Michael Standley & Associates Pty Ltd* (1998) 43 NSWLR 468, the Court of Appeal endorsed the approach of Stein J in Vacik.

5.4 In Moto, Bignold J set out the following principles for consideration in satisfying the precondition of substantially the same:

(a) the finding of fact requires the **comparison between the development as originally approved and the development as proposed to be modified** [or in our case as approved under the MOD 1 Consent]. At 55:

'The requisite factual finding obviously requires a comparison between the development, as currently approved, and the development as proposed to be modified…'

(b) the objective of the comparison is to determine whether the modification is **essentially or materially** the same as that which was originally approved [or in our case as approved under the MOD 1 Consent]. At 55:

'… The result of the comparison must be a finding that the modified development is "essentially or materially"" the same as the (currently) approved development.'

(c) the comparative task **involves a quantitative as well as qualitative appreciation of the differences** - a numeric or quantitative evaluation of the modification when compared to the original consent [or in our case as approved under the MOD 1 Consent] absent any qualitative assessment will be “legally flawed”. At 52:

'That opinion appears to involve some form of numeric or quantitative evaluation of the modification as a particle of the whole, without attempting any qualitative assessment.

With respect, I think this approach is legally flawed and I am entirely unable to accept it. Far less am I persuaded by it to the extent that fulfils the requirement of the EP&A Act s96(2)(a).'

(d) the comparative task needs to be **undertaken in the context**, including the circumstances in which the original development consent was granted. At 56:

'The comparative task does not merely involve a comparison of the physical features or components of the development as currently approved and modified where that comparative exercise is undertaken in some type of sterile vacuum. Rather, the comparison involves an appreciation, qualitative, as well as quantitative, of the developments being compared in their proper contexts (including the circumstances in which the development consent was granted).'

(e) the comparative task needs to assess the **physical features as well as the environmental impacts** of the changes. At 57-62:

'[57] At the level of physical change, the modified development is obviously different by virtue of the elimination of the ramp access from the Warringah Expressway to the Club carpark, with the direct consequence of employing the Walker Street ROW as the sole means of vehicular access to the redevelopment's on-site carparking provision.

[58] Qualitatively appreciated, that difference is in respect of material and essential features of the approved development, that materiality involving the importance attributed to the physical features of the approved development sought to be modified.

[59] In the present case, the separate ingress for vehicular traffic to the Club was a material and essential physical element of the approved development. It was held to be "important" in my judgment, allowing the appeal and granting the development consent.

[60] Its proposed elimination materially changes the approved development.

[61] Because the requirement of s96(2)(a) calls for an ultimate factual finding on the primary facts of the case, only illustrative assistance is to be gained from consideration of other cases involving their own factual findings on the relevant satisfaction required by s96(2)(a) (or its antecedent, s102(1)(a)).

[62] Reference to those cases indicates that environmental impacts of proposed modifications to approved developments are relevant to the ultimate factual finding-see in addition to Vacik and Tynan, the Court of Appeal's judgment in Mison v Randwick Municipal Council (1991) 73 LGRA 349 at 353 (though the last mentioned case was not directly concerned with s102(1)(a)).'

(f) consideration should be given to **any feature of the development which is important, material or essential**. A change to such a feature is likely to mean that it is not substantially the same development. At 64:

'Although it is well established that the comparative task required to be undertaken to satisfy the requirement of s96(2)(a) involves a comparison of the whole of the developments being compared, that fact does not eclipse or cause to be eclipsed a particular feature of the development, particularly if that feature is found to be important, material or essential. This approach is exemplified in the decision of Talbot J in The Satellite Group (Ultimo) Pty Ltd v Sydney City Council (unreported 2 October 1998) where Talbot J held that the statutory modification power was not available because his Honour had not been satisfied that the development as proposed to be modified would be substantially the same as the currently approved development.'

6. Application of principles to the Proposed Modification

6.1 We have reviewed the Modification 2 Scope Report dated March 2020, and the Wongawilli MOD2 NW Mains DPIE Pre-Lodgement Meeting powerpoint slides dated 15 September 2020 which we understand have been prepared in support of the Proposed Modification.

6.2 The essence of the development authorised by the MOD 1 Consent was the continued operation of a underground coal mine.

6.3 The relevant key aspects of the Proposed Modification include:

(a) extending the time limitation for mining operations from 31 December 2020 to 31 December 2025;

(b) extending the North West (**NW**) Mains headings to access the existing Wongawilli Ventilation Shaft 1;

(c) making minor improvements to coal conveyance infrastructure, including the construction of a new approximately 60m long conveyor;

(d) improving access to the NW Mains via existing Portals 6 and 7;

(e) changing the mining method from both longwall and first workings to just first workings;

(f) improving waste management procedures; and

(g) reducing employment to up to 150 FTEs.

6.4 In our view, having regard to the common law authorities and the statutory test, the Proposed Modification is 'substantially the same development' as that authorised by the MOD 1 Consent because:

(a) the essence of the development will not be altered by the Proposed Modification. That is, the 'essence' of the development will remain the use of the land for the purposes of an underground coal mine;

(b) the carrying out of the Proposed Modification will not result in any significant qualitative and quantitative differences which would alter the essence of the development; and

(c) the Proposed Modification will not involve any significant environmental impacts, in fact it could go a long way to reduce the current impacts of the development being carried out under the MOD 1 Consent.

6.5 Accordingly, it is our view that the Proposed Modification is 'substantially the same development' for which consent was originally granted and the consent authority has the power to assess and grant consent to the Proposed Modification.

6.6 Please contact us if you wish to discuss any of the above in greater detail. We are also available to discuss the above with the consent authority's assessing officers if required.

Yours faithfully
MinterEllison

Simon Ball
Partner

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nick.ferguson@minterellison.com
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Appendix C

Updated project description

C.1 Updated description of the modified project

Table C.1 includes a consolidated description of the modified project.

Table C.1 Updated project description

Development component	Description
Tenement	No change to mining tenements. Mining activities are approved to be CCL 766, ML 1565 and ML 1596
Life of mine	Extension of mine life by 5 years, from December 2020 to 31 December 2025.
Coal production	No change to coal production, which will continue at up to 2 Mtpa, noting restricted production during the MOD2 approval period given stone driveage requirements.
Operating hours	Operating hours will continue to be as approved: • 24 hours per day, seven days per week; • Unloading from coal handling / train loading infrastructure occurring during normal operational hours: – 7 am to 6 pm Monday to Friday; – 8 am to 4 pm Saturday; and – No time on Sundays and public holidays. • Conveyance of coal from the Wongawilli upper pit top to the lower pit top will be restricted to normal operational hours.
Coal seams	No changes (ie Bulli and Wongawilli Coal Seams).
Mining method	Change from longwall and first workings mining methods to first working mining methods only.
Underground workings	Current approval encompasses four 5.5 m wide by 3.6 m high roadways with access from existing portals. Additional first workings proposed to enable access to the existing Wongawilli Shaft No. 1.
Mine infrastructure, coal stockpiles and product transport	No change to rail transport requirements. No change to Wongawilli pit top administration and workshop facilities. Additional access to the NWMD via existing Portals W9 and W10. Relocation of crusher, sizer and screen to underground. Improvements to the coal conveyance network including the construction of a new section of coal conveyor, approximately 60 m in length and coal storage bin. Extension of the Wongawilli lower pit top noise wall.
Rail transport requirements	There will continue to be no transport of coal by road. Train movement restrictions will change to: • maximum of 4 train movements a day; and • no train movements at night.

Table C.1 Updated project description

Development component	Description
Waste management	Waste rock to be stored underground within existing and NWMD workings. Maintain approval for waste rock to be utilised on the surface for landscaping and rehabilitation purposes.
Mine ventilation	Revised NWMD will reduce future ventilation shaft requirements via relying on the existing Wongawilli 1 ventilation shaft. Four portals into the NWMD.
Workforce	Employment of up to 150 FTEs.

Appendix D

Updated mitigation measures table

D.1 Management and mitigation measures

A summary of the environmental mitigation measures for the proposed modification is provide in Table D.1.

Table D.1 Updated mitigation measures

Aspect	Measure
Noise and vibration	Preliminary mitigation options targeting the main operational noise sources at the site have been considered in a mitigation decision making matrix (Table 9.1 of Appendix E). Mitigation strategies have been considered in the following hierarchical approach: 1. control of noise at the source; 2. once the feasible and reasonable controls at the source are exhausted, controlling the transmission of noise; and 3. once source and transmission feasible and reasonable controls are exhausted, considering mitigation measures at the noise sensitive receivers.
	It is anticipated that all the feasible and reasonable noise mitigation measures identified in the mitigation decision making matrix (Table 9.1 of Appendix E) will be adopted. These include: • rail load out improvements, which could be in the form of new/improved enclosure, engineering design solutions to reduce noise emissions from coal leaving bin and entering wagons (or a combination of any of these); • noise suppression kit for dozer or new dozer; • noise suppression kit for FEL or new FEL; • improvements to screen/sizer and elevator enclosures; and • extend existing 6 m high rail barrier further north to the rail loadout bin.
	The implementation of all noise mitigation measures proposed will require significant operational planning, engineering design and, in some cases, significant capital investment.
	WWC will require an appropriate timeline to coordinate and implement all these measures.
	Based on the results table, the predicted noise levels at each assessment location are estimated to reduce by 3-8 dB at most assessment locations, compared to predicted noise levels from approved operations. • Indicative noise contours including mitigation measures are provided in Figure 9.1 and Figure 9.2 of Appendix E. It is noted that noise contours do not include the applicable LFN modifying factor. • The residual noise impact categorisations, after the implementation of feasible and reasonable mitigation measures, are displayed spatially in Figure 9.3 of Appendix E, showing a significant reduction in the number of properties predicted to be significantly impacted by the Wongawilli Colliery operational noise compared to approved operations.
Air quality	The Colliery as approved currently has numerous mitigation and management measures in place to reduce potential air quality impacts.
	The Colliery operates under the Air Quality and Greenhouse Gas Management Plan (AQGHGMP) to ensure all personnel undertaking works at the Colliery understand their responsibility to manage air quality.
	The mitigation and management measures as described within the AQGHGMP would continue to be implemented as part of MOD2.

Table D.1 Updated mitigation measures

Aspect	Measure
Surface water	• Water management is currently documented in the Surface Water Management Plan (SWMP) (Wollongong Coal 2019a). • Management of wastewater and greywater is documented in the Integrated Wastewater Management Plan (IWMMP) (Wollongong Coal 2019b).
	The SWMP details the surface water monitoring program and Trigger Action Response Plan (TARPs) necessary to identify and respond to potential surface water impacts associated with the Wongawilli Colliery operations. The water monitoring program and TARPs detailed in the SWMP have been developed to ensure that the Wongawilli Colliery complies with the EPL 1087 LDP conditions.
	The SWA recommends the following further measures: • the surface water quality monitoring program for the Lake Avon catchment is recommenced and continued for the duration of the colliery's operation; • water quality monitoring is undertaken in the tributary of Robins Creek downstream of the overflow point from the Mine Dam; • field water quality monitoring is undertaken each month and/or following overflow events; • sampling and laboratory water quality analysis is undertaken at least at six-monthly intervals; • water quality parameters to be monitored should comprise: • pH, EC, DO and temperature during field analysis; and • total alkalinity, total dissolved solids, sulphate, total metals, total phosphorous and total nitrogen via laboratory analysis; • metering of pumped volumes from key water storages is undertaken including transfer from the Mine Dam and Pond C; and • outcomes of the surface water monitoring program to be reported in the Wongawilli Colliery Annual Review reports, in accordance with the SWMP (Wollongong Coal 2019). The above measures will provide an improved understanding of the potential water quality impacts to Robins Creek associated with the Wongawilli Colliery.
Subsidence	• Fit-for-purpose or low-height machinery such as a suitably designed road-header is recommended to manage variable mining conditions and achieve a satisfactory level of productivity. • The use of such machinery is recommended for excavation of the shale material in the mid-steam split of the Bulli Seam over the first approximately 1500 m of the NW Mains, the immediate roof strata of the Bulli Seam and the stone driveages to access the Wongawilli Ventilation Shaft 1.
	• Drill ahead strategies to confirm the presence of coal on the other side of dykes are recommended to manage the vertical alignment of the belt road in the areas above secondary extraction in the Wongawilli Seam.
	• Some areas above secondary extraction in the Wongawilli Seam will likely require meshing and additional rib support to control roadway width. A program of monitoring and response is recommended to match the support requirements to the strata and stress conditions.
	• Staying above the existing Bulli Seam workings in the area close to the Wongawilli Ventilation Shaft 1, to avoid all the legacy issues associated with mining through old workings. This approach will ensure that: – there would be no need to intersect the existing Bulli Seam workings which are old, low height and relatively poorly supported; – the shaft could be back filled to above the Bulli Seam and sealed to prevent circulation loss into existing workings in the Bulli Seam and Wongawilli Seam; and – waste rock material from the stone driveages could be disposed of into the shaft.

Table D.1 Updated mitigation measures

Aspect	Measure
	• A precautionary approach is recommended to manage the potential for inflows from the Avon Lake Reservoir into the proposed four roadways of the NW Mains. The strategy considered most effective to manage the potential for inflows involves being able to drill ahead in the Bulli Seam through the dyke and below the base of Avon Lake Reservoir. This approach would confirm there are no zones of increased hydraulic conductivity that would lead to high potential inflows into the underground roadways from the reservoir.
Biodiversity	The BDAR recommends reducing impacts on biodiversity values within the study area by avoiding and/or minimising the removal of native vegetation and fauna habitat. Steps undertaken to avoid and minimise impacts to biodiversity are broken down into site selection and planning, construction and operation phases of the proposed modification. **Site selection and planning** The location of the proposed conveyor to be installed is necessary to connect the conveyor portal to the existing infrastructure at the Wongawilli Colliery. The reutilisation of infrastructure at the Wongawilli Colliery minimises impacts to native vegetation and flora and fauna habitats present within the broader study area, by avoiding construction of completely new infrastructure. Construction Mitigation measures recommended to avoid and minimise further indirect impacts to vegetation and habitat during the construction phase of the proposed works include: • installation of appropriate exclusion fencing around trees and vegetation to be retained in the study area; • installation of appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'; • identification of the location of any 'No Go Zones' in site inductions and a Construction Environmental Management Plan (CEMP); • all material stockpiles, vehicle parking and machinery storage will be located within cleared areas or areas proposed for clearing, and not in areas of native vegetation that are to be retained; • prosed hollow-bearing tree to be removed should be placed in the area of retained vegetation to provide additional fauna habitat; • removal of the hollow-bearing tree should be supervised by a qualified ecologist; • where appropriate native vegetation cleared from the subject land should be mulched for re-use on the site, to stabilise bare ground; • wet down areas to reduce dust generation during construction; • implementation of temporary stormwater controls during construction and to ensure that discharges to the drainage channels are consistent with existing conditions; sediment and erosion control measures should be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect current drainage channels. These should conform to relevant guidelines, should be maintained throughout the construction period and should be carefully removed following the completion of works; Table 11 and Table 12 of Appendix X outline detailed mitigation measures to be undertaken by WCL in order to minimise any impacts to potential threatened microbats utilising the old gantry and tumbler house or the existing mine tunnel entrance, as a result of works associated with the proposed modification. Some of the management measures are outlined below: The following measures are recommended for impacts associated with the construction of coal conveyor adjacent to a potential roosting and breeding structures for threatened microbats:

Table D.1 Updated mitigation measures

Aspect	Measure

Table 8.1 Impact management and mitigation strategies for the old gantry and tumbler house structures

Impact	Environmental management measures	Timing	Responsibility
Construction of coal conveyor adjacent to a potential roosting and breeding structures for threatened microbats	A microbat survey is to be undertaken during the day prior to the commencement of construction of the proposed conveyor. All potential habitat is to be inspected to confirm if microbats are present.	Pre-construction	Project Ecologist, Environmental Manager
	A detailed schedule of management, monitoring and mitigation measures specific to the construction phase of the project will be implemented in the CEMP.	Pre-construction	Project Ecologist, Environmental Manager
	Appropriate noise barriers are to be installed between the proposed conveyor and the old gantry and tumbler house before the start of construction, ensuring not to impede movement of microbats in and out of the structure.	Pre-construction	Environmental Manager, Contractors
	It will be ensured that any staff that are required to undertake works within the vicinity of the structure are briefed on the importance of minimising disturbance to the structure and any potential resident microbats.	Pre-construction	Environmental Manager, Site Foreman, Contractors
	Any necessary lighting required for the proposed works will be directed away from the structures, and designed such that light spill does not occur within retained vegetation.	Construction	Environmental Manager, Contractors
	WCL will maintain appropriate exclusion zones around the structures, and manage any night works by ensuring noise and light pollution is kept to a minimum, particularly through the breeding and lactation period (October and March) in the vicinity of the identified microbat habitat.	Construction, operation	Environmental Manager, contractors
	If it is identified that bats are present in torpor within the structure, fortnightly winter monitoring should be conducted during any upgrades or maintenance works to ensure that over-wintering roosting colonies are not being adversely impacted.	Construction, operation	Project Ecologist
	Unexpected finds and stop works procedures are to be implemented if microbats are observed exiting the structure during construction.	Construction	Environmental Manager and Site Foreman
	Any permanent lighting required for operation of the proposed conveyor will be designed to be directed away from, and avoid light spill into, the structure and any retained vegetation.	Operation	Environmental Manager
	Permanent noise barriers will be constructed between the conveyor and the microbat structure, to minimise noise or vibration disturbance to resident microbats.	Operation	Environmental Manager
	The structure will be designated as a permanent no-go-zone to avoid disturbance to microbats from increased foot traffic in the vicinity.	Operation	Environmental Manager

Table D.1 Updated mitigation measures

Aspect	Measure

Table 8.2 Impact management and mitigation strategies for the existing mine tunnel entrance

Impact	Environmental management measure	Timing	Responsibility
Reutilisation of the existing mine tunnel entrance that provides potential roosting and breeding habitat for threatened microbats	A pre-clearance survey is to be undertaken during the day in September or October, when individuals from all microbat species concerned would have returned to their breeding habitat prior to the breeding season. All areas with the potential to support microbat habitat within the existing mine tunnel entrance will be inspected.	Pre-construction	Project Ecologist, Environmental Manager
	If threatened microbats are not located during preclearance		
	All potential habitat found not to support microbats during pre-clearance surveys and considered likely to be impacted by the proposed works is to have temporary exclusion measures installed to prevent microbats from moving in before works begin. These measures are to be installed immediately following the pre-clearance survey, to ensure microbats do not move into the habitat overnight. Exclusion measures may include: thick tape (such as bitumen tape) or plywood installed over habitat; expanding foam to remove cracks and gaps that may be utilised by microbats; and sealing of all side entrances that connect the existing tunnel to other inactive sections of the adit system, including the old gantry and tumbler house. Sealing off of these entrances will ensure that microbats are able to continue utilising inactive adit structures, without exposure to works within the exiting tunnel entrance. Exclusion measures are to be confirmed sufficient and effective by a qualified ecologist prior to works beginning. Any habitat not considered likely to be impacted by the works, for example permanently unused sections within the adit system are to remain available to any displaced microbats. This will include the installation of bat-friendly gates at any entrances to the system available to microbats. A detailed schedule of management, monitoring and mitigation measures specific to the construction phase of the project will be implemented in the CEMP.	Pre-construction	Project Ecologist, Environmental Manager

If non-breeding threatened microbats are located during preclearance

If microbats are found to be present in the existing tunnel entrance during the pre-clearance inspection, but are not likely to be utilising the structure as a maternity roost (i.e. no evidence of pregnant or lactating females) then temporary exclusion measures are to be installed overnight once the bats have left the roost to forage.

Planned roost exclusion can only be conducted outside the breeding season (October – March) and over wintering time (mid-May to August) under the supervision of a qualified ecologist to ensure all microbats have vacated the roost. The following safeguards must be considered to minimise potential impacts to displaced bats:

- ensure that this procedure is not conducted during an extensive dry period (drought) as this could be detrimental and lead to mortality, if there is no nearby suitable habitat; and
- avoid conducting this procedure during windy, full-moon, cold or rainy nights (i.e. >20 mm in 24 hours), as there is a low likelihood of roost exodus.

The most beneficial timing for planned roost exclusion is in autumn (mid-April – early May) and the start of spring (September). This would avoid both the breeding and overwintering period for microbats.
If works and exclusion of roosting bats are required during the overwintering months (mid-May to August), when many culvert roosting bats enter torpor (hibernation state), the following additional safeguards must be adhered to:

- nocturnal monitoring of roost activity is to be undertaken by a qualified ecologist, and bats must be confirmed as leaving the roost to forage on at least two separate occasions prior to installation of exclusion measures;
- if bats are not confirmed as leaving the roost to forage (ie. in winter torpor) additional monitoring is to be undertaken until regular foraging has resumed; and
- works are not to impact upon the tunnel with bats present in winter torpor.

Additional safeguards that must be considered when exclusion devices are installed include:

- all roost exclusion should be done after dusk, once individuals have emerged to feed and an ecologist is satisfied no microbat individuals remain within the roost; and
- roosting habitat that has been sealed must be regularly monitored to ensure the sealing mechanism remains intact and no microbats are able to utilise the habitat. If it is suspected that the exclusion mechanism has failed then an ecologist must re-inspect the habitat before the seal is reapplied.

Alternative roosting habitat should be made or left available wherever possible when undertaking passive roost exclusion.

Table D.1 Updated mitigation measures

Aspect	Measure		
	If breeding threatened microbats are located during preclearance		
	Although unlikely, if threatened microbats are found to be present in the existing tunnel entrance during the preclearance survey, and appear to be in breeding condition (ie. pregnant or lactating females, presence of young), any use of the tunnel will be immediately postponed and appropriately qualified ecologists will be consulted to determine the most appropriate steps to be taken.		
	Appropriate approval authorities would also be notified.		
	Maternity roosts are considered habitat critical to the survival of these species.		
	Reports are to be provided outlining the findings of pre-clearance assessments and detailing the exclusion measures installed and procedure (if required).	All works	Project Ecologist
	Unexpected finds and stop works procedure are to be implemented if microbats are observed within the existing tunnel during works.	Construction operation	Site Foreman, Environmental Manager and Project Ecologist
Operations	The following recommendations are made to avoid impacts resulting from 'operation' of the proposed works: • any lighting required around the facility should point towards the development and not into surrounding vegetated areas; • on-going treatment of exotic species from within retained vegetation should be undertaken to assist vegetation resilience and quality.		
Historic heritage	The following mitigation measures will be implemented to minimise potential impacts to historic heritage sites associated with the proposed modification. i) **Archival recording** A digital photographic archival recording of the Wongawilli pit top part of the study area will be undertaken prior to any works occurring. This is in accordance with Policy 12 of the CMP. The archival recording will comply with the NSW Heritage Council guidelines *How to Prepare Archival Records of Heritage Items and Photographic Recording of Heritage Items Using Film or Digital Capture 2006.* **ii) Protection of Dumper House (B4)** The existing fencing surrounding the Dumper House will be marked with high visibility bunting to further protect it from any possible damage during the construction of the new conveyor. This is in accordance with Policy 5 of the CMP. **iii) Unexpected finds procedure** Any relics discovered during the construction will trigger the implementation of Wollongong Coals unexpected find procedure. Work in the vicinity of the any unanticipated relic would cease and an archaeologist will be contacted to make a preliminary assessment of the find, including notification to the Heritage Council, if required.		
Aboriginal heritage	The study area has been assessed as being of low potential for identification of any Aboriginal archaeological sites, however, it is recommended in the unlikely event an item or items of Aboriginal historical significance should be discovered during the course of development the following protocols be followed:		

Table D.1 Updated mitigation measures

Aspect	Measure
	Recommendation 1: No further archaeological assessment is required – No further archaeological work is required in the study area due to the entire study area being assessed as having low archaeological potential. **Recommendation 2:** Discovery of unanticipated Aboriginal objects – All Aboriginal objects and places are protected under the *National Parks and Wildlife Act 1974* (NPW Act). It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Heritage NSW, Department of Premier and Cabinet (Heritage NSW). Should any Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the archaeologist will provide further recommendations. These may include notifying the Heritage NSW and Aboriginal stakeholders. **Recommendation 3:** Discovery of Aboriginal ancestral remains – Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity you must: 1. Immediately cease all work at the location and not further move or disturb the remains. Notify the NSW Police and Heritage NSW's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location. 3. Not recommence work at that location unless authorised in writing by Heritage NSW. **Recommendation 4:** The proponent should continue to consult with RAPs about the management of Aboriginal cultural heritage sites within the study area through the life of the project.
Social	The proposed mitigation and management strategies for potential social impacts identified and outlined in the SIA are summarised below: • traffic and transport: – reduced hours of production on weekends and out of hours to mitigate road delays; – Council upgrades to Wongawilli Road (previously owned by the Colliery) to manage public safety from increased traffic; • historic heritage: – archival recording, high visibility bunting, and unexpected finds procedure to mitigate loss of historic heritage; • air quality: – dust suppression measures outlined in the AQIA to mitigate health impacts from expelled dust; • biodiversity: – actions to avoid or minimise impacts and offsetting one vegetation zone through the transfer and retirement of biodiversity credits or by paying into the BCT Offset Fund, to mitigate the loss of native species' habitats; • noise and vibration – reduce out of hours operation and mitigation measures outlined in noise assessment, to mitigate amenity impacts from noise and vibration.

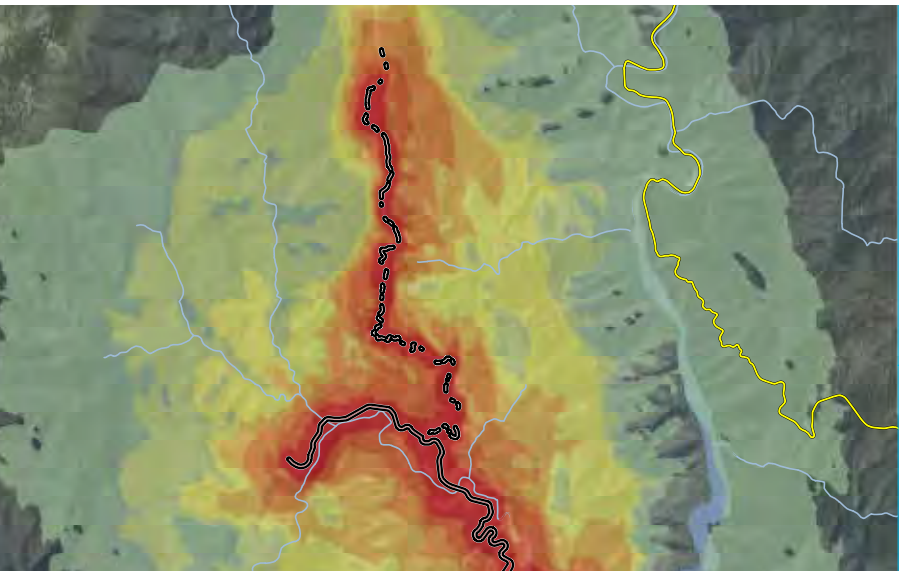
Appendix E

Noise and vibration impact assessment

Wongawilli Mod 2 NW Mains

Noise and vibration impact assessment

Prepared for Wollongong Coal
November 2020



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Wongawilli Mod 2 NW Mains

Noise and vibration impact assessment

Report Number

J200053 NVIA

Client

Wollongong Coal

Date

10 November 2020

Version

Final

Prepared by	**Approved by**
	
Katie Teyhan Associate 10 November 2020	**Najah Ishac** Director 10 November 2020

Executive Summary

ES1 Introduction

EMM has prepared an NVIA for the Wongawilli Colliery to accompany a modification application (MOD2) to the existing Project Approval (PA) for the underground coal mine (PA 09_0161).

The site has been in operation since approximately 1916 and, given the proximity of surrounding residential areas, is aware of the potential for noise impacts at neighbouring noise sensitive receptors. A significant amount of mitigation works has been undertaken over many years with a focus on reducing noise from mobile plant operating on the stockpile area and noise from the screen and sizer enclosure.

ES2 Operational noise assessment

Operational noise from Wongawilli Colliery has been assessed in accordance with the methodology outlined in the NPfI for existing sites. The methodology for applying the NPfI to existing sites is outlined in Section 6.1.1 of the NPfI and is summarised as follows as applicable to the proposed modification:

1. An evaluation of approved mine noise emissions was undertaken. Results of noise compliance monitoring, which has been undertaken quarterly, indicates that the Colliery has been predominantly compliant with existing operational noise limits as well as rail noise limits associated with noise from use of the rail spur. Further, the site has had minimal complaints in relation to noise and vibration with three complaints recorded in the five year period prior to the mine entering care and maintenance in 2019.

2. Project noise trigger levels (PNTLs) were established, in accordance with the NPfI, to set a benchmark level to assess the need to consider noise mitigation. These were based on the results of contemporary ambient noise monitoring undertaken by EMM during July 2020 as well as historical noise monitoring when the mine was operational (as reported herein).

3. Noise emissions from approved Wongawilli Colliery operations were predicted, having regard to noise-enhancing meteorological effects such as wind and temperature inversions, as per the NPfI. Approved operations noise emissions were validated via a comparison to results of historical noise compliance surveys.

4. Predicted approved noise emission levels were compared to PNTLs including consideration of applicable modifying factors to account for annoying characteristics of noise as per the NPfI. This comparison found that approved noise emissions were above the contemporary PNTLs at various noise-sensitive receptors surrounding the mine. It is noted that significant encroachment of residential development has occurred since the most recent modification to the current approval.

5. Given the preceding, an assessment of feasible and reasonable noise mitigation strategies was undertaken. Comparison of predicted mitigated mine noise levels to approved levels indicated a general improvement to noise emissions in the order of 3-8 dB. Residual noise impacts after incorporating feasible and reasonable noise mitigation strategies were categorised in accordance with the VLAMP and showed a considerable reduction in the number of properties affected by residual noise impacts from Wongawilli Colliery.

6. Achievable noise limits were determined for Wongawilli Colliery at six locations around the mine expected to represent the nearest potentially most affected residences in each direction from the Colliery. These will likely form the basis of revised noise goals for the Colliery and would be appropriate locations for future noise compliance monitoring.

As per the results of historical noise compliance monitoring, night-time noise emissions from the Colliery are generally steady-state; typically described as 'mine hum'. Maximum noise events from site have typically not been observed during the night period. Predicted maximum noise levels at the assessment locations are below the relevant sleep disturbance L_{Amax} screening levels. Hence, as per the NPfI requirements, a detailed assessment of maximum noise level events is not required.

ES3 Vibration

Vibration from operational activity is not expected to change as a result of the proposed modification compared to that currently approved. The main potential source of vibration from the site is movement of the dozer and/or front-end loaders in the ROM stockpile area. Given the separation distance of at least 150m between the stockpile area and the nearest private residences, vibration levels are expected to be below that which could cause disturbance to residents. Further, there is very limited construction activity associated with the proposed modification. Thus, a detailed assessment of vibration impacts has not been included in this report.

ES4 Road traffic noise

Given that the mine is currently in care and maintenance there will likely be a noticeable increase in road traffic noise when operations recommence. Notwithstanding, road traffic noise generated by mine-related traffic is predicted to achieve relevant road traffic noise goals. There is significant development occurring in the vicinity of the Colliery in relation to residential urban areas. Thus, it is likely that road traffic volumes in the vicinity of the Colliery, unrelated to operation of the mine, will increase as a result of the continued and future development of residential subdivisions.

ES5 Rail traffic noise

Rail noise levels from operation of trains on the Wongawilli rail spur are not proposed to change compared to those currently approved. Rail noise from up to two trains during the daytime period is predicted to comply with the relevant rail noise goal established in accordance with the RING (EPA, 2013) and is also below the current rail noise limit provided in PA 09 – 0161.

Table of Contents

Appendices

Tables

Figures

1 Introduction

1.1 Overview

Wongawilli Colliery (the Colliery) is an underground coal mine located approximately 15 kilometres (km) south-west of Wollongong within the Wollongong and Wingecarribee local government areas (LGAs). The site is owned and operated by Wollongong Coal Pty Limited (Wollongong Coal). Wollongong Coal is majority owned by Jindal Steel and Power Limited (JSPL).

This noise and vibration impact assessment (NVIA) has been prepared to accompany a modification application (MOD2) to the existing Project Approval (PA) for the underground coal mine (PA 09_0161) originally approved in November 2011 and subsequently modified in December 2015 (MOD1).

MOD2 is sought under section 4.55(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

MOD2 seeks to extend the life of the Colliery by five years to enable Wollongong Coal to continue development of the approved North West Mains Development (NWMD). Furthermore, the modification largely seeks approval to extend the length of the approved NWMD alignment to access the existing Wongawilli Ventilation Shaft 1 and minor surface activities.

1.2 Assessment guidelines and requirements

This NVIA has been prepared to accompany the modification report and assesses the noise and vibration impacts of the proposed modification on existing noise-sensitive receptors in the surrounding area.

No assessment requirements were issued for the proposed modification by Department of Planning, Industry and Environment (DPIE). Notwithstanding, this NVIA has been completed with reference to the following guidelines and policies:

- NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry* (NPfI);
- NSW Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline* (ICNG);
- NSW EPA 2013, *Rail Infrastructure Noise Guideline* (RING);
- NSW Department of Environment, Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP); and
- Department of Environment and Conservation NSW 2006, *Assessing Vibration: a technical guideline*.

A number of technical terms have been utilised throughout this report for the discussion of noise and vibration. These are explained in the Glossary.

1.3 The site and surrounds

The approved NWMD and proposed additional driveage underlies the eastern extent of the Illawarra Plateau within the Upper Nepean State and Illawarra Escarpment Conservation Areas, including the south-western part of Lake Avon, Gallahers Creek and Flying Fox No. 3 Creek, smaller tributary streams and two identified swamps. The existing Upper and Lower Wongawilli Colliery pit top site infrastructure is situated on the eastern escarpment of the Illawarra Plateau, approximately 15 km south-west of Wollongong (Figure 1.1).

The Colliery occupies 14,767 hectares (ha) under mining leases CCL 766, ML 1565 and ML 1596 located within the Wollongong and Wingecarribee LGAs in the Illawarra region of NSW (Figure 1.1).

The existing Colliery mine access point and surface infrastructure facilities are at approximately 260 metres Australian Height Datum (mAHD) (referred to as the 'Upper Wongawilli pit top'), while the coal handling facilities are at the base of the Illawarra Escarpment at approximately 40 m AHD (referred to as the 'Lower Wongawilli pit top'). The Wongawilli Upper and Lower pit tops are connected by an existing coal conveyor and an access road.

Wongawilli Road/West Dapto Road connects the Colliery to the Princess Highway approximately 4.3 km west of the mine. The Colliery's private rail line runs east from the Lower Wongawilli pit top to the south of Wongawilli before joining the main Illawarra railway line. Whilst the state-owned Unanderra to Moss Vale rail line is west of the Wongawilli upper pit top and runs in a north south direction.

The nearest major population centres are the Wollongong suburbs of Horsley, approximately 2.7 km south-east, and Dapto, approximately 4 km south-east of the Lower Wongawilli pit top. The residential suburbs of Wongawilli and Dombarton neighbour the Colliery (Figure 1.2).

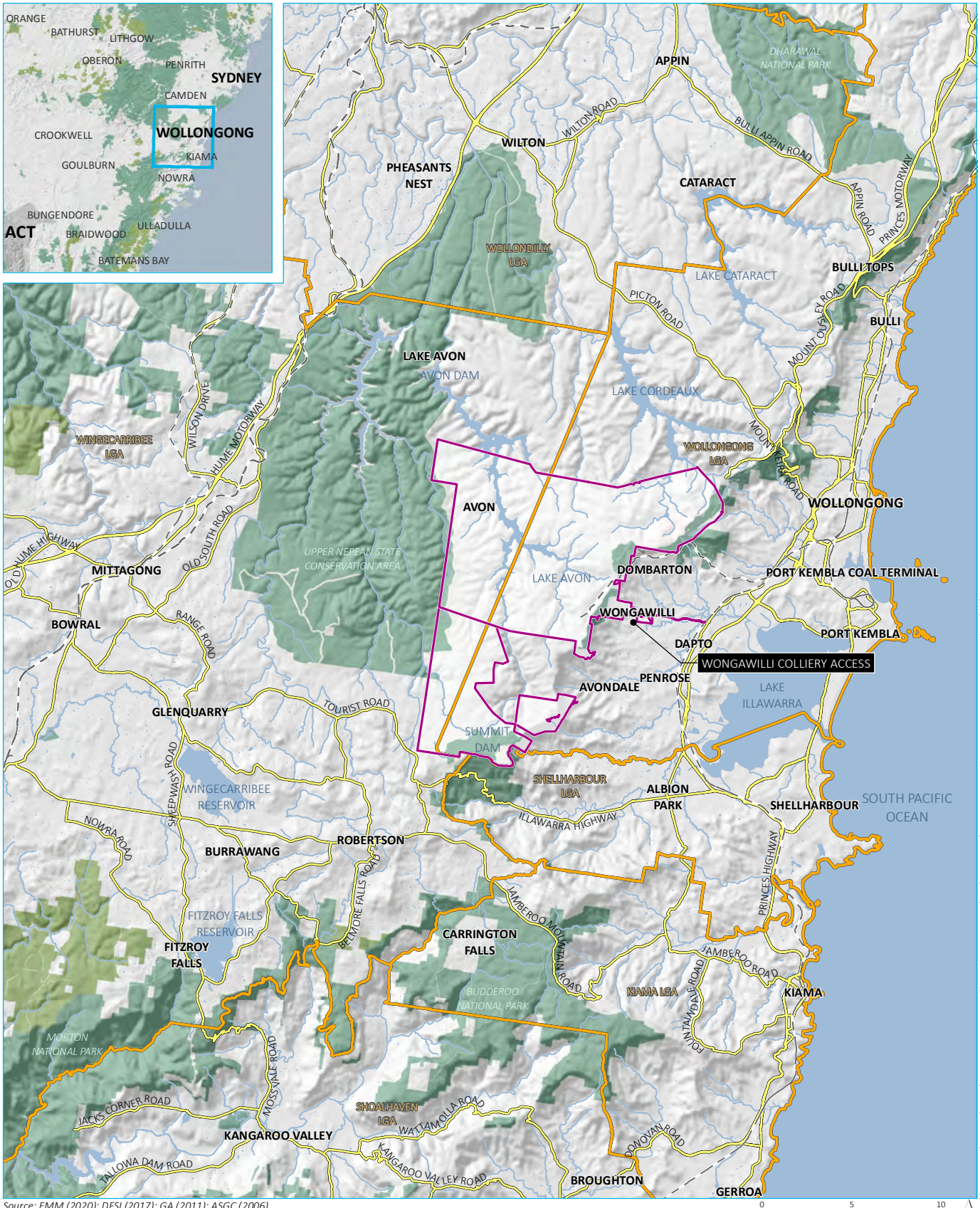
1.4 The project area

MOD2 will allow for the completion of the approved NWMD, comprising approximately 4.5km of the remaining underground mains heading with an additional driveage extension of approximately 2.9 km to the existing Wongawilli Ventilation Shaft 1.

The connection to this shaft will ensure ventilation requirements are met for the NMWD.

The modification proposes to utilise existing Upper and Lower Wongawilli pit top (surface) infrastructure with the exception of minor changes to replace a portion of the Upper Wongawilli pit top conveyor network. This change is proposed to improve the conveying of coal from the NWMD to the existing coal handling and train loading facilities located at the Lower Wongawilli pit top. All aspects of the modification fall within the existing Project Application Area.

The project area in relation to the Colliery can be seen in Figure 1.2.



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

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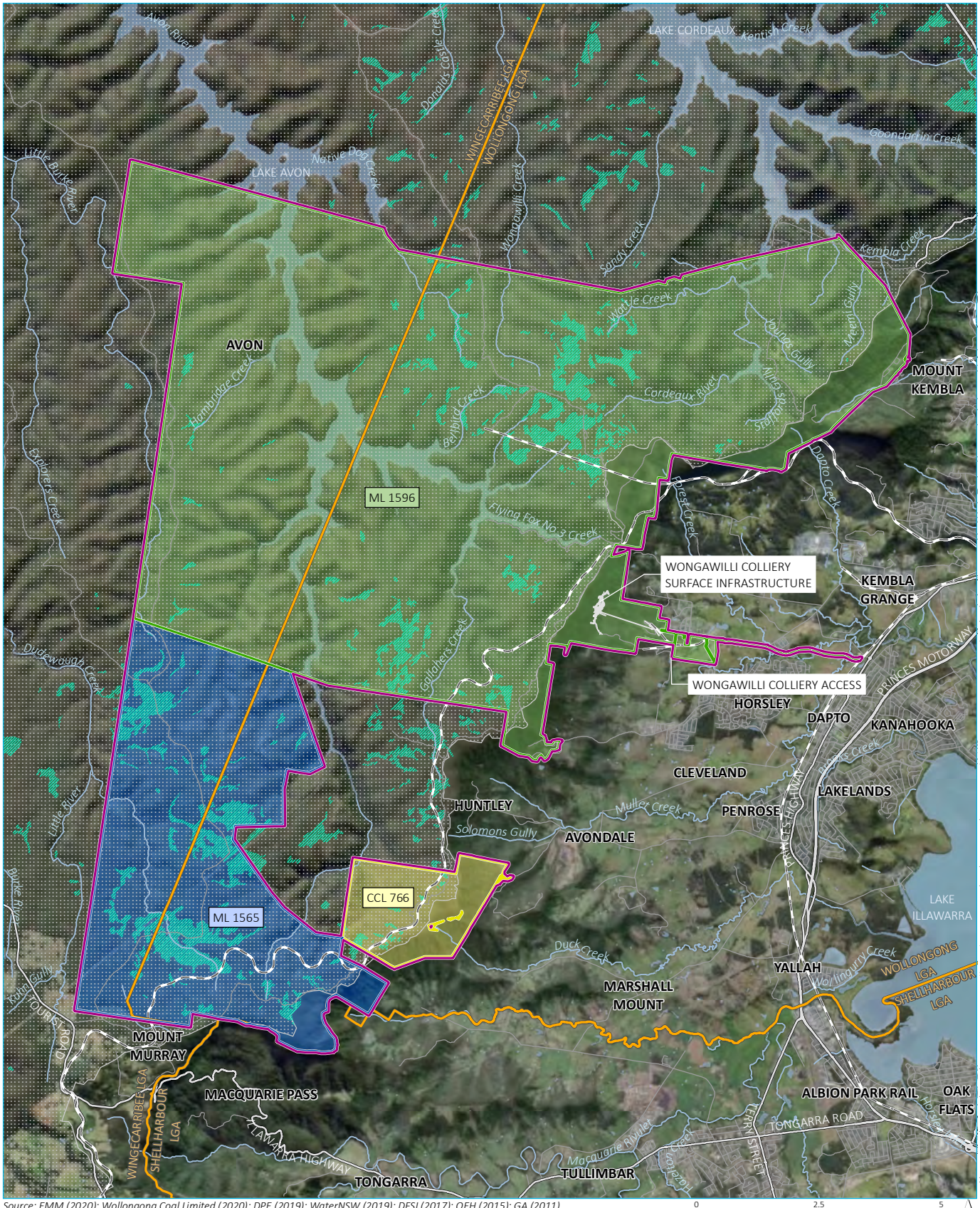
KEY

- Project application area
- Rail line
- Major road
- Named watercourse
- Waterbody
- Local government area
- NPWS reserve
- State forest

Regional setting

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 1.1

EMM creating opportunities



Source: EMM (2020); Wollongong Coal Limited (2020); DPE (2019); WaterNSW (2019); DFSI (2017); OEH (2015); GA (2011)

0 2.5 5 km

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KEY

- Project application area
- Mining title
  - ML 1565
  - ML 1596
  - CCL 766
- Wongawilli Colliery surface infrastructure
- Rail line
- Major road
- Minor road
- Named watercourse
- Waterbody
- Upland swamp
- Metropolitan special area
- Local government area

NOTE: Project application area is offset for viewing purposes

Local setting

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 1.2

EMM creating opportunities

2 Proposed modification

2.1 Overview

MOD2 is seeking to:

- extend the life of the mine by five years to 31 December 2025 to enable Wollongong Coal to continue development of the approved NWMD;
- additional driveage and underground mains heading of approximately 2.9 linear km to access the existing Wongawilli Ventilation Shaft 1;
- provide additional access to the NWMD to that currently approved via existing Portals W10and W9;
- minor alignment changes to the approved NWMD as ventilation infrastructure is no longer proposed at the western end of the approved NWMD alignment;
- relocation of coal handling infrastructure including the crusher, sizer and screen from the Wongawilli lower pit top to underground; and
- construction of a new section of coal conveyor system, approximately 60 m in length, and coal storage bin at the Wongawilli upper pit top.

Wollongong Coal propose to continue coal production at up to 2 Mtpa, noting restricted production during the MOD2 approval period given stone driveage requirements. Wollongong Coal in addition propose to utilise largely existing surface infrastructure (ie coal handling, water management systems, administration facilities) at the Wongawilli lower and upper pit tops. Product coal will continue to be transported from the Colliery to Port Kembla by rail.

The modification does not seek to change any of the other aspects of the mining operations, including the extraction rate, coal processing and handling activities, offsite coal transportation routes or hours of operation which will remain as currently approved.

MOD2 compared to the current approved project is outlined in Figure 2.1. A site layout is provided in Figure 2.2 and Figure 2.3.

Table 2.1 Proposed modification

Element	The Colliery (Currently approved Project)	MOD2
Operating hours	24 hours per day, seven days per week Unloading from coal handling / train loading infrastructure occurring during normal operational hours: • 7am to 6pm Monday to Friday • 8am to 4 pm Saturday • no time on Sundays and public holidays	Conveyance of coal from the Wongawilli upper pit top to the lower pit top to be restricted to normal operational hours.
Coal seams	Bulli and Wongawilli Coal Seams	No change

Table 2.1 Proposed modification

Element	The Colliery (Currently approved Project)	MOD2
Extraction rate	2 million tonnes per annum	No change
Approval period ending	31 December 2020	31 December 2025
Mine life	9 years consisting of 4 years (original consent), plus 5 years (MOD1)	Coal extraction until 31 December 2025, representing an extension of the approved mine life by 5 years
Mining method	Longwall and first workings mining methods	First working mining methods only.
Underground workings	Four 5.5 m wide by 3.6 m high roadways Access from existing portals	Minor alignment changes to the western end of the approved NWMD, Additional first workings proposed to enable access to the existing Wongawilli Shaft 1.
Mine infrastructure, coal stockpiles and product transport	Wongawilli lower and upper pit top facilities and coal handling / load out infrastructure to rail	No change to rail transport requirements. No change to Wongawilli pit top administration and workshop facilities. Additional access to the NWMD via existing Portals W9 and W10. Relocation of crusher, sizer, and screen to underground. Improvements to the coal conveyance network including the construction of a new section of coal conveyor, approximately 60 m in length and coal storage bin. Extension of the Wongawilli lower pit top noise wall.
Rail transport requirements	No transport of coal by road. Train movements restrictions: • 8 train movements (calendar year average) a day • 10 train movements (max. weekly rolling average) a day • 3 train movements a night during normal operations • 4 train movements a night during advertised campaigns, with a maximum of 10 such campaigns per year	Maximum of 4 train movements a day. No train movements at night.
Waste management	Waste rock to be stored underground in two of the four Western Driveage roadways. Waste rock which does come to the surface to be utilised for ballast or fill underground or used on the surface for landscaping and rehabilitation	Waste rock to be stored underground within existing and NWMD workings. Maintain approval for waste rock to be utilised on the surface for landscaping and rehabilitation purposes

Table 2.1 Proposed modification

Element	The Colliery (Currently approved Project)	MOD2
Mine ventilation	Mine portals and vent shafts including: • two portals for personnel and materials • one portal for coal extraction • two portals into the NWMD • Wongawilli Shaft 1, Nebo Shaft 3 and 4 Existing Nebo area portals (Wonga Belts and Wonga Track) and ventilation shafts (Vent Shaft 3 and 4) are proposed to be closed off and rehabilitated so will no longer be in use	Revised NWMD will reduce future ventilation shaft requirements via relying on the existing Wongawilli 1 ventilation shaft. Four portals into the NWMD.
Workforce	Approved for up to 300 FTEs and contract personnel	Employment of up to 150 FTEs

2.2 Project description

2.2.1 Proposed additional driveage

MOD2 includes an extension of the NWMD to the north-west by approximately 1,300 m and by a further 1,600 m to the north-east. The extension will provide access to the existing Wongawilli Shaft 1 to provide ventilation for the full extent of the NWMD (refer Figure 2.1).

2.2.2 Wongawilli pit top

Wollongong Coal propose to largely utilise existing pit top surface infrastructure at the Wongawilli lower and upper pit top areas. The exception being the construction of a new section of coal conveyor system, approximately 60 m in length, and coal storage bin at the Wongawilli upper pit top and relocation of the coal preparation infrastructure including the crusher, sizer and screen which is to be located underground. Wollongong Coal in addition, propose to utilise two additional existing portals located at the Wongawilli upper pit top, Portals W9 and W10, to provide improved access to the NWMD. Surface infrastructure including the Wongawilli Shaft 1 is displayed in Figure 2.1, the Wongawilli lower and upper pit top facilities are identified respectively in Figure 2.2 and Figure 2.3.

ROM coal has historically been conveyed from the NWMD from the existing conveyor belt portal using the Main North Underground Conveyor via the Transfer House to the Decline ROM Coal Conveyor before being placed within either of the Coal Storage Bins or at the Lower Wongawilli pit top stockpile area. Existing coal preparation infrastructure is located at the Wongawilli lower pit top, in which ROM is subject to crushing and sizing prior to being placed within the coal storage bins or at the stockpile area. ROM coal is directly loaded to trains from the Coal Storage Bins or from stockpiles via a front hand loader.

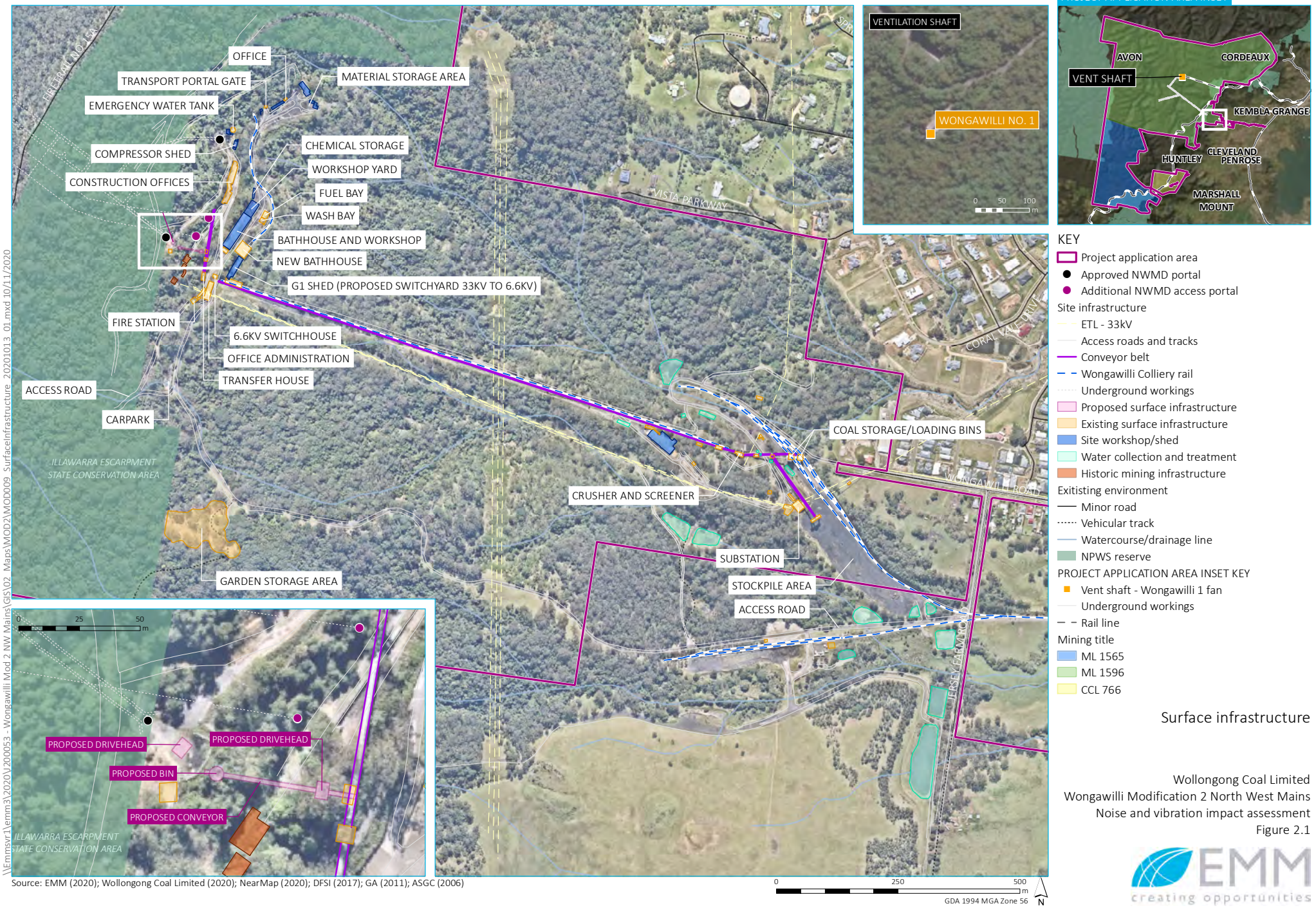
MOD2 seeks to improve the coal conveyor network by constructing a new conveyor section from North West Mains B Portal to the existing Main North Underground Conveyor. The new conveyor section comprises the construction of a coal storage bin in which ROM coal would be placed before being transported via the new section of conveyor, approximately 60m in length, to the existing Main North Underground Conveyor. The new conveyor section would also require the construction of three drive heads and ancillary support infrastructure.

Minor modifications to the existing Main North Underground Conveyor will also be required to facilitate the upgrade of the conveyor network. All new and upgraded conveyor sections will be enclosed to reduce impacts as is consistent with existing infrastructure. Proposed minor changes to the existing conveyor network are identified in Figure 2.1.

The proposed changes to the conveyor network will improve the transportation of ROM coal from the NWMD portals to the existing coal handling and train loading infrastructure and will result in the redundancy of approximately 50 m of the existing Main North Underground Conveyor. This section of the existing conveyor will be decommissioned in accordance with the Mining SEPP and does not form part of this modification.

The relocation of coal preparation equipment including the crusher, sizer and screen is proposed to remove noise sources at the Wongawilli lower pit top. The relocation of the equipment to underground will provide improved noise outcomes for residents neighbouring the operation. The relocated coal preparation equipment would be integrated into the existing coal conveyance system located within the NWMD workings. The existing crusher, sizer and screen will be removed from the Wongawilli lower pit top. To further reduce potential noise impacts to local receivers the existing noise barrier located at the Wongawilli lower pit top will be extended, as displayed in Figure 2.3. The extension to the noise barrier is proposed to be located within the existing rail corridor disturbance area.

No further changes are proposed to existing surface infrastructure to that currently approved.



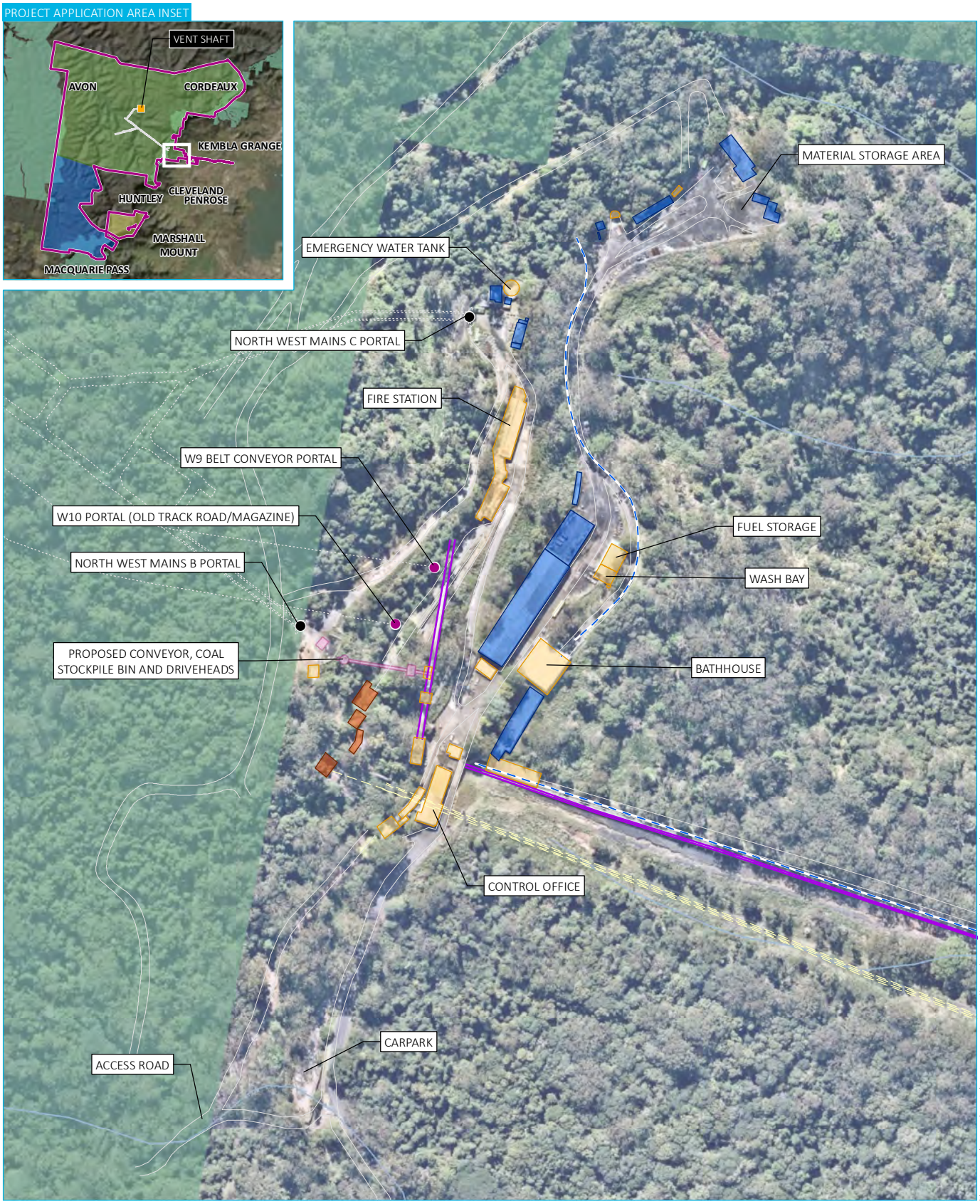
\\Emmsvr1\emm3\2020\J200053 - Wongawilli Mod 2 NW Mains\GIS\02 Maps\MOD2\MOD009 SurfaceInfrastructure 20201013 01.mxd 10/11/2020

Source: EMM (2020); Wollongong Coal Limited (2020); NearMap (2020); DFSI (2017); GA (2011); ASGC (2006)

Surface infrastructure

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 2.1

EMM
creating opportunities



Source: EMM (2020); WCL (2020); DFSI (2017); GA (2011); ASGC (2006)

0 50 100 m
GDA 1994 MGA Zone 56

N

KEY

- Project application area
- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure
- ETL - 33kV
- Access roads and tracks
- Conveyor belt
- Wongawilli Colliery rail
- Underground workings

- Proposed surface infrastructure
- Existing surface infrastructure
- Existing site workshop/shed
- Historic mining infrastructure

Existing environment
- Minor road
- Watercourse/drainage line
- NPWS reserve

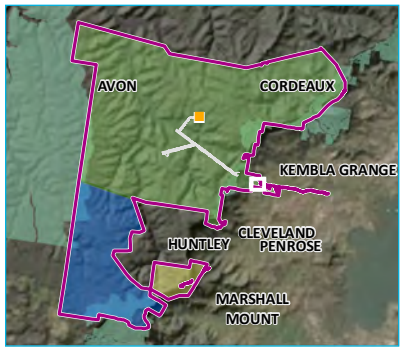
PROJECT APPLICATION AREA INSET KEY
- Vent shaft
- Underground workings

Mining title
- ML 1565
- ML 1596
- CCL 766

Wongawilli upper pit top

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 2.2

EMM creating opportunities



KEY

- Project application area

Site infrastructure

- ETL - 33kV
- Access roads and tracks
- Conveyor belt
- Wongawilli Colliery rail
- Noise barrier (6 m height)
- Proposed noise barrier extension
- Existing surface infrastructure
- Site workshop/shed
- Water collection and treatment

Exitisting environment

- Minor road
- Vehicular track
- Watercourse/drainage line

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

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Source: EMM (2020); Wollongong Coal Limited (2020); NearMap (2020); DFSI (2017); GA (2011); ASGC (2006)

0 50 100 m

GDA 1994 MGA Zone 56

N

Wongawilli lower pit top

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 2.3

EMM
creating opportunities

2.2.3 Hours of operation

This modification does not propose to change the existing Wollongong Colliery hours of operation, being 24 hours per day, seven days per week with unloading from coal handling / train loading infrastructure occurring during normal operational hours as follows:

- 7am to 6pm Monday to Friday;
- 8am to 4 pm Saturday; and
- no time on Sundays and public holidays.

However, to further minimise potential impacts to residents neighbouring the operation, Wollongong Coal propose to restrict the conveyance of coal from the Wongawilli upper pit top to the lower pit top to during normal operational hours as defined above. Coal is proposed to be stored within the proposed coal storage bin located at the Wongawilli upper pit top outside of normal operating hours.

2.2.4 Workforce requirements

As result of longwall mining no longer occurring at the Colliery, FTE personnel requirements will reduce to approximately 150 persons.

2.2.5 Mining operations

As previously stated, MOD2 does not seek to change any of the other aspects of the mining operations, including the coal processing and handling activities, offsite coal transportation routes, proposed rehabilitation activities or hours of operation which will remain as currently approved.

2.2.6 Construction Activities

Minor surface construction works as described in Section 2.2.2 will be undertaken to improve the coal conveyance system and preparation system. Construction activities are minor in nature and accounted for under the proposed work force requirements identified in Section 2.2.4.

Improvements to existing infrastructure, as necessary, will be undertaken in accordance with the PA.

2.2.7 Schedule of Works

Initial works following approval of MOD2 will likely involve the following prior to commencement of mining operations:

- establishment of the surface mine services for the NWMD;
- re-support existing (underground) workings to the design support criteria;
- installation of underground services;
- delivery and introduction to site for mining and ancillary equipment for underground works; and
- onboarding of staff and mine workforce.

It is likely that these initial works will take approximately three months to complete and enable progression to the initial underground mining activities. The first stage of mining will be completed in approximately 26 weeks and involve stone driveage with limited coal production during this time. The stockpile will likely not be used during this first stage.

The second stage of the mine development will produce coal that will be sent to the storage bin or stockpile area during day shift only. It is estimated that the second stage will be approximately 26 weeks duration.

Full operations are not expected to commence until two years after the approval is awarded. This is due to the nature of the initial mine entry construction which will entail a significant amount of stone excavation and support to reach the thicker and economic sections of the Bulli coal seam. Limited use of the surface facilities will be required through the initial period of mine establishment. It is further proposed that the use of the surface coal clearance system (conveyor belt) will only be used during the dayshift hours to handle the limited quantity of coal that will be produced.

While the mine is completing the initial works, further engineering design will be completed to design and procure a coal handling and clearance system that aims to reduce potential impacts, most notably noise emission to neighbouring landholders. Areas that have been initially identified for consideration in this regard are as follows:

- conveyance from the mine portal to the lower stockpile area - redesigned to minimise the transfer points of the material and replace the existing decline conveyor belt system;
- coal storage and train loading facility - redesigned to minimise noise emissions e.g. use of mobile equipment will be minimised or contained in an enclosed facility, lower impact loading system, etc;
- coal bins - the location and design will be reviewed; and
- additional noise barriers and/or enclosures.

2.3 Assessment locations

The nearest noise and vibration sensitive receptors (herein referred to as assessment locations) are shown in Figure 2.4 and described in Table 2.2. Consistent with PA 09_0161, previous noise impact assessments and the current compliance noise monitoring requirements the neighbouring residential areas have been categorised in four noise catchment areas (NCA): RA1a, RA1b, RA2 and RA3.

It is noted that significant residential development encroachment has occurred in the vicinity of the Colliery since the most recent modification to the current approval. The nearest residential developments at that time are represented by the existing noise monitoring locations; RA1a, RA1b, etc. and are indicated in Table 2.2.

Table 2.2 Assessment locations

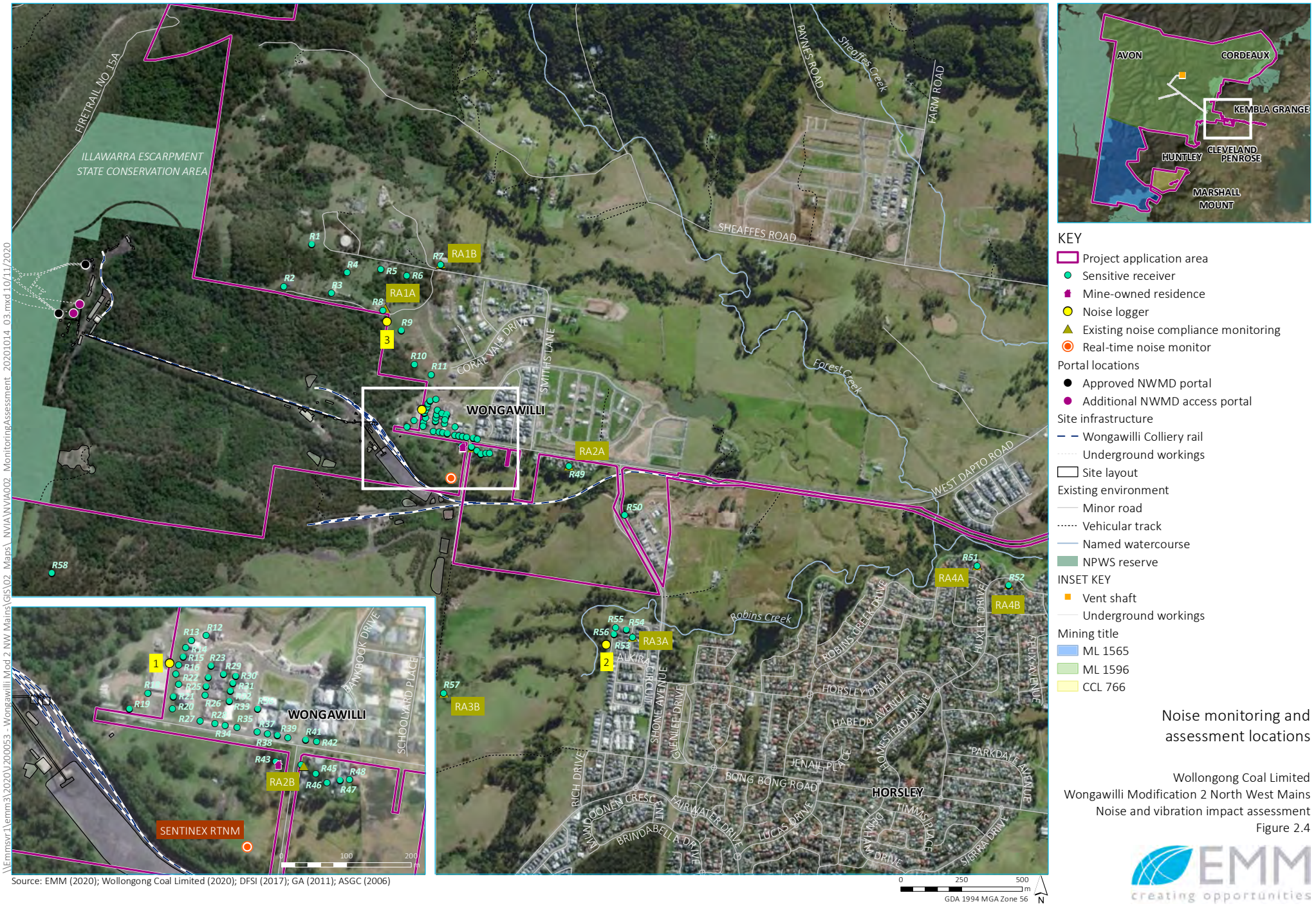
Assessment location	NCA	Type
R1	RA1b	Resident - Suburban
R2	RA1b	Resident - Suburban
R3	RA1b	Resident - Suburban
R4	RA1b	Resident - Suburban

Table 2.2 Assessment locations

Assessment location	NCA	Type
R5	RA1b	Resident - Suburban
R6	RA1b	Resident - Suburban
R7 (RA1b)	RA1b	Resident - Suburban
R8 (RA1a)	RA1a	Resident - Suburban
R9	RA1a	Resident - Suburban
R10	RA1a	Resident - Suburban
R11	RA1a	Resident - Suburban
R12	RA2	Resident - Urban
R13	RA2	Resident - Urban
R14	RA2	Resident - Urban
R15	RA2	Resident - Urban
R16	RA2	Resident - Urban
R17	RA2	Resident - Urban
R18	RA2	Rural fire service
R19	RA2	Wongawilli Community Hall
R20	RA2	Resident - Urban
R21	RA2	Resident - Urban
R22	RA2	Resident - Urban
R23	RA2	Resident - Urban
R24	RA2	Resident - Urban
R25	RA2	Resident - Urban
R26	RA2	Resident - Urban
R27	RA2	Resident - Urban
R28	RA2	Resident - Urban
R29	RA2	Resident - Urban
R30	RA2	Resident - Urban
R31	RA2	Resident - Urban
R32	RA2	Resident - Urban
R33	RA2	Resident - Urban
R34	RA2	Resident - Urban
R35	RA2	Resident - Urban
R36	RA2	Resident - Urban
R37	RA2	Resident - Urban
R38	RA2	Resident - Urban
R39	RA2	Resident - Urban

Table 2.2 Assessment locations

Assessment location	NCA	Type
R40	RA2	Resident - Urban
R41	RA2	Resident - Urban
R42	RA2	Resident - Urban
R43	RA2	Project-related
R44 (RA2b)	RA2	Resident - Urban
R45	RA2	Resident - Urban
R46	RA2	Resident - Urban
R47	RA2	Resident - Urban
R48	RA2	Resident - Urban
R49 (RA2a)	RA2	Resident - Urban
R50	RA2	Resident - Urban
R51 (RA4a)	n/a – rail noise only	Resident - Urban
R52 (RA4b)	n/a – rail noise only	Resident - Urban
R53 (RA3a)	RA3	Resident - suburban
R54	RA3	Resident - suburban
R55	RA3	Resident - suburban
R56	RA3	Resident - suburban
R57 (RA3b)	RA3	Resident - suburban
R58	n/a - isolated residence	Resident - suburban



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Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

Noise monitoring and assessment locations

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 2.4

EMM creating opportunities

3 Assessment methodology

3.1 Applying the NPfI to existing sites

The NPfI provides a methodology for the assessment of operational noise from existing industrial sites. The NPfI acknowledges that some industrial sites were designed for higher allowable noise emissions than those outlined in current NSW noise policy and may have been in existence before neighbouring noise-sensitive developments. This is certainly the case for the Colliery with the encroachment of residential properties. The range of mitigation options available for such sites can be limited or costly.

Section 6.1 of the NPfI states that:

> The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where noise emissions from the existing site exceed the project noise trigger levels (PNTLs) as defined in the NPfI, the relevant regulatory authorities and proponent will determine achievable noise limits for the site through negotiation and discussion with relevant stakeholders as required.

The process for applying the NPfI to existing sites is outlined in Section 6.1.1 of the NPfI and is summarised as follows as applicable to the amended project:

1. Undertake an initial evaluation, including whether approvals/licences include noise limits and whether they are being met.

2. Establish relevant PNTLs, in accordance with the NPfI, to establish a benchmark level to assess the need to consider noise mitigation.

3. Measure/predict the noise levels produced by the source in question, having regard to meteorological effects such as wind and temperature inversions.

4. Compare the measured/predicted noise level with the PNTLs.

5. Where the PNTLs are exceeded, assess feasible and reasonable noise mitigation strategies.

6. Develop and refine achievable noise limits that will become long-term noise goals for the site. This may involve interaction between the regulator and proponent as well as consultation with the community. Regulators and operators need to consider the technical practicalities and cost of noise reduction measures, and how long it will take to implement these measures, along with the environmental consequences of exceeding the PNTLs.

7. Monitor compliance with the agreed noise limits, and review and amend the noise performance of the site as required.

3.2 Operational noise limits - NPfI

Noise from industrial sites or processes in NSW is regulated by the local council, NSW Department of Planning, Industry and Environment (DPIE) and/or the EPA and usually have a licence and/or development consent conditions stipulating noise limits. These limits are normally derived from operational noise levels applied at assessment locations. They are based on EPA guidelines (ie NPfI) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation measures.

The reaction to noise is highly subjective. Hence, it is not possible to adopt noise levels that will guarantee that no one will experience an impact. Adherence with the PNTLs should not be interpreted to mean that industrial noise will be inaudible, or that all members of the community will find the noise acceptable. The PNTLs for industry provide a benchmark for assessing a proposed or existing industrial development.

Both the increase in noise level above background levels (ie the intrusiveness of a source) as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources. To ensure both of these factors are considered, the EPA provides two separate noise trigger levels: intrusiveness and amenity. The fundamental difference being intrusiveness noise levels apply over 15 minutes in any period (day, evening or night), whereas the amenity noise levels apply to the entire assessment period (day, evening or night).

3.2.1 Assessing intrusiveness

The intrusive noise trigger levels require that $L_{Aeq,15\ minute}$ noise levels from the site during the relevant operational periods (ie day, evening and night) do not exceed the rating background level (RBL) by more than 5 dB. The NPfI recommends that the intrusive noise trigger level for evening be set at no greater than the intrusive noise level for daytime and that the intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Intrusive noise trigger levels are applicable at residential assessment locations only.

With regard to determining relevant RBLs the NPfI allows for noise from the existing premises to be included in background noise measurements if it has been operating for a significant period of time (eg greater than 10 years) and is operating in accordance with noise limits and requirements imposed in a consent or licence.

A long-term, unattended ambient noise survey was undertaken during March 2020 to establish background noise levels at neighbouring noise sensitive receptors. Since the site is currently in care-and-maintenance, historical data from the Wollongong Coal real-time noise monitor (refer Figure 2.4) has been analysed to determine background noise levels when the mine was operational. This methodology is described further in Section 5.2.

3.2.2 Assessing amenity

The amenity assessment is based on noise targets specific to land use and associated activities. The targets relate only to industrial-type noise and do not include road, rail and/or community noise. Where the measured existing industrial noise approaches the recommended amenity noise level, 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.

Cumulative industrial noise is not a necessary consideration because no other industries are present in the area. Hence, the project amenity noise level for the subject development is the recommended amenity noise level (outlined in Table 2.2 of the NPfI).

Residences within the RA2 NCA have been categorised in the NPfI urban amenity category given their proximity to the existing mine and railway line. This is consistent with the current amenity levels provided in PA 09_0161. All other residences have been categorised in the NPfI suburban amenity category as per the definition provided in the NPfI:

An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry.

The neighbouring Rural Fire Service has been assessed as a commercial premises and the Community Hall has been assessed as an active recreation area.

An extract from the NPfI that relates to the amenity noise levels relevant to the proposed modification is given in Table 3.1.

Table 3.1 Amenity noise levels - Recommended L_{Aeq} noise levels from all industrial noise sources

Type of receptor	Noise amenity area	Time of day[1]	Recommended $L_{Aeq(Period)}$ noise level (dB)[2]
Residence	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65
Active recreation area	All	When in use	55

[1] Daytime: 7 am to 6 pm; Evening: 6 pm to 10 pm; Night-time: 10 pm to 7 am. On Sundays and Public Holidays, Daytime: 8 am - 6 pm; Evening: 6 pm - 10 pm; Night-time: 10 pm - 8 am.

[2] The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

3.2.3 Project noise trigger levels

PNTLs are the lower of the derived intrusiveness and amenity levels.

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 (8 hour) assessment period. This is outlined in the NPfI and has been used in this assessment to standardise the time periods for the intrusive and amenity noise levels.

3.2.4 Low frequency noise

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds ($L_{zeq,15minute}$)

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the day period.

3.2.5 Sleep disturbance

The difficulty in establishing an absolute noise level criterion that would correlate to an acceptable level of sleep disturbance is acknowledged by relevant governing authorities.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where night-time noise levels at a residential location exceed:

- $L_{Aeq,15\ minute}$ 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 NPfI also references guidance regarding potential for sleep disturbance provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels (L_{Amax}) below 50–55 dB are unlikely to awaken people from sleep; and

- one or two noise events per night, with maximum internal noise levels (L_{Amax}) of 65–70 dB, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60–65 dB calculated at the facade of a residence is unlikely to awaken people according to the RNP.

If noise levels over the NPfI screening levels are identified, then additional analysis would consider factors such as the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;

- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development;

- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods); and

- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

3.3 Voluntary Land Acquisition and Mitigation Policy

Consent authorities are required to consider the Voluntary Land Acquisition and Mitigation Policy (VLAMP) (DPE 2018) when assessing and determining development applications and modification applications for SSD mining developments. Page 17 of VLAMP states the following with regard to the application of voluntary mitigation and voluntary land acquisition:

> A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:
>
> - operational noise impacts of a development on privately-owned land; and
>
> - rail noise impacts of a development on privately-owned land near a non-network rail line (private rail line), that is on, or exclusively servicing an industrial site (see Appendix 3 of the *Rail Infrastructure Noise Guideline* (RING) (EPA 2013));
>
> But not:
>
> - construction noise impacts, as these impacts are shorter term and can be controlled;
>
> - noise impacts on the public road or rail network; or
>
> - modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts[13].
>
> [13]Noise issues for existing premises may be addressed through site-specific pollution reduction programs under the NSW *Protection of the Environment Operations Act 1997*.

Of most interest is the last point above relating to the relative noise impact of the proposed operation compared to the existing/approved development. With minimal changes to the existing/approved infrastructure the noise emissions from site will not increase/change compared to the approved development. Hence the impact assessed at residences that existed when the site was last operational is not expected to increase as a result of the modification proposed. As this assessment shows (refer Section 9.3) an estimated reduction of 3-8 dB in operational noise levels is predicted to be achievable at most assessment locations compared to predicted noise levels from approved operations with the implementation of feasible and reasonable mitigation measures. Further, the implementation of feasible and reasonable mitigation measures is predicted to result in a significant reduction in the number of properties categorised as experiencing significant, moderate or marginal residual noise impacts from the Colliery compared to approved operations.

Since the modification is predicted to result in beneficial outcomes with regard to noise impacts voluntary mitigation or voluntary land acquisition rights would not apply as per VLAMP. It is relevant to note that due to the encroachment of residential development in the area in recent times, the level of noise impact at the current nearest noise-sensitive receptors will be greater than that determined at the nearest receptors at the time of the previous assessment.

The characterisation of the noise impacts (as outlined in the VLAMP and NPfI) are generally based on human perception to changes in noise levels as explained in the glossary of the acoustic terms in this report. For example, a change in noise level of 1–2 dB is typically indiscernible to the human ear. The characterisation of a residual noise impact of 0–2 dB above the PNTL is therefore considered negligible.

This characterisation of residual noise impacts is outlined further in Table 3.3.

Table 3.3 VLAMP characterisation of noise impacts and potential treatments

If the predicted noise level minus the project noise trigger level is:	And the total cumulative industrial noise level is:	Characterisation of impacts	Potential treatment
All time periods 0-2 dB	Not applicable	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
All time periods 3-5 dB	< recommended amenity noise level > recommended amenity noise level but the increase in total cumulative industrial noise level resulting from development is <1 dB	Impacts are considered to be **marginal**	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.
All time periods 3-5 dB	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is >1dB	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	< recommended amenity noise level	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	> recommended amenity noise level	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and refer voluntary land acquisition provisions
Night > 5 dB	Not applicable	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and refer voluntary land acquisition provisions

Source: VLAMP (NSW Government, 2018)

3.4 Road traffic noise

The principle guidance to assess the impact of noise from project-related road traffic on public roads is the NSW Department of Environment, Climate Change and Water (DECCW) Road Noise Policy (RNP) (2011). The Colliery is located off Jersey Farm Road via Wongawilli Road and West Dapto Road from the Princes Highway. The nearest residences potentially affected by project-related traffic are located on Wongawilli Road which is classified as a sub-arterial road according to the RNP definitions. These include a residence located on the corner of Wongawilli Road and Jersey Farm Road with the potential to be impacted by road traffic noise from each of these roads. For this residence only, total project-related road traffic noise has been predicted from both roads and compared to the criteria for a sub-arterial road.

The road traffic noise assessment criteria for residential assessment locations, reproduced from Table 3 of the RNP for road categories relevant to the Project are provided in Table 3.4.

Table 3.4 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	60 $L_{Aeq,15hr}$	55 $L_{Aeq,9hr}$

Source: RNP (DECCW 2011).

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

In addition to meeting the assessment criteria (Table 3.4), any significant increase in total traffic noise at assessment locations must be considered. Assessment locations experiencing increases in total traffic noise levels above those presented in Table 3.5 should be considered for mitigation.

Table 3.5 Road traffic relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase, dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq(15hr)}$ + 12 dB	Existing traffic $L_{Aeq(9hr)}$ + 12 dB

Source: RNP (DECCW 2011).

3.5 Rail noise

3.5.1 Non-network rail line

The principal guidance for assessing rail traffic on non-network rail lines exclusively servicing industrial sites is provided in Appendix 3 of the NSW EPA 2013 *Rail Infrastructure Noise Guideline* (RING).

The RING (EPA 2013) states that "*rail related activities (such as movement of rolling stock on rail loops or sidings, loading and shunting activities etc.) occurring within the boundary of an industrial premises as defined in an environment protection licence are to be assessed as part of the industrial premises using the NSW INP (EPA 2000)*". This approach has been adopted for the rail loading activities and train movements confined to the industrial premises (ie rail loading area).

Where a non-network rail line exclusively servicing one or more industrial sites extends beyond the boundary of the industrial premises, noise from this section of track should be assessed against the recommended acceptable L_{Aeq} noise levels from industrial noise sources for the relevant receiver type and indicative noise amenity area in Table 2.2 of the NPfI, as reproduced in Table 3.6. This approach has been adopted to assess rail noise from the spur which connects the Wongawilli rail loading area to the public network rail line.

Table 3.6 Non-network rail line noise trigger levels for residential land uses

Assessment location	Amenity area	Period	RING criteria[1] (NPfI amenity noise criteria), dB, $L_{Aeq, period}$
Residences adjoining rail spur	Urban	Day	60
		Evening	50
		Night	45

Notes: 1. Taken from Table 6 of the RING (EPA 2013). It is noted that the RING references the now superseded Industrial Noise Policy (EPA, 2000) however for the purpose of establishing rail noise guidelines the recommended amenity noise levels are consistent between the INP and NPfI.

3.6 Construction noise

Given the limited extent and duration of the proposed construction activities, construction noise impacts are not expected as a result of the proposed modification and have not been assessed within this report.

3.7 Operational and construction vibration

Vibration from operational activity is not expected to change as a result of the proposed modification compared to that currently approved. The main potential source of vibration from the site is movement of the dozer and/or front-end loaders in the ROM stockpile area. Given the separation distance of at least 150m between the stockpile area and the nearest private residences, vibration levels are expected to be below that which could cause disturbance to residents. Further, there is very limited construction activity associated with the proposed modification. Thus, a detailed assessment of vibration impacts has not been included in this report.

4 Existing noise requirements

4.1 Project Approval 09-0161

Schedule 4 Conditions 1 to 8 of project approval (PA) 09-0161 outline the current obligations in relation to noise from the Colliery.

4.1.1 Operational noise criteria

Schedule 4 Condition 1 provides intrusive noise limits for *existing* (at that time) residences and is reproduced as follows.

1. The Proponent shall ensure that the noise generated by the project (including train loading and shunting within the yard but excluding train movements on the Wongawilli rail spur) does not exceed the criteria in Table 3 and Table 4 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 3: Noise Criteria dB(A) – Intrusive Noise Limits – Existing Residences

Receiver Area	***Day***	***Evening***	***Night***	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
RA1	43	43	43	59
RA2	44	43	43	60
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

The Schedule 4 Condition 1 intrusive limits were developed for existing residences as stated in the Table 3 heading. The original approval PA 09-0161 was granted on 2 November 2011, whilst Mod 1 was granted 27 November 2015. The aforementioned residential encroachment occurred after 2015. Schedule 4 Condition 1 also provides amenity noise limits applicable to all residences.

Table 4: Noise Criteria dB(A) – Amenity Noise Limits – All residences

Receiver Area	***Day***	***Evening***	***Night***
	$L_{Aeq(11\ hour)}$	$L_{Aeq(4\ hour)}$	$L_{Aeq(9\ hour)}$
All privately-owned land	60	50	45

Schedule 4 Condition 2 contains long-term noise goals for the development as follows:

2. The Proponent shall make continual endeavours to reduce the noise generated by the project, with the objective being that noise generated by the project (including train loading and shunting within the yard but excluding train movements on the Wongawilli rail spur) does not exceed the criteria in Table 5 at any existing residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 5: Noise Criteria dB(A) – Intrusive Noise Goals – Existing Residences

Receiver Area	***Day***	***Evening***	***Night***	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
RA1	40	40	38	51
RA2	40	40	38	51
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

Schedule 4 Condition 3 contains noise limits relevant to use of the rail spur as follows:

3. The Proponent shall ensure that the noise generated by railway activities on the Wongawilli rail spur outside of the yard limits (excluding any train shunting or when loading is taking place) does not exceed the criteria in Table 6 at any existing residence on privately-owned land.

Table 6: Noise Criteria dB(A) – Rail Noise Limits – Existing residences

Receiver Area	***Day***	***Night***
	$L_{Aeq(period)}$	$L_{Aeq(period)}$
All existing residential receivers	65	60

With regard to rail noise, Schedule 4 Condition 4 states that the Proponent shall use its best endeavours to ensure that its rail spur is only accessed by locomotives that are approved to operate on the NSW rail network in accordance with noise limits provided in RailCorp's EPL 12208 and trains comprising no less than 30 wagons.

4.1.2 Noise Audit

Schedule 4 Condition 7 outlines the requirement for a Noise Audit for the project. *NRE Wongawilli Colliery Noise Audit* (Noise Audit) dated December 2013 was prepared by Wilkinson Murray Pty Limited (WMPL) and is attached in Appendix A. This report included a review of and recommendations regarding the following areas:

1. Background noise data and noise criteria;

2. Noise modelling inputs and operational scenarios; and

3. Noise mitigation measures.

The Noise Audit also provided an action plan to confirm the effectiveness of the audit recommendations. The main findings of the Noise Audit are summarised in the following sections.

i Background noise data and noise criteria

The Noise Audit included additional background noise monitoring and provided a review of the operational noise criteria. The Audit found that the noise criteria provided in the Project Approval were higher than those determined in accordance with noise policy current at that time. Notwithstanding, the noise criteria were considered "*reasonable goals for a working, established colliery to achieve considering the proximity of existing residential receivers and updated background noise levels*."

ii Noise model inputs and operational scenarios

The noise model was updated with operational information current at the time of the Noise Audit and sound power levels measured by WMPL. Results of noise modelling indicated that predicted noise levels were above the relevant intrusive noise criteria within RA1 and RA2. However, validation noise measurements were not undertaken. Operational noise emissions were predicted to achieve the relevant amenity noise goals and rail noise limits along the spur.

iii Noise mitigation measures

The following additional mitigation measures were recommended as a result of the review of the main plant and processes that contribute to off-site noise emissions:

- Reduce the noise emissions from existing mobile plant (i.e. front-end loaders and dozer) by at least 5dB or purchase quieter mobile plant to achieve the same reduction.
- Reduce noise from the screen/sizer building and main conveyor by at least 5dB.
- Procurement of any new plant to allow for low-noise upgrades.
- Reduce noise from the loading bin operation by at least 5dB.
- Additional noise audits to ensure that noise from all major plant/ processes are confirmed.

4.2 Environment Protection Licence 1087

The Colliery also operates under Environment Protection Licence (EPL) 1087.

EPL 1087 does not contain specific noise limits but does describe a previous requirement in relation to noise reduction from the site. Section 7 Item G.2 describes completed Pollution Reduction Programs (PRP) relevant to the site. *PRP11: Noise Reduction from the Screener/Sizer Building* required the licensee to enclose the vibrating screen located in the screener sizer building. This item was marked as complete by the EPA dated 31 May 2012.

5 Approved mine noise

5.1 Existing noise mitigation and management

The site has been in operation since approximately 1916 and, given the proximity of surrounding residential areas, is aware of the potential for noise impacts at neighbouring noise sensitive receptors. Quarterly noise compliance monitoring is undertaken and reported on the Colliery website. Wongawilli also operate and maintain a real-time noise monitor the results of which are reported quarterly on their website. It is noted that site has been in care and maintenance since 2019 and hence data collected since that time is considered baseline data only.

A significant amount of mitigation works has been undertaken over many years with a focus on reducing noise from mobile plant operating on the stockpile area and noise from the screen and sizer enclosure. The following noise mitigation measures are currently implemented at the site:

- all conveyors and transfer points are enclosed;
- 6m high concrete barrier adjacent the rail line (as shown in Figure 2.3);
- upgrades to the screen/ sizer enclosure as per the PRP in EPL 1087; and
- preference is for all product to go directly to rail loadout bins and avoid stockpiling of product. This, in turn, avoids the use of the dozer in the stockpile area and the requirement to load trains via FEL.

5.2 Existing operational noise emissions

A summary of the available quarterly noise monitoring results, as provided in the quarterly noise compliance reports for the period from Q3 2016 until the site went into care and maintenance (last quarter where operations were measured was Q4 2018) is shown in Table 5.1, Table 5.2 and Table 5.3 together with the existing criteria applicable at each location. Q2 and Q3 for 2017 were not provided due to mine not operating during this period. A total of 16 surveys (evening and night surveys during each quarter) have been reviewed at each monitoring location.

Results of quarterly monitoring indicate that the Colliery has been predominantly compliant with existing noise limits. During Q3 2018 a mine noise level of $L_{Aeq,15min}$ 44-46 dB was reported compared to the noise limit of 43 dB. However, this was not reported citing the allowable +2dB tolerance as provided in the, now superseded, Industrial Noise Policy (INP) (EPA, 2000).

Night-time mine noise levels were generally identified as a ‘continuous hum’ with no maximum noise events observed. Further, no annoying characteristics were observed that triggered the application of modifying factors as defined in the INP and NPfI.

Table 5.1 Summary of quarterly noise compliance monitoring results during evening (6pm – 10pm) – $L_{Aeq,15min}$

Location	2016		2017		2018				Noise limits
	Q3	Q4	Q1	Q4	Q1	Q2	Q3	Q4	
RA1a	<35	32	<35	<37	<42	<43	<42	41	43
RA1b	IA	<39	<33	n/a	<39	36-38	<40	<40	43
RA2a	35	36-37	<35	<34	<38	37-39	<43	<40	43
RA2b	33-36	37-38	IA	<44	<36	**44-46**	<40	<45	43
RA3a	<35	IA	<38	<37	<30	n/a	<40	<40	40
RA3b	33-34	IA	<35	<31	<38	<40	<40	41	40

Table 5.2 Summary of quarterly noise compliance monitoring results during night (10pm – 7am) – $L_{Aeq,15min}$

Location	2016		2017		2018				Noise limits
	Q3	Q4	Q1	Q4	Q1	Q2	Q3	Q4	
RA1a	30	31	<27	<28	<42	<40	<42	<40	43
RA1b	32-34	33	<30	<26	<40	38-40	<38	<40	43
RA2a	32	31	<33	<43	<41	n/a	<41	<40	43
RA2b	33	IA	<35	<30	<43	38-41	<42	<45	43
RA3a	34	IA	<37	<32	<28	37-39	<36	<40	38
RA3b	34	<30	<32	<31	<37	<40	36	<38	38

Table 5.3 Summary of quarterly noise compliance monitoring results during night (10pm – 7am) – $L_{A1,1min}$

Location	2016		2017		2018				Noise limits
	Q3	Q4	Q1	Q4	Q1	Q2	Q3	Q4	
RA1a	<35	36	<43	<67	<46	<40	<45	<40	59
RA1b	<35	<35	<45	<51	<45	<40	<41	<40	59
RA2a	<35	31	<44	<42	<34	<40	<44	<40	60
RA2b	36	IA	<35	<44	<40	<40	42	<40	60
RA3a	<35	IA	<40	<38	<41	<38	42	<40	48
RA3b	<35	<30	45	<41	<38	<41	<38	<40	48

5.3 Existing rail noise

Most of the historic quarterly noise compliance monitoring in relation to rail noise was undertaken at location RA4b (refer Figure 2.4). However, this location is situated much further from the rail line than the nearest dwellings. The nearest dwelling that was existing at the time of the approval (441 West Dapto Road) is located approximately 20 m from the rail spur and the current, nearest residences are located on Rosina Street, Kembla Grange, approximately 15m from the rail spur. Based on review of available aerial imagery there is a barrier located on the boundary of these residences that provides acoustic shielding from the rail line.

Of most relevance to an assessment against the consent is rail noise compliance monitoring undertaken approximately 20 m from the rail spur at a location representative of the dwelling at 441 West Dapto Road. These results are summarised in Table 5.4.

Table 5.4 Rail noise compliance monitoring summary – 20m from rail spur

Date	Time (HH:MM)	Duration (s)	L_{AE} (dB)	Rail noise level[2], $L_{Aeq(period)}$ (dB)	Criteria, $L_{Aeq(period)}$ (dB)
21 September 2016	08:01	217	93	56	65
21 September 2016	08:31	282	99		
21 September 2016	12:38	195	93		
22 September 2016	14:11	242	95	50	65
23 September 2016	09:48	232	93	54	65
23 September 2016	14:17	84	96		
25 September 2016	10:03	129	92	54	65
25 September 2016	14:33	212	97		
26 September 2016	11:52	160	92	51	65
26 September 2016	16:42	156	93		
27 September 2016	10:57	193	95	57	65
27 September 2016	14:09	167	97		
27 September 2016	18:24	255	96		
23 February 2017	14:34	193	93	48	65
23 February 2017	18:21	220	99		
24 February 2017	12:06	170	93	51	65
24 February 2017	15:44	202	95		
25 February 2017	13:19	183	93	48	65
25 February 2017	17:29	181	96		
28 February 2017	11:17	244	92	53	65
28 February 2017	14:27	193	97		
1 March 2017	11:27	165	92	49	65
1 March 2017	14:12	250	93		
	Logarithmic average sound exposure level		**95**		

Notes: 1. L_{AE} is sound exposure level for each individual pass-by event and is the measured, free-field noise level.
2. Calculated rail noise levels include a façade correction of +2.5dB.

Based on the results presented in Table 5.4 the average sound exposure level per train pass-by event is L_{AE} 95 dB at 20 m from the rail line.

5.4 Complaints history

In the five years prior to the mine entering care and maintenance in 2019, there were three complaints relating to noise or vibration. These are summarised as follows based on the records provided on the Wongawilli website:

- 17 January 2014 – excessive horn blasting from trains. An investigation was undertaken into the train driver's behaviour. The complainant was satisfied with the results.
- 3 July 2017 – noise from Colliery. Source of complaint was determined to be an issue with the stockpile area screen and sizer. Noise was reduced by repair and replacement of parts.
- 15 February 2019 – vibrations felt in house located just south of the pit top area. This could have been due to the feeder on the surface continuously loading wet coal to the decline conveyor. A response was provided to the resident.

6 Existing acoustic environment

6.1 Current ambient noise levels – mine in care-and-maintenance

To establish current ambient and background noise levels unattended noise monitoring was completed by EMM at three locations surrounding the Colliery in July 2020 in accordance with the NPfI. The locations of relevant long-term noise loggers are shown on Figure 2.4.

The noise loggers were in place from 21 July until 4 August 2020 and were programmed to record statistical noise level indices continuously in 15-minute intervals. Calibration of each noise logger was checked prior to and following unattended noise monitoring. The equipment carried appropriate and current NATA calibration certificates. Weather data for the unattended noise monitoring period was obtained from the nearest relevant NSW Office of Environment and Heritage weather station. Wind speed and rainfall data were used to exclude noise data during periods of any rainfall and/or wind speeds exceeding 5 m/s (approximately 9 knots) in accordance with the methodology provided in the NPfI.

A summary of the background and ambient noise monitoring results is provided in Table 6.1. Detailed daily graphs of the data obtained by EMM are provided in Appendix B. It is noted that the requirement for a minimum of seven days of valid noise data was not met at any of the noise monitoring locations primarily due to weather conditions. However, since assessment background levels were measured at or below the minimum NPfI background levels, the minimum NPfI levels were adopted and hence the limited sampling does not impact the assessment outcomes.

Table 6.1 Summary of existing measured background and ambient noise levels (March 2020)

Monitoring location (relevant NCA)	Period[1]	RBL[2] (dB)	$L_{Aeq, period}$ noise level[3] (dB)
L1 - Rural Fire Service, Wongawilli Road, Wongawilli RA2	Day	29	44
	Evening	31	40
	Night	29	49
L2 – near Illoura Place, Wongawilli RA3	Day	30	43
	Evening	28	40
	Night	23	38
L3 – Vista Parkway, Wongawilli RA1	Day	35	47
	Evening	31	37
	Night	28	37

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; Night: 10 pm to 7 am.
2. The RBL is an NPfI term and is used to represent the background noise level.
3. The energy averaged noise level over the measurement period and representative of general ambient noise.

Based on observations whilst on-site, the main contributors to overall ambient noise levels are as follows:

- L1 – local residential activity, natural sounds (eg birdsong) and aircraft;
- L2 – local residential activity, distant traffic and natural sounds (eg insects and wind in foliage); and
- L3 – local residential activity, distant traffic, natural sounds (eg birdsong) and aircraft.

6.2 Historical ambient noise levels – mine operational

The NPfI allows for noise from the existing premises to be included in background noise measurements if it has been operating for a significant period of time (ie greater than 10 years) and is operating in accordance with noise limits and requirements imposed in a consent or licence. Wongawilli Colliery has been in operation since 1916 and a review of results of the most recent quarterly monitoring indicate that the Colliery has been predominantly compliant with existing noise limits.

The Colliery went into care and maintenance in July 2019. The approximate timing of the recent residential development in the vicinity of the Colliery was determined via a review of historical Google Earth imagery. It was determined that the majority of the residential development in close proximity to the mine was established by December 2018 with major earthworks and road construction for the development occurring over 2016 and 2017.

In order to determine ambient noise levels representative of when the Colliery was operational and residential development was present, historical data from the Wollongong Coal real-time noise monitor (refer Figure 2.4) for the period June 2018 to June 2019 was analysed. The real time noise monitor is located at a similar distance from the processing and loading facility at the Colliery as the nearest residence. Daily train movement data was used to indicate periods when the site was operational.

Assessment background levels (ABL) for each period (day, evening and night) are provided in Appendix B. It is noted that some data during the period under consideration was not available from the noise monitor. Notwithstanding, there was approximately 57 days of valid noise data taking into account the available data coinciding with times when the mine was operational after the development of residences in the area. A summary of the historical noise monitoring data is provided in Table 6.2.

Table 6.2 Wongawilli Colliery real time noise monitoring summary – June 2018 – June 2019

	Day			Evening			Night		
	$L_{Aeq,period}$ low pass[1]	$L_{Aeq,period}$ [2]	RBL[3]	$L_{Aeq,period}$ low pass[1]	$L_{Aeq,period}$[2]	RBL[3]	$L_{Aeq,period}$ low pass[1]	$L_{Aeq,period}$[2]	RBL[3]
All available data June 2018 – June 2019	46	51	38	45	48	39	45	47	37
Mine operational only	**47**	**50**	**40**	**46**	**48**	**41**	**46**	**48**	**40**
Mine not likely operational	45	51	37	44	48	37	44	47	34

1. This value is the logarithmic average of the $L_{Aeq,period}$ low-pass noise level; the equivalent continuous energy average noise level excluding noise above 800Hz third octave frequency band.
2. This value is the logarithmic average of the $L_{Aeq,period}$ noise level.
3. RBL – Rating Background Level; median of all ABL.

7 Project noise goals

7.1 Project noise trigger levels

7.1.1 Intrusiveness

The intrusiveness targets require that $L_{Aeq,15min}$ noise levels from site during the relevant operational periods (ie day, evening and night) do not exceed the relevant RBL by more than 5 dB. It is noted that where the RBL for the evening or night period is higher than the day period RBL, the lower RBL for the day period has been adopted as the evening and night period RBLs in accordance with the NPfI.

The RBLs utilised for determination of the intrusiveness target for RA1b and RA3 are based on the NPfI minimum background levels since results of background noise monitoring (presented in Table 6.1) were at or below these and given that the mine (when operational) is expected to have had a minimal influence on background levels in these areas. The RBLs utilised for determination of the intrusiveness target for RA1a and RA2 are based on those determined from the real-time noise monitor when the mine was operational in accordance with NPfI methodology. The project intrusive noise levels are presented in Table 7.1.

Table 7.1 Intrusive noise levels

Assessment and representative noise monitoring locations	Adopted RBL (dB)[2]			Project intrusive noise level, $L_{Aeq,15min}$ (dB)		
	Day[1]	Evening[1]	Night[1]	Day	Evening	Night
RA1a	40	40	40	45	45	45
RA1b	35	30	30	40	35	35
RA2	40	40	40	45	45	45
RA3	35	30	30	40	35	35

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; Night: all remaining periods.
2. Where the RBL for the night period is higher than the day or evening period RBL, the lower RBL has been adopted as the night period RBL in accordance with the NPfI methodology.

7.1.2 Amenity

The assessment of amenity is based on noise targets specific to the land use. Residential assessment locations have been categorised in either the suburban or urban amenity categories in accordance with the NPfI definitions.

Since the Colliery is the only industrial noise source in the immediate area and there is limited potential for other industrial developments to be introduced into the area in the future, the recommended amenity noise level (as per Table 2.2 of the NPfI) has been assigned as the project amenity noise level for the development.

As described earlier, a 3 dB adjustment is adopted for 15-minute worst case period noise levels from the Colliery for the entire day (11 hour), evening (4 hour) and night (9 hour) assessment periods. This assumption is outlined in the NPfI and has been used in this assessment to standardise the time periods for the intrusive and amenity noise levels.

The corresponding recommended amenity noise levels for all assessment locations are given in Table 7.2.

Table 7.2 Project amenity noise levels

Assessment location	Noise amenity area	Project amenity noise level ($L_{Aeq,15min}$) (dB)		
		Day	Evening	Night
NCA RA2 residential assessment locations	Urban	63	53	48
All other residential assessment locations	Suburban	58	48	43
R18 Rural fire service	Commercial premises	68	68	68
R19 Wongawilli Community Hall	Active recreation area	58	58	58

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; night: all remaining periods.

7.1.3 Project noise trigger levels

The PNTLs are the more stringent of either the project intrusive or amenity noise levels and are shown in Table 7.3.

Table 7.3 Project noise trigger levels, $L_{Aeq,15min}$

Assessment location	Intrusive noise level, $L_{Aeq,15min}$, dB			Amenity noise level, $L_{Aeq,15-min}$, dB			PNTL, $L_{Aeq,15min}$, dB		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
RA1a	**45**	**45**	45	58	48	**43**	45	45	43
RA2[2]	**45**	**45**	**45**	63	53	48	45	45	45
All other residential assessment locations (RA1b and RA3)[2]	**40**	**35**	**35**	58	48	43	40	35	35
R18 Rural fire service	n/a	n/a	n/a	**68**	**68**	**68**	68	68	68
R19 Wongawilli Community Hall	n/a	n/a	n/a	**58**	**58**	**58**	58	58	58

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; night: all remaining periods.

2. Residential assessment location R43 is owned by Wongawilli Colliery and, hence, has not been considered as a noise-sensitive receptor.

7.2 Sleep disturbance

Based on the guidance provided in the NPfI, Table 7.4 provides the sleep disturbance screening levels for the residential assessment locations.

Table 7.4 Sleep disturbance screening levels for residential assessment locations

Assessment location	Adopted RBL (dB)	Sleep disturbance screening levels (dB)	
		$L_{Aeq,15min}$	L_{Amax}
RA1b and RA2	40	45	55
All other residential assessment locations	30	40	52

Reference has also been made to the conclusions presented in the RNP regarding assessment of the potential for sleep disturbance. The RNP summarises a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels (L_{Amax}) below 50 to 55 dB are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels (L_{Amax}) of 65 to 70 dB, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60 to 65 dB calculated at the facade of a residence are unlikely to cause awakening affects.

7.3 Road traffic noise goals

The nearest residences potentially affected by project-related traffic are located on Wongawilli Road which is classified as a sub-arterial road with reference to the RNP. The nearest facades of these residences are located approximately 8 m from the road. The residence located on the corner of Wongawilli Road and Jersey Farm Road is approximately 16 m from Wongawilli Road and 10 m from Jersey Farm Road.

The road traffic noise assessment criteria for residential assessment locations, reproduced from Table 3 of the RNP for road categories relevant to the Project are provided in Table 3.4. It is noted that these criteria relate to road traffic noise from all sources and not just project-related traffic.

7.4 Rail noise goals

Rail noise goals for all residences adjoining the Wongawilli rail spur are provided in Table 7.5. These criteria apply to the rail spur sections outside of the defined site boundary in accordance with the RING.

Table 7.5 Non-network rail line rail noise trigger levels for residential land uses

Assessment location	Amenity area	Period	RING criteria[1] (NPfI amenity noise criteria), dB, $L_{Aeq, period}$
Residences adjoining rail spur	Urban	Day	60
		Evening	50
		Night	45

Notes: 1. Taken from Table 6 of the RING (EPA 2013). It is noted that the RING references the now superseded Industrial Noise Policy (EPA, 2000) however for the purpose of establishing rail noise guidelines the recommended amenity noise levels are consistent between the INP and NPfI.

It is noted that these contemporary rail noise goals are more stringent than those currently provided in PA 09 – 0161 which are $L_{Aeq,15hour}$ (day) 65 dB and $L_{Aeq,9hour}$ (night) 60 dB, and consistent with rail targets for network rail lines recommended by the EPA.

8 Operational noise assessment

8.1 Overview

This section presents the methods and base parameters used to model noise emissions from the Colliery, including the effects of noise-enhancing meteorological conditions.

Noise modelling was based on three-dimensional digitised ground contours of the surrounding land and surface infrastructure. The operational noise model represents a snapshot of typical operations, with equipment placed at various locations and heights, representing realistic scenarios.

Noise predictions were carried out using the iNoise software, created by the same developers of B&K's Predictor software. iNoise calculates total noise levels at assessment locations from concurrent operation of multiple noise sources. The model considers factors such as the lateral and vertical location of plant, source-to-receptor distances, ground effects, atmospheric absorption, topography of the surface facilities area and surrounds and applicable meteorological conditions.

8.2 Meteorology

During certain weather conditions, mine noise emissions at the assessment locations may increase or decrease compared with noise during calm conditions. This is due to refraction caused by the varying speed of sound with increasing height above the ground that occurs during winds or where air temperature changes with height.

A simple yet conservative approach has been selected for the consideration of potentially noise-enhancing weather conditions with reference to Fact Sheet D of the NPfI. Noise emissions from the Colliery have been predicted for noise-enhancing conditions. This provides a conservative approach since the noise emissions predicted under noise-enhancing conditions are expected to represent the upper range of noise emissions from the Colliery.

8.3 Plant and equipment

The operational noise model considered a representative snapshot of surface operations with equipment placed at locations representing a realistic operational scenario. Adopted locations of plant and equipment are shown in Appendix C.

As provided in Section 5.1, the use of the stockpile area will be avoided wherever possible. WWC have estimated that the stockpile area, and the mobile equipment working within it, would be utilised approximately 10% of the time. Further, there will be up to two trains per day with each expected to take, on average, up to four hours to load. Hence, noise modelling has considered two separate operational scenarios during the daytime period:

1. Train loading occurring via rail load-out bin (excluding use of stockpile); and

2. Train loading occurring via FEL from stockpile (excluding use of rail loadout bin).

The operational scenario considered during evening and night periods includes filling of the rail loadout bin and excludes trains, rail loading and the use of the stockpile.

Most equipment sound power level data have been adopted from those provided in previous noise assessments as follows:

- *NRE Wongawilli Colliery Noise Impact Assessment* prepared by ERM Australia Pty Ltd dated October 2010; and

- *NRE Wongawilli Colliery Noise Audit* prepared by Wilkinson Murry Pty Limited dated December 2013.

Where data was not available, sound power data has been obtained from an EMM database of similar plant and equipment. A summary of the acoustically significant fixed and mobile equipment items considered in the noise model is provided Table 8.1.

Table 8.1 Acoustically significant plant and equipment for noise modelling

Item (location)	Sound power level per item (dBA)	Operating during this period			
		Day		Evening	Night
		Train loading via bin	Train loading via stockpile		
Transformer (pit top)[1]	84	✓	✓	✓	✓
Compressor (pit top)[1]	90	✓	✓	✓	✓
Underground transport (NW Mains C portal)[1]	102	✓	✓	✓	✓
Underground transport (NW Mains B portal)[1]	102	✓	✓	✓	✓
Underground transport (near bath-house)[1]	102	✓	✓	✓	✓
Forklift (pit top)[2]	99	✓	✓	✓	✓
Elevator (load out area)[1]	104	✓	✓	✓	✓
Sizer (load out area)[1]	108	✓	✓	✓	✓
Rail load out bin (load out area)[1]	105	✓	×	×	×
Transfer house (pit top)[2]	94	✓	✓	✓	✓
Conveyor drive (stockpile conveyor)[2]	94	✓	✓	×	×
Front-end loader (FEL) (stockpile)[2]	109	×	✓	×	×
Ventilation fan (near portal)[3]	90	✓	✓	✓	✓
Wongawilli No.1 ventilation fan (west of pit top)[3]	91	✓	✓	✓	✓
Conveyor drive (pit top)[2]	94	✓	✓	✓	✓
Conveyor drive (load out bin conveyor)[2]	94	✓	✓	✓	✓
Conveyors (various)[2]	74/m	✓	✓	✓	✓
Watercart (pit top)[3]	103	✓	✓	✓	✓
Locomotives x2 (rail line)[3]	102	✓	✓	×	×
Rail wagons (rail line)[2]	75/m	✓	✓	×	×
Dozer (stockpile)[2]	113	×	✓	×	×

1. Sourced from *NRE Wongawilli Colliery Noise Impact Assessment* prepared by ERM Australia Pty Ltd dated October 2010.
2. Sourced from *NRE Wongawilli Colliery Noise Audit* prepared by Wilkinson Murry Pty Limited dated December 2013.
3. Sourced from EMM database.

8.4 Low frequency noise modifying factor

Historical noise compliance monitoring reports state that modifying factors were considered in accordance with the methodology provided in the NPfI and that they were not applicable at all noise monitoring locations. However, detailed one third-octave data was not provided. The nearest noise compliance monitoring location is RA2b. Mine noise at this location is generally described as 'steady state' or 'mine hum' and, based on the description of mining operations during each noise survey, the main noise source contributing to off-site noise levels is the screen and sizer building. RA2b is located approximately 520 m from the screen and sizer building.

Given that the nearest, current dwellings are nearer to the mine than RA2b the following methodology was utilised to determine where LFN modifying factors may apply and at what magnitude.

One-third octave frequency spectrum data was obtained from an EMM database of plant similar in scale and nature to that of the Colliery screen and sizer building. This spectrum was adjusted to the highest overall mine noise level measured at RA2b (and also adjusted to account for distance) to determine a likely site noise spectrum at RA2b. This estimated noise spectrum, provided in Table 8.2, was then utilised to calculate the likely assessment locations (nearer to site than RA2b) where the LFN modifying factor might apply.

Table 8.2 Estimated LFN 1/3 octave spectrum at RA2b

Centre frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Estimated sound pressure level	45	64	53	42	46	42	44	50	43	41	43	44	40
NPfI LFN threshold levels	92	89	86	77	69	61	54	50	50	48	48	46	44

Based on the above it was determined that a modifying factor of +5 dB during the evening and night (and a corresponding +2 dB during the daytime) would apply at assessment locations within 280 m of the screen and sizer plant. There are no assessment locations within 280 m of the screen and sizer plant and, as such, a modifying factor of +5 dB is not likely to apply to any residential assessment locations. Further, a modifying factor of +2 dB during the evening and night periods is estimated to be applicable at assessment locations less than 510 m (and greater than 280 m) from the screen and sizer plant. Relevant modifying factors are shown in the noise prediction results tables provided in Appendix D.

8.5 Noise model validation

Since the mine is currently in care and maintenance it was not possible to validate the adopted sound power levels or the relevance (or not) of modifying factors to account for annoying noise characteristics. WWC have made a commitment to verify sound power levels of on-site plant and equipment and received off-site noise once operations recommence.

Notwithstanding the preceding, noise from approved operations was modelled and compared to the results of historical operator-attended noise compliance surveys as reported in the quarterly noise monitoring reports. This comparison is summarised in Table 8.3.

Table 8.3 Predicted $L_{Aeq,15min}$ noise levels compared to results of historic noise compliance monitoring

Location	Measured range of noise emissions – evening and night* (dB)	Predicted (including noise enhancing weather conditions) (dB) worst-case of all operational scenarios considered		
		Day	Evening	Night
RA1a	<27 to <43	46	43	43
RA1b	IA to 40	42	38	38
RA2a	31 to <43	41	36	36
RA2b	IA to 46	47	42	42
RA3a	IA to <40	36	31	31
RA3b	IA to 41	34	30	30

IA: inaudible.
* As summarised in Table 5.1 and Table 5.2.

Since the results of noise compliance monitoring have typically been reported as "less than" a value and it is not clear from the reports exactly what equipment was operational at the time of each survey it is not possible to provide a direct comparison to predicted noise emissions. Notwithstanding, there seems to be reasonable correlation between predicted levels and the highest reported noise emission measured during noise compliance surveys. It appears the model may be underpredicting at locations RA3a and RA3b however the predicted levels at these locations compare well (i.e. within 2dB) with most of the reported measured results (as per Table 5.1 and Table 5.2). The operational noise model is therefore considered as appropriate as it can be for the purpose of determining noise impacts from the Colliery.

8.6 Operational noise assessment

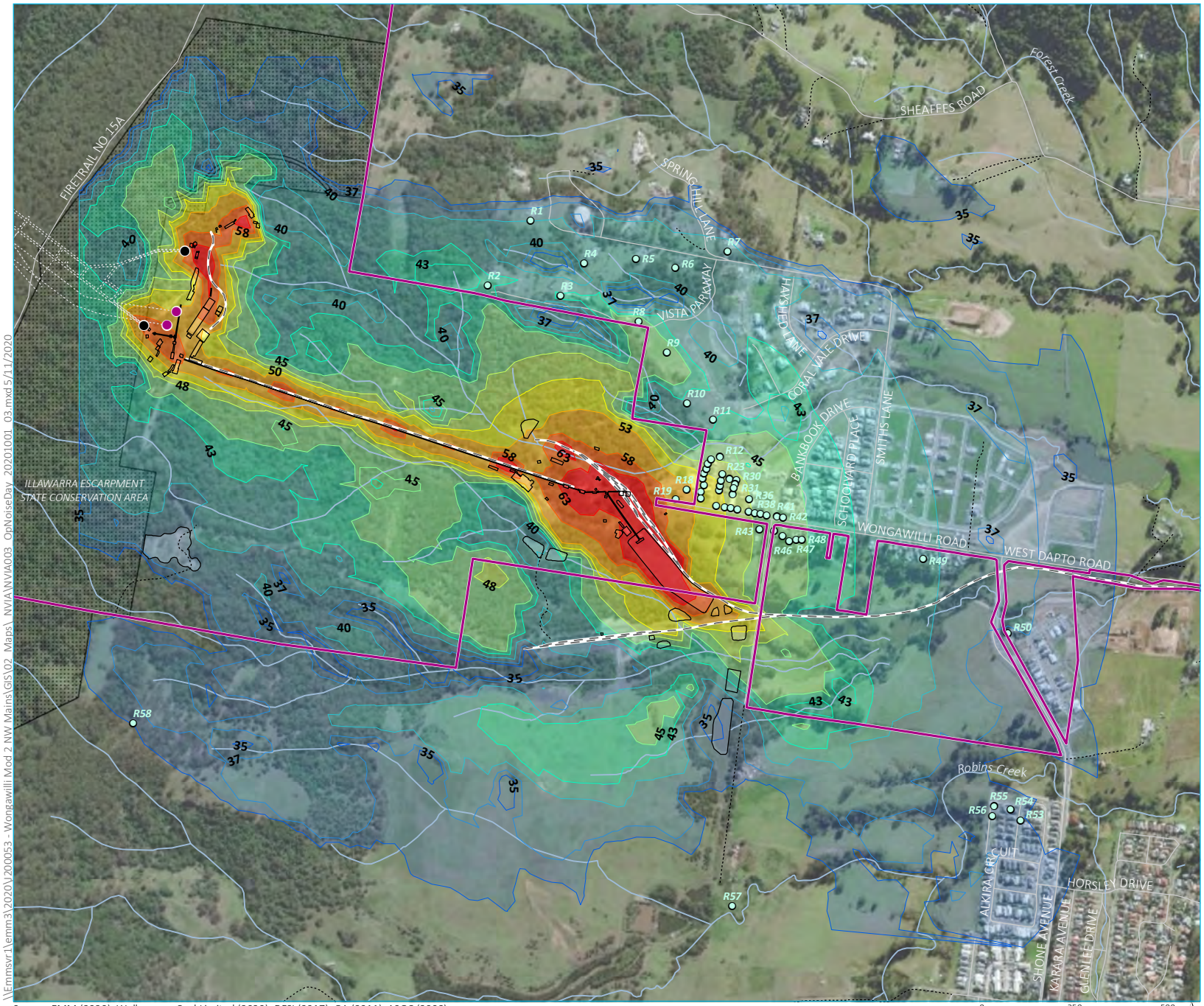
Predicted noise emission levels for approved operations at the Colliery are presented in detail in Appendix D. The results table provides the predicted noise emission level at each assessment location and a comparison to relevant PNTLs and existing noise limits. Approved operational noise emissions are predicted to be up to 7 dB above the PNTLs at some assessment locations. Approved operational noise emissions are predicted to be within 2-3 dB of the site's current approved intrusive noise limits[1] and within 2 dB of the current approved amenity noise limits.

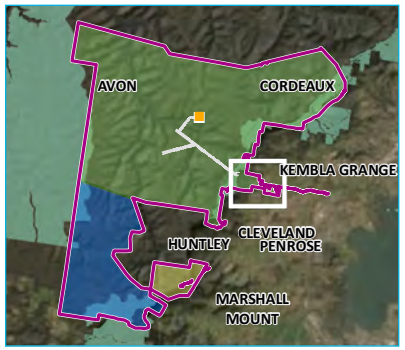
Indicative night-time noise contours for approved operations under noise-enhancing weather conditions are provided in Figure 8.1, Figure 8.2 and Figure 8.3for day and night operations. It is noted that the noise contours do not include the applicable LFN modifying factor since these only apply at specific residences (refer Appendix D).

Predicted residual noise impacts from both operational scenarios considered have been categorised as per Table 1 of the VLAMP with reference to noise predictions under noise-enhancing weather conditions. These residual noise impact categorisations are displayed spatially in Figure 8.4.

Further discussion of predicted noise emissions is provided in Section 9 of this report. Since PNTLs are predicted to be exceeded, an assessment of reasonable and feasible mitigation has been undertaken in accordance with the methodology provided in the NPfI for the assessment of noise emissions from existing sites.

[1] Noting that these only apply at residential dwellings that existed at the time of the current approval.





KEY

- Project application area
- Sensitive receiver

Operational noise contours (day)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Existing operational noise contours - daytime - loading from bins - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 8.1

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

N

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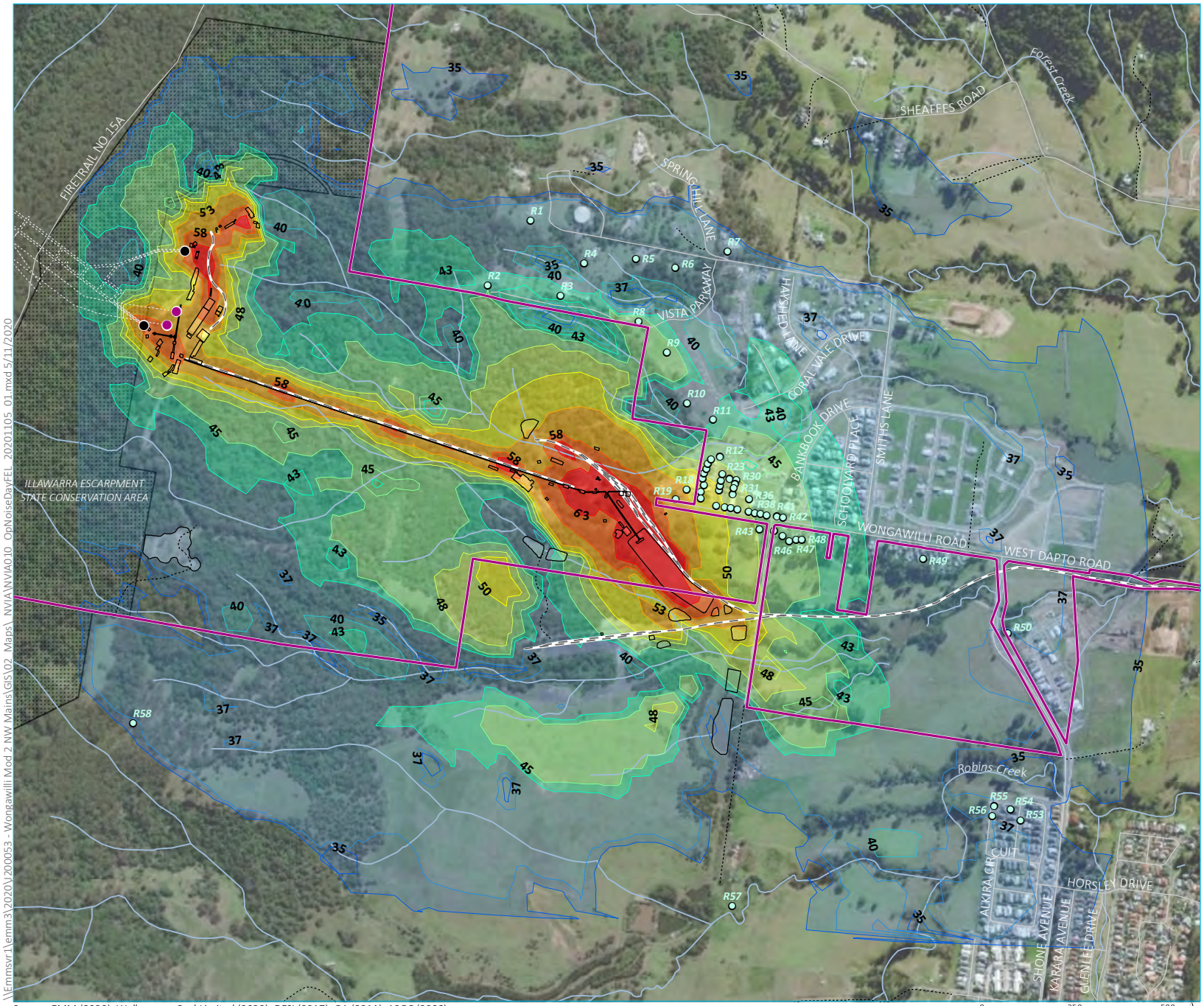

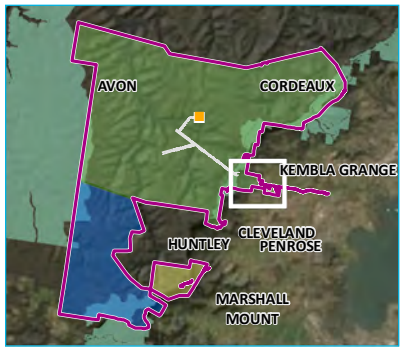

KEY

- Project application area
- Sensitive receiver

Operational noise contours (day)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Existing operational noise contours - daytime - loading from FEL - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 8.2

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

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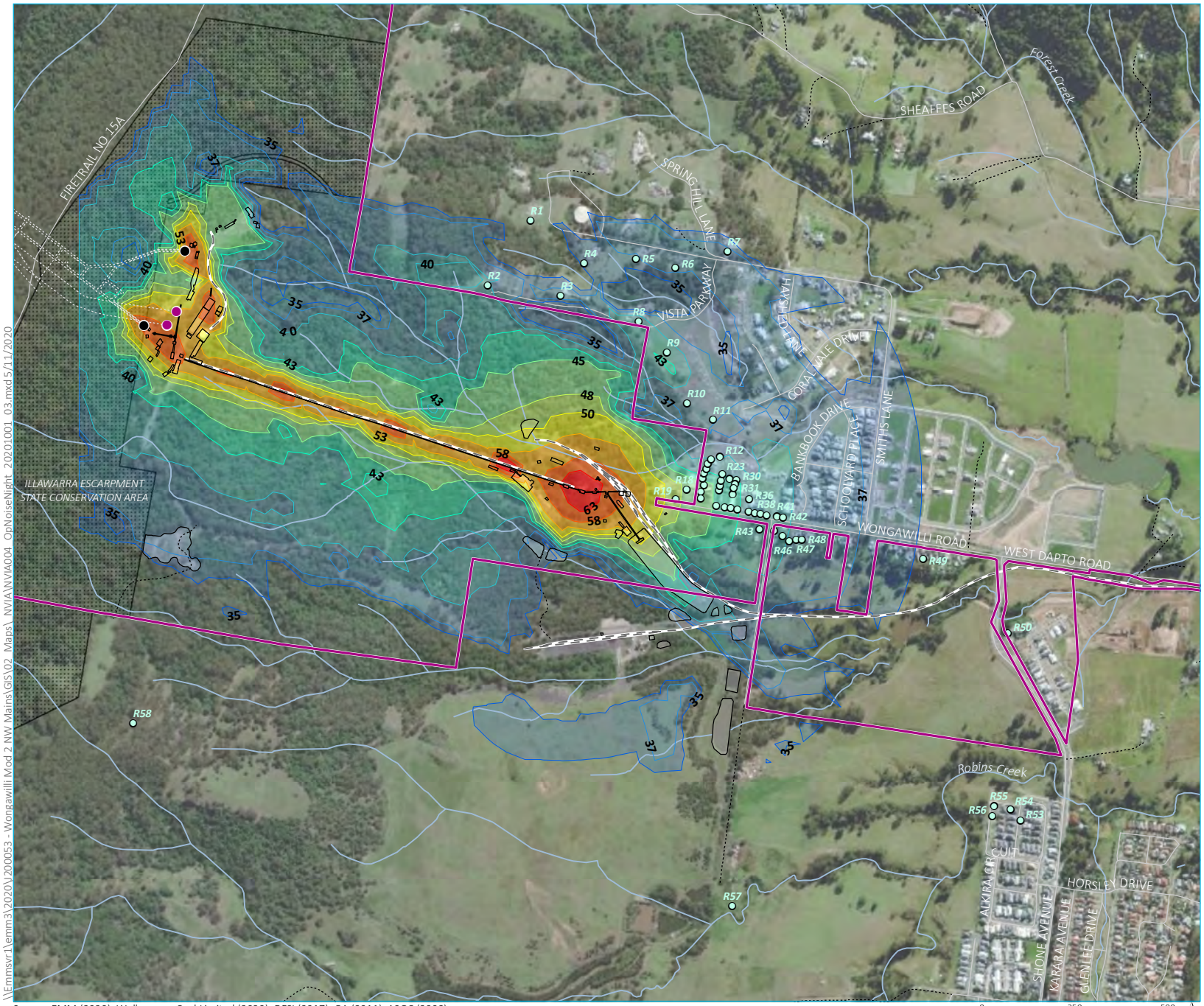

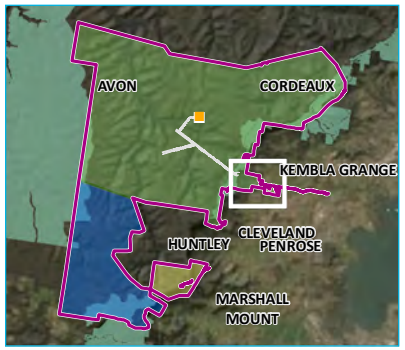

KEY

- Project application area
- Sensitive receiver

Operational noise contours (night)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Existing operational noise contours - night - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 8.3

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

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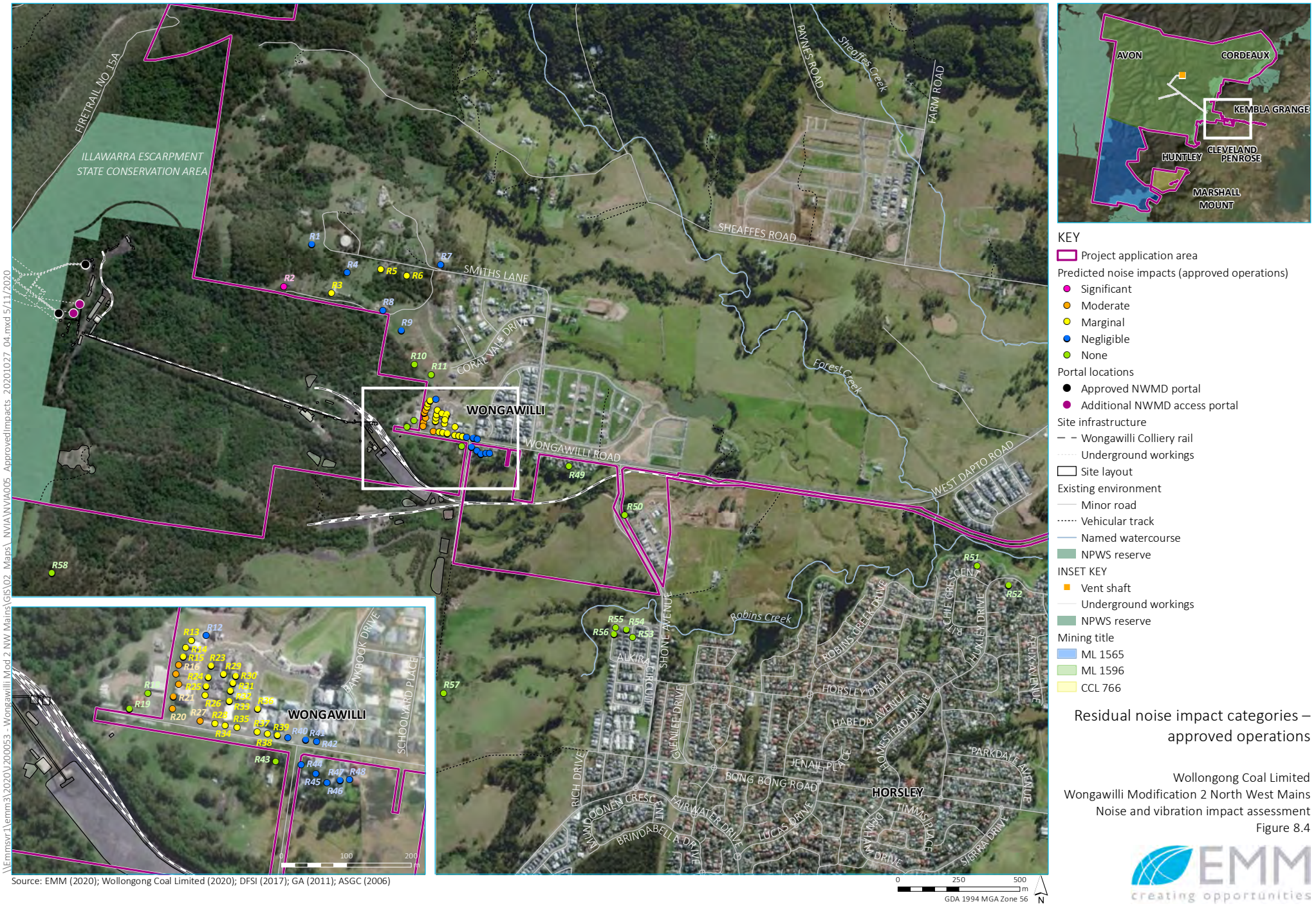

KEY

- Project application area

Predicted noise impacts (approved operations)

- Significant
- Moderate
- Marginal
- Negligible
- None

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Named watercourse
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Residual noise impact categories – approved operations

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 8.4

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

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8.7 Sleep disturbance

Consideration has been given to likely maximum noise level events at the nearest residential assessment locations. The Colliery is approved to operate 24 hours per day, 7 days a week. It is noted that the Colliery's operations will not significantly change as a result of the proposed modification when compared to currently approved operations.

As per the results of historical noise compliance monitoring, night-time noise emissions from the Colliery are generally steady-state; typically described as 'mine hum'. Maximum noise events from site have typically not been observed during the night period. Based on these observations and the results of historical noise compliance monitoring it has been assumed that maximum noise levels from site (L_{Amax}) during the night-time would be typically 2 dB greater than the average noise emission level ($L_{Aeq,15minute}$).

Predicted maximum noise levels for operation of the Colliery are presented in Table 8.4 for all assessment locations. The level presented here is the worst-case of both scenarios considered; loading from bins or loading from FEL.

Table 8.4 Predicted L_{Amax} noise levels and sleep disturbance assessment

Assessment location	Night predicted mine noise level (noise enhancing)		Sleep disturbance screening levels	
	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
R1	35	37	40	52
R2	41	43	40	52
R3	38	40	40	52
R4	37	39	40	52
R5	39	41	40	52
R6	39	41	40	52
R7 (RA1b)	37	39	40	52
R8 (RA1a)	44	46	45	55
R9	45	47	45	55
R10	39	41	45	55
R11	40	42	45	55
R12	43	45	45	55
R13	44	46	45	55
R14	44	46	45	55
R15	45	47	45	55
R16	47	49	45	55
R17	48	50	45	55
R18	48	50	n/a	n/a
R19	49	51	n/a	n/a
R20	49	51	45	55
R21	49	51	45	55
R22	48	50	45	55
R23	46	48	45	55
R24	47	49	45	55
R25	47	49	45	55
R26	47	49	45	55
R27	48	50	45	55
R28	47	49	45	55
R29	46	48	45	55
R30	46	48	45	55
R31	46	48	45	55
R32	46	48	45	55
R33	46	48	45	55

Table 8.4 Predicted L_{Amax} noise levels and sleep disturbance assessment

Assessment location	Night predicted mine noise level (noise enhancing)		Sleep disturbance screening levels	
	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
R34	46	48	45	55
R35	46	48	45	55
R36	45	47	45	55
R37	45	47	45	55
R38	45	47	45	55
R39	44	46	45	55
R40	44	46	45	55
R41	41	43	45	55
R42	41	43	45	55
R43	44	46	n/a	n/a
R44 (RA2b)	41	43	45	55
R45	41	43	45	55
R46	41	43	45	55
R47	40	42	45	55
R48	40	42	45	55
R49 (RA2a)	35	37	45	55
R50	32	34	45	55
R51 (RA4a)	23	25	40	52
R52 (RA4b)	22	24	40	52
R53 (RA3a)	30	32	40	52
R54	30	32	40	52
R55	30	32	40	52
R56	30	32	40	52
R57 (RA3b)	29	31	40	52
R58	33	35	40	52

Predicted maximum noise levels at the assessment locations (Table 8.4) are below the relevant sleep disturbance L_{Amax} screening levels. Hence, as per the NPfI requirements, a detailed assessment of maximum noise level events is not required.

8.8 Road traffic noise assessment

8.8.1 Project-related traffic

With all coal from the Colliery being transported via rail, daily traffic to and from the Colliery will consist of employee light vehicles and other vehicles associated with maintenance, contractors and deliveries.

The *Traffic Impact Assessment for Modification 2 Wongawilli Colliery* prepared by Transport & Urban Planning Pty Ltd dated November 2020 (TIA) has been referenced regarding existing and project-related traffic movements. Based on the data within this report, the proposed shift times and number of workers at the mine are summarised in Table 8.5.

Table 8.5 Details of shift times and number of workers

Shift	Number of workers
Monday to Friday	
Day shift (7.00am to 3.00pm)	26
Afternoon shift (3.00pm to 11.00pm)	15
Night shift (11.00pm to 7.00am)	15
Saturdays and Sundays	
Day time shift only (7.00am to 3.00pm)	6

Deliveries and maintenance vehicles are expected to number 60 per week (120 movements) with a maximum of up to 10 deliveries and maintenance vehicles (20 movements) per day. These vehicles will typically be small to large rigid trucks and some 19 m long articulated trucks and would be distributed throughout any 24-hour period with the majority occurring during the day. The morning and afternoon peak hours assumed for the purpose of predicting road traffic noise are consistent with those provided in the TIA; 6.30am – 7.30am and 2.30pm-3.30pm, respectively, consistent with the site's shift changes.

8.8.2 Road traffic noise predictions

The Federal Highway Traffic Noise Model (FHWA) (US Department of Transportation) method was used to calculate road traffic noise levels at the nearest residential façades from mine-related traffic only. The nearest residential assessment location on the corner of Jersey Farm Road and Wongawilli Road is R44 (RA2b) and is located approximately 10m and 16m from each road, respectively. Other residences on Wongawilli Road are located as near as approximately 8 m from the road. The FHWA road traffic noise calculation method considers traffic volumes, average travelling speed, road gradient to establish noise source strength, and includes attenuation due to distance, ground absorption and screening from buildings or barriers.

Predicted road traffic noise levels at the nearest potentially affected residential facades are summarised in Table 8.6.

Table 8.6 Predicted road traffic noise – project-related traffic only (dB)

Location	$L_{Aeq,15hour}$ day		$L_{Aeq,9hour}$ night	
	Predicted	Total road traffic noise goal	Predicted	Total road traffic noise goal
10m from Jersey Farm Road	52.8	60	48.1	55
16m from Wongawilli Road	51.5		46.9	
Total at corner of Jersey Farm Road/Wongawilli Road	*55.2*		*50.6*	
8m from Wongawilli Road	55.6		50.9	

Given that the mine is currently in care and maintenance there will likely be a noticeable increase in road traffic noise when operations recommence. Notwithstanding, road traffic noise generated by mine-related traffic is predicted to be at least 4 dB below the relevant noise goal.

Average existing daily traffic volumes on Wongawilli Road are in the order of 3,126 per day including 11.1% heavy vehicles. Based on these volumes, addition of mine-related traffic (112 light-vehicle movements and up to 20 heavy vehicles per day) will also meet the relative increase criteria.

8.8.3 Road traffic noise discussion

Based on the predicted noise levels (refer Table 8.6) and estimates of current road traffic volumes on Wongawilli Road and Jersey Farm Road, it is likely that the addition of mine-related traffic will not increase total road traffic noise levels above the relevant criteria.

In addition, the traffic generation associated with the modification will be less than that currently approved due to the reduction of the workforce from 300 full time equivalent personnel (approved) to 150 full time equivalent personnel.

West Dapto is being developed as a series of linked residential urban areas with subdivisions being developed at Wongawilli and the neighbouring suburbs of Horsley and Sheaffes. Wollongong City Council has developed the West Dapto Access Strategy and is undertaking transport and road upgrade works in stages, in various parts of the West Dapto urban release area with a number of projects already completed including the Princes Highway / West Dapto Road intersection and upgrades to Shone Avenue. As part of the current projects, Council is proposing to upgrade Wongawilli Road between the Community Hill at Wongawilli and Shone Avenue, to provide safer access for pedestrians, cyclists, residents and visitors. Future works include the upgrading of West Dapto Road, between Shone Avenue and Princes Highway.

Based on the preceding, it is likely that road traffic volumes in the vicinity of the Colliery, unrelated to operation of the mine, will increase as a result of the continued and future development of residential subdivisions.

8.9 Rail noise assessment

The nearest dwelling that was existing at the time of the current approval (441 West Dapto Road) is located approximately 20 m from the rail spur. The current, nearest residences are located on Rosina Street, Kembla Grange, approximately 15 m from the rail spur, at a higher elevation than (approximately 3 m above) the rail line and include a fence barrier along the boundary between the rail line and residence. A conservative estimate has been made regarding the effectiveness of the barrier; a 5 dB reduction to rail noise levels has been assumed based on the distances between the residences, barrier and the rail line and an assumed barrier height of 1.8 m.

Based on the results of rail noise compliance monitoring an average sound exposure level (SEL) of 95 dB was determined. This is a logarithmic average of the measured free field noise levels from 23 passby events measured at 20 m from the rail line. The highest measured free-field SEL at the same location was 99 dB.

Based on proposed movements of up to two trains per day (four pass-by events) the $L_{Aeq,15hour}$ rail noise was calculated using the following standard formula:

$$L_{Aeq,period} \text{ contribution} = SEL - 10\log(T) + 10\log(N)$$

where SEL is the sound exposure level; T is time in seconds for the day period (7 am to 10 pm); and N is the number of pass-by events.

A +2.5 dB facade correction was added to the free-field measurements before comparing with relevant rail noise criteria.

Based on the preceding, the calculated daytime rail noise level at the nearest existing dwelling (15 m from rail line and inclusive of the barrier) is estimated to range between $L_{Aeq,day}$ 55dB and 59 dB. The calculated daytime rail noise level at the dwelling located 20 m from the rail line is estimated to range between $L_{Aeq,day}$ 56dB and 60 dB. Hence, rail noise from up to two trains during the daytime period is predicted to comply with the rail noise goal of $L_{Aeq,day}$ 60 dB determined in accordance with the RING (EPA, 2013) and is also below the current rail noise limit provided in PA 09 – 0161.

Further, rail noise levels are not proposed to change compared to those currently approved.

9 Assessment of noise mitigation

9.1 Discussion of project and mitigation schedule

Initial works following approval of the proposed modification will likely involve the following prior to commencement of mining operations:

- establishment of the surface mine services for the NW drivages;
- re-support existing (underground) workings to the design support criteria;
- installation of underground services;
- delivery and introduction to site for mining and ancillary equipment for underground works; and
- onboarding of staff and mine workforce.

It is likely that these initial works will take approximately three months to complete and enable progression to the initial underground mining activities. The first stage of mining will be completed in approximately 26 weeks and involve stone drivage with no coal produced during this time. The stockpile area will not be used during this first stage.

The second stage of the mine development will produce coal that will be sent to the storage bin or stockpile area during day shift only. It is estimated that the second stage will be approximately 26 weeks duration.

Full operations will not commence until two years after the extension to the approval is awarded. This is due to the nature of the initial mine entry construction which will entail a significant amount of stone excavation and support to reach the thicker and economic sections of the Bulli coal seam. Limited use of the surface facilities will be required through the initial period of mine establishment. It is further proposed that the use of the surface coal clearance system (conveyor belt) will only be used during the dayshift hours on weekdays to handle the limited quantity of coal that will be produced.

WWC will undertake noise monitoring at the site and representative off-site locations to monitor conditions through the initial works. Communication with relevant stakeholders regarding noise monitoring and management plans as well as progress in relation to noise mitigation investigations will be part of this process as things develop.

While the mine is completing the initial works further engineering design will be completed to design and procure a coal handling and clearance system that aims to reduce the noise impacts to the community. Areas that have been initially identified for consideration in this regard are as follows:

- sizing and screening infrastructure – replaced and/or located underground;
- conveyance from the mine portal to the lower stockpile area - redesigned to minimise the transfer points of the material and replace the existing decline conveyor belt system;
- coal storage and train loading facility - redesigned to minimise noise emissions e.g. use of mobile equipment will be minimised or contained in an enclosed facility, lower impact loading system;
- coal bins - the location and design will be reviewed; and
- additional noise barriers and/or enclosures.

9.2 Feasible and reasonable mitigation

Consideration of the feasibility and reasonableness of existing and additional noise mitigation measures has been undertaken with reference to the guidance provided in Section 3.4 of the NPfI. The NPfI also provides the following guidance on the application of noise mitigation to existing premises:

> The range of noise reduction strategies for existing situations is generally more limited than those available for new development at the planning stage. For example, spatial separation between the source and receiver is not an option for existing situations. The initial focus for existing sites should be operational procedures and prioritising noise-control measures that provide the greatest benefits to residents at least cost.

The main operational noise sources at the site contributing to off-site noise levels are the screen and sizer building and elevator, rail load out bin, locomotives, dozer and front-end loaders. Preliminary mitigation options targeting these noise sources have been considered as provided in Table 9.1 noting that additional investigations will be undertaken during initial and early works upon approval of the modification. Mitigation strategies have been considered in the following hierarchical approach:

1. control of noise at the source;
2. once the feasible and reasonable controls at the source are exhausted, controlling the transmission of noise; and
3. once source and transmission feasible and reasonable controls are exhausted, considering mitigation measures at the noise-sensitive receivers.

Table 9.1 Mitigation decision making matrix

Mitigation option	Feasible?	Reasonable?	Justification for adopting / disregarding and expected noise benefit
At-source controls			
Rail load out improvements; this could be in the form of new/improved enclosure, engineering design solutions to reduce noise emissions from coal leaving bin and entering wagons (or a combination of any of these).	Yes, to be confirmed through further investigations	Yes	These measures will require consideration of engineering design and capital investment, but it is expected that a reduction of noise levels would be possible. For assessing noise from a mitigated rail load out activity an overall reduction in sound power level of 3dB has been adopted.
Noise suppression kit for dozer or new dozer	Yes	Yes	It is expected that a 5dB reduction to the overall dozer sound power level would be achievable. Being one of the main contributors to off-site mine noise emissions these controls to the dozer will have the benefit of reducing mine noise at all neighbouring residences.
Noise suppression kit for FEL or new FEL	Yes	Yes	It is expected that a 5dB reduction to the overall FEL sound power level would be achievable. Being one of the main contributors to off-site mine noise emissions these controls to the dozer will have the benefit of reducing mine noise at all neighbouring residences.

Table 9.1 Mitigation decision making matrix

Mitigation option	Feasible?	Reasonable?	Justification for adopting / disregarding and expected noise benefit
Relocate sizing and screening infrastructure underground	Yes	Yes	This measure will require consideration of engineering design and capital investment and will result in a significant reduction to mine noise emissions at nearby residences, in particular with regard to low frequency noise emissions. It is expected that the current enclosure housing the sizing and screening plant would be retained with coal transferred via conveyor within the current enclosure.
Improvements to elevator enclosure	Yes, to be confirmed through further investigations	Yes	This measure will require consideration of engineering design and capital investment, but it is expected that a reduction of noise levels would be possible. For the purpose of assessing noise from these improved enclosures an overall reduction in sound power level of 4dB has been adopted for the elevator enclosure.
Reduce noise from locomotives	No	No	As per the findings of the Noise Audit report (WMPL 2013) the proponent has made an effort to reduce noise from their rail operations through the use of locomotives that meet the noise limits of RailCorp's EPL, increasing the number of carriages (from 17 to 21) and minimising (now excluding) train loading activity during the night time.
Control transmission of noise			
Relocation of significant noise sources to increase separation distance between site and nearest residents	Yes	No	Relocation of the site would require a significant and prohibitive capital cost as well as potential long-term down-time for the mine.
Extend existing 6m high rail barrier further north to the rail loadout bin	Yes	Yes	Extending the rail barrier north would provide additional acoustic shielding to, primarily, locomotives on the track whilst loading wagons. Approximate extension of the rail noise barrier is shown in Appendix E. The extension will be located within the existing Lower Pit Top disturbance footprint.
Mitigation at the receptor			
Receptor mitigation	Yes	No	The implementation of the preceding noise mitigation measures will result in improved noise emissions compared to emissions from approved operations at all assessment locations.

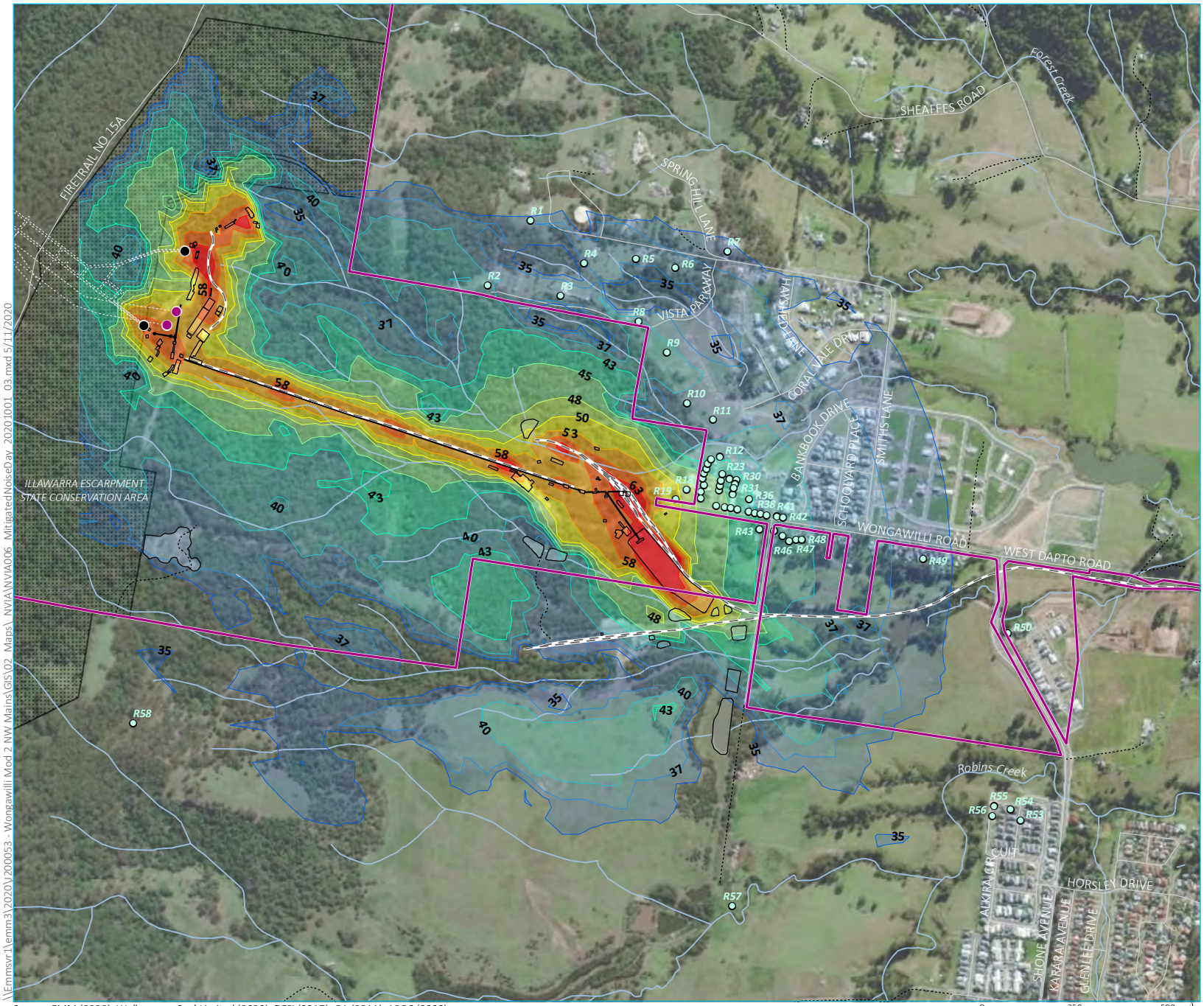
It is anticipated that all the feasible and reasonable noise mitigation measures identified above will be adopted. The implementation of all noise mitigation measures proposed will require significant operational planning, engineering design and, in some cases, significant capital investment. WWC will require an appropriate timeline to coordinate and implement all these measures.

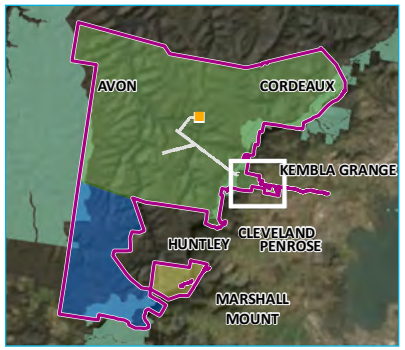
Noise emission predictions inclusive of the feasible and reasonable mitigation measures (as per Table 9.1) are presented in table format in Appendix F. Indicative noise contours including mitigation measures are provided in Figure 9.1, Figure 9.2 and Figure 9.3.

It is noted that, since the sizing and screening infrastructure has been removed from the surface the LFN modifying factor is no longer applicable at the nearest residences.

The results table provides the predicted noise level at each assessment location, inclusive of feasible and reasonable mitigation measures, and a comparison to relevant PNTLs. An estimated reduction of 3-8 dB in operational noise levels is predicted to be achievable at most assessment locations compared to predicted noise levels from approved operations.

Predicted residual noise impacts from the mitigated operational scenarios considered have been categorised as per Table 1 of the VLAMP with reference to noise predictions under noise-enhancing weather conditions. These residual noise impact categorisations after the implementation of feasible and reasonable mitigation measures are displayed spatially in Figure 9.4. This shows a significant reduction in the number of properties predicted to experience residual noise impacts compared to approved operations.





KEY

- Project application area
- Sensitive receiver

Operational noise contours (day)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

N

Operational noise contours - mitigated - daytime - loading from bins - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 9.1

EMM creating opportunities

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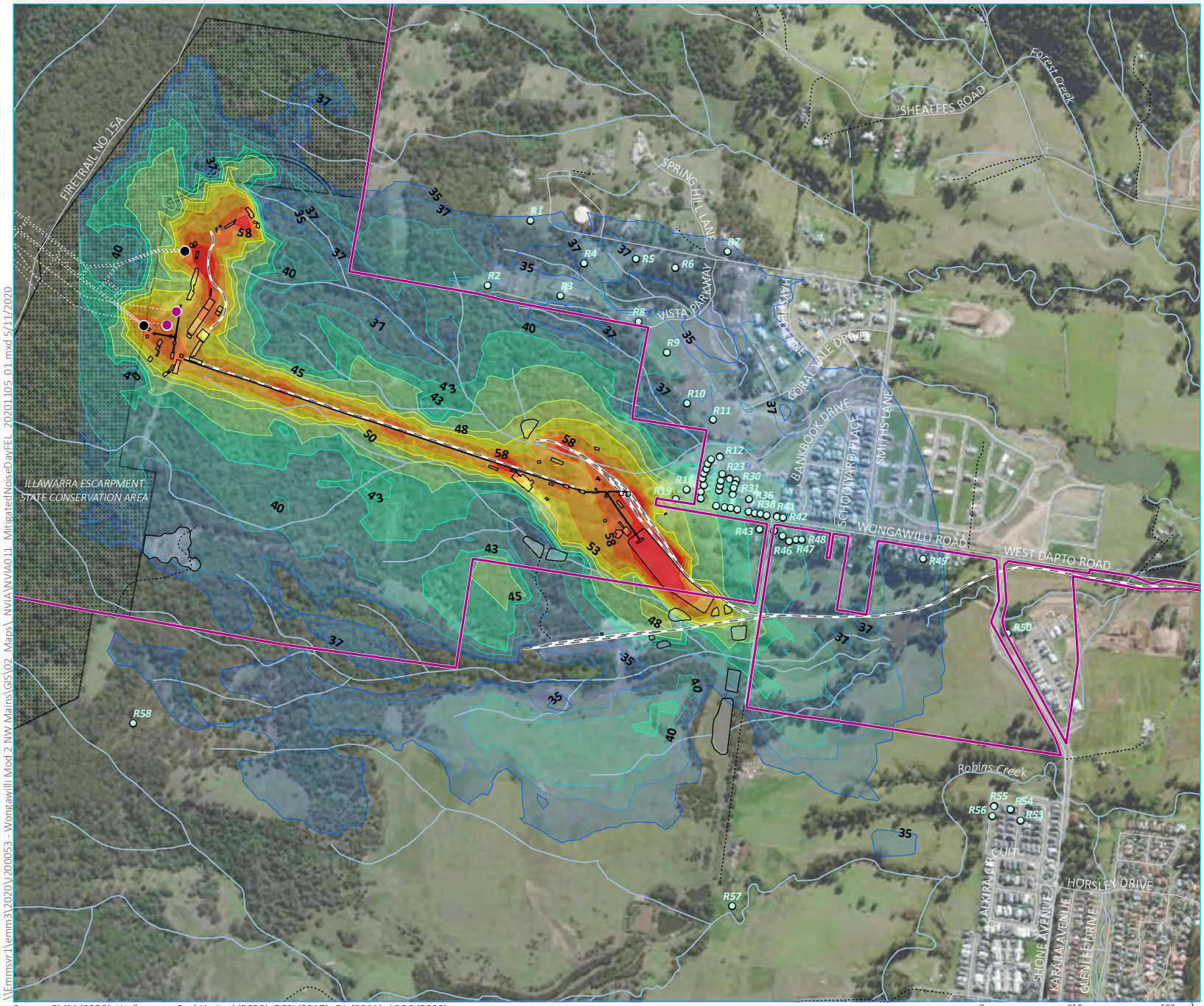
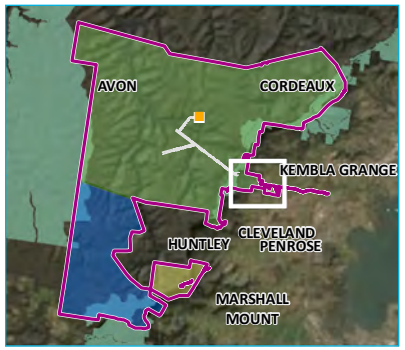




KEY

- Project application area
- Sensitive receiver

Operational noise contours (day)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

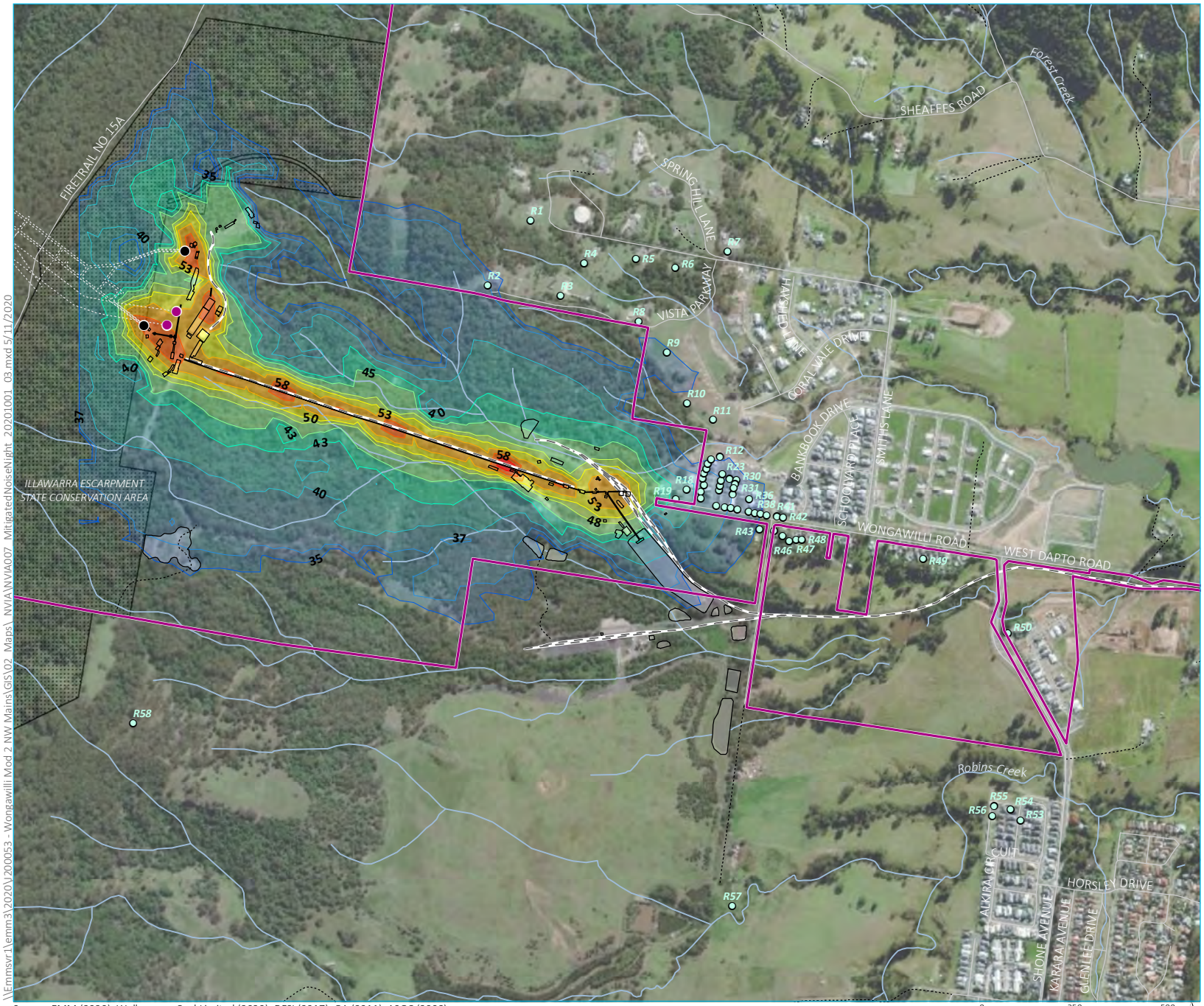
N

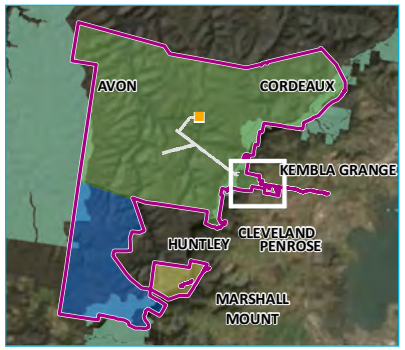
\\Emmsvr1\emm3\2020\200053 - Wongawilli Mod 2 NW Mains\GIS\02 Maps\ NVIA\NVIA011 MitigatedNoiseDayFEL 20201105 01.mxd 5/11/2020

Operational noise contours - mitigated - daytime - loading from FEL - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 9.2

EMM creating opportunities





KEY

- Project application area
- Sensitive receiver

Operational noise contours (day)

- 35 - 37 dB(A)
- 37 - 40 dB(A)
- 40 - 43 dB(A)
- 43 - 45 dB(A)
- 45 - 48 dB(A)
- 48 - 50 dB(A)
- 50 - 53 dB(A)
- 53 - 58 dB(A)
- 58 - 63 dB(A)
- >63 dB(A)

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Operational noise contours - mitigated night - indicative only

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 9.3

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 56

N

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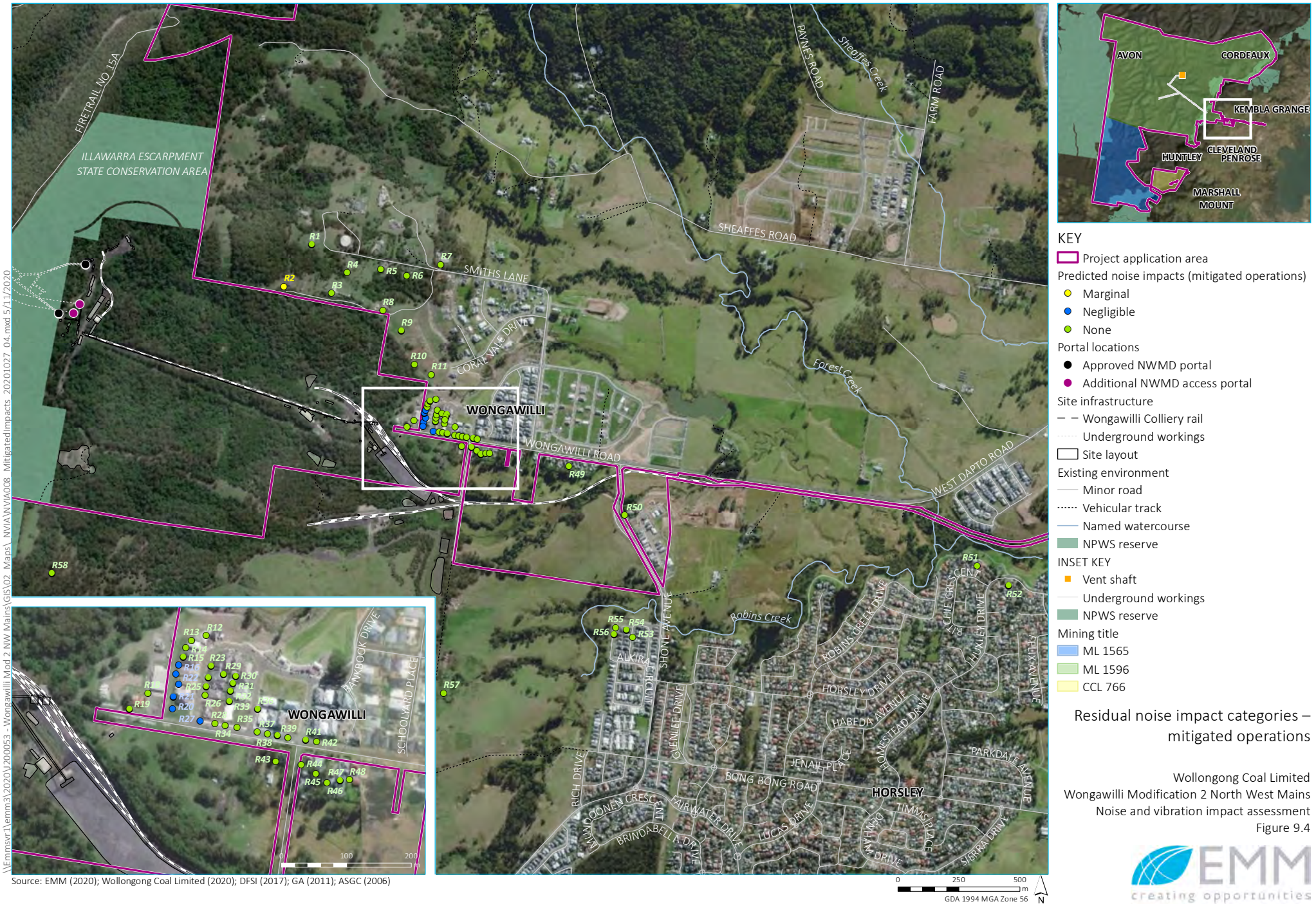
EMM creating opportunities



KEY

- Project application area

Predicted noise impacts (mitigated operations)

- Marginal
- Negligible
- None

Portal locations

- Approved NWMD portal
- Additional NWMD access portal

Site infrastructure

- Wongawilli Colliery rail
- Underground workings
- Site layout

Existing environment

- Minor road
- Vehicular track
- Named watercourse
- NPWS reserve

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

Residual noise impact categories – mitigated operations

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure 9.4

Source: EMM (2020); Wollongong Coal Limited (2020); DFSI (2017); GA (2011); ASGC (2006)

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EMM creating opportunities

10 Achievable noise levels

To assist in the negotiation process that will likely be an outcome of this study, Table 10.1 provides a summary of the predicted noise levels at six locations around the mine. These locations are expected to represent the nearest potentially most affected residences in each direction from the Colliery and would be appropriate locations for future noise compliance monitoring.

Table 10.1 Predicted 'achievable' noise levels (noise enhancing) (dB)

Location	PNTL ($L_{Aeq,15min}$)			Existing noise limit as per PA 09-0161						Achievable noise levels (Approved operations) ($L_{Aeq,15min}$)			Achievable noise levels (Mitigated operations) ($L_{Aeq,15min}$)		
				Intrusive ($L_{Aeq,15min}$)			Amenity ($L_{Aeq,period}$)								
	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt
R2	40	35	35	43	43	43	60	50	45	45	41	41	41	38	38
R9	45	45	43	n/a	n/a	n/a	60	50	45	47	45	45	41	35	35
R20	45	45	45	n/a	n/a	n/a	60	50	45	52	48	48	47	39	39
R55	40	35	35	40	40	38	60	50	45	<40	<35	<35	<40	<35	<35
R57	40	35	35	40	40	38	60	50	45	<40	<35	<35	<40	<35	<35
R58	40	35	35	n/a	n/a	n/a	60	50	45	<40	<35	<35	<40	<35	<35

Notes: 1. Noise level predictions presented in this table include the relevant LFN modifying factor.

It is of note that the achievable noise levels for mitigated operations are predicted to achieve the existing intrusive noise limit (where applicable) and comply with the existing amenity noise limit at all assessment locations. Further, implementation of all feasible and reasonable mitigation measures is predicted to result in reduction of mine noise emissions of 3-8 dB at all nearest assessment locations.

11 Conclusion

EMM has prepared an NVIA for the Wongawilli Colliery to accompany a modification application (MOD2) to the existing Project Approval (PA) for the underground coal mine (PA 09_0161).

Operational noise from Wongawilli Colliery has been assessed in accordance with the methodology outlined in the NPfI for existing sites. Contemporary noise goals (PNTLs) were established based on the results of ambient noise monitoring undertaken in July 2020 as well as historical noise monitoring when the mine was operational. Operational noise levels from approved operations were predicted based on information provided in previous noise studies and compared to the results of historical noise compliance monitoring.

Approved operational noise emissions were predicted to exceed the relevant PNTL at the nearest assessment locations. Hence, a preliminary assessment of feasible and reasonable noise mitigation measures was undertaken noting that additional investigations will be undertaken in this regard during initial and early works upon approval of the modification.

An estimated reduction of 3-8 dB in operational noise levels is predicted to be achievable at most assessment locations compared to predicted noise levels from approved operations. Further, incorporation of feasible and reasonable mitigation measures is predicted to result in a significant reduction in the number of properties predicted to be affected by residual noise impacts from Wongawilli Colliery compared to approved operations.

Given that the mine is currently in care and maintenance there will likely be a noticeable increase in road traffic noise when operations recommence. Notwithstanding, road traffic noise generated by mine-related traffic is predicted to achieve relevant road traffic noise goals. There is significant development occurring in the vicinity of the Colliery in relation to residential urban areas. Thus, it is likely that road traffic volumes in the vicinity of the Colliery, unrelated to operation of the mine, will increase as a result of the continued and future development of residential subdivisions.

Rail noise levels from operation of trains on the Wongawilli rail spur are not proposed to change compared to those currently approved. Rail noise from up to two trains during the daytime period is predicted to comply with the relevant rail noise goal established in accordance with the RING (EPA, 2013) and is also below the current rail noise limit provided in PA 09 – 0161.

Glossary

Table G.11.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	Definition
ABL	The assessment background level (ABL) is defined in the INP 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.
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.
Day period	Monday–Saturday: 7.00 am to 6.00 pm, on Sundays and public holidays: 8.00 am to 6.00 pm.
dB	Noise is measured in units called decibels (dB).
DPIE	NSW Department of Planning, Industry and Environment
EMM	EMM Consulting Pty Limited
EP&A Act	NSW *Environmental and Planning Assessment Act 1979* (NSW)
EPA	NSW Environment Protection Authority (formerly the Department of Environment, Climate Change and Water).
Evening period	Monday–Saturday: 6.00 pm to 10.00 pm, on Sundays and public holidays
ICNG	Interim Construction Noise Guideline
Intrusive noise level	The intrusive noise level refers to noise that intrudes above the background level by more than 5 dB.
L_{A1}	The A-weighted noise level exceeded for 1% of the time.
L_{A10}	The A-weighted noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L_{A90}	The A-weighted noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L_{Aeq}	The A-weighted energy average noise level. This is the equivalent continuous sound pressure level over a given period. The $L_{Aeq(15\text{-}minute)}$ descriptor refers to an L_{Aeq} noise level measured over a 15 minute period.
L_{Zeq}	The unweighted energy average noise level. This is the equivalent continuous sound pressure level over a given period without any frequency weighting applied.
L_{Amax}	The maximum A-weighted sound pressure level received during a measurement interval.
Night period	Monday–Saturday: 10.00 pm to 7.00 am, on Sundays and public holidays: 10.00 pm to 8.00 am.
NMP	Noise management plan
PNTL	The project noise trigger levels are targets for a particular industrial noise source or industry. The PNTLs are the lower of either the project intrusive noise level or project amenity noise level.
POEO Act	NSW *Protection of the Environment Operations Act 1997* (NSW)
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RNP	Road Noise Policy
Sound power level (L_w)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table G.1.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure G.1.1.

Table G.1.2 Perceived change in noise

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

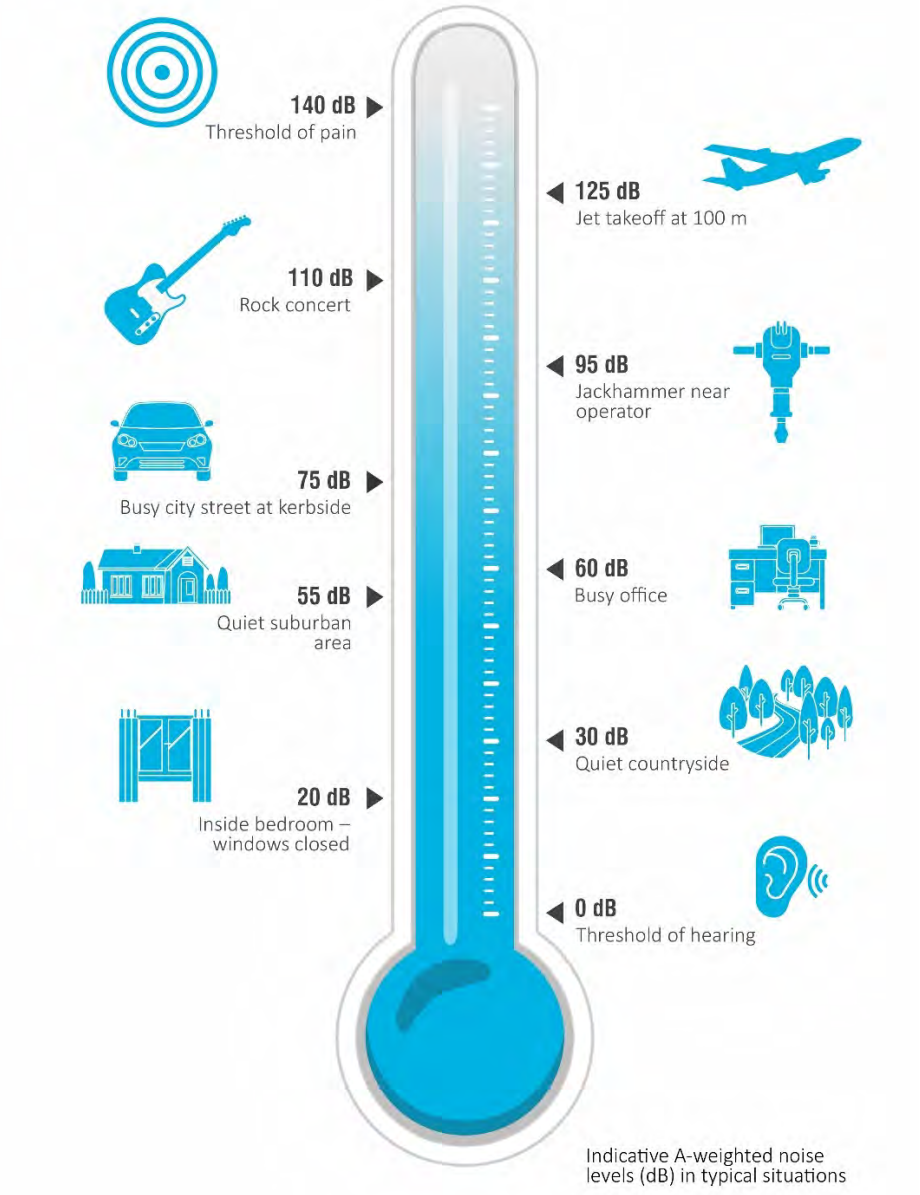


Figure G.1.1 Common noise levels

References

NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry*

NSW Government 2018, *Voluntary Land Acquisition and Mitigation Policy For State Significant Mining, Petroleum and Extractive Industry Developments* (VLAMP)

NSW EPA 2013, *Rail Infrastructure Noise Guideline* (RING)

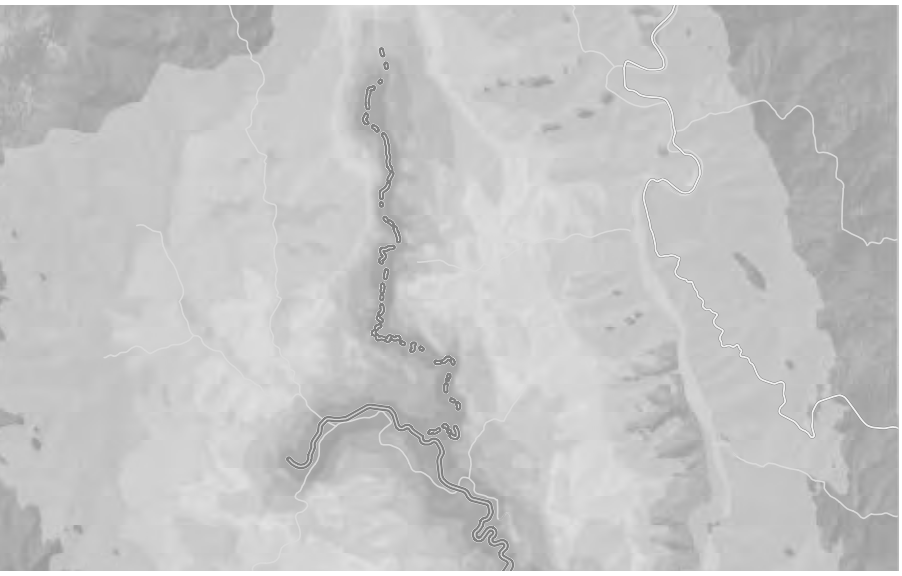
NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy* (RNP)

NSW Environmental Protection Authority (EPA) 2009, *The Interim Construction Noise Guideline* (ICNG)

Department of Environment and Conservation NSW 2006, *Assessing Vibration: a technical guideline*

Appendix A

Noise audit report



ACOUSTICS AND AIR

NRE WONGAWILLI COLLIERY

NOISE AUDIT

REPORT NO. 11309-B
VERSION B

DECEMBER 2013

PREPARED FOR

GUJARAT NRE WONGA PTY LTD
NRE WONGAWILLI COLLIERY
WONGAWILLI ROAD
WEST DAPTO NSW 2530

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	UCDraft – No Appendices	27 August 2013	Sam Demasi	John Wassermann
B	Final Draft	30 August 2013	Sam Demasi	-
B	Final	16 December 2013	Sam Demasi	-

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TABLE OF CONTENTS

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

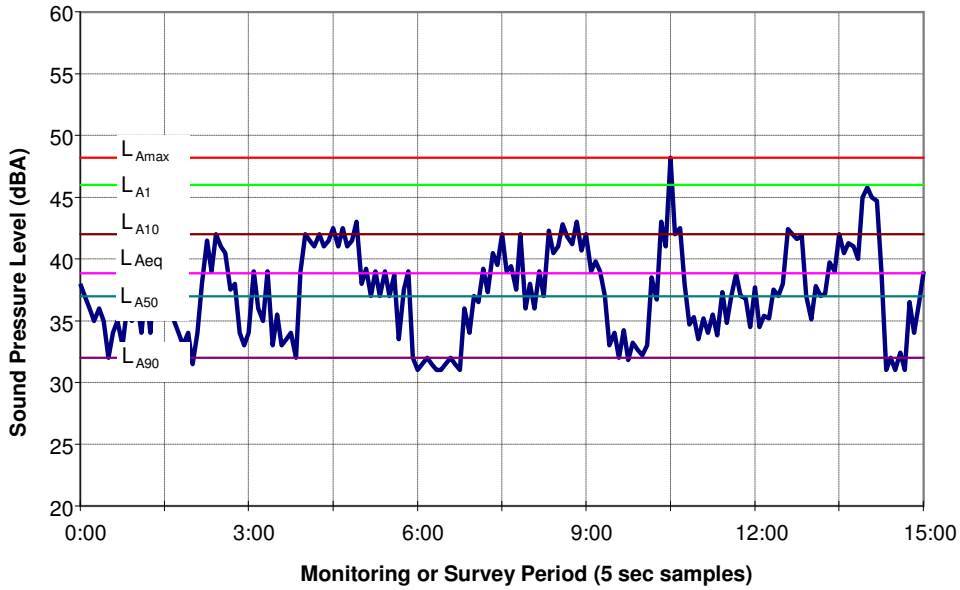
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



INTRODUCTION

Project Background & History

The Wongawilli Colliery is located approximately 15km south west of Wollongong, near the village of Wongawilli in New South Wales. Historically, the Colliery has produced up to 2Mtpa with all coal produced transported to Port Kembla Coal Terminal via rail. Gujarat NRE Wonga Pty Ltd own and operate the Colliery including the rail line.

Environmental Resources Management Australia (ERM) conducted a noise impact assessment as part of an Environmental Assessment for Wongawilli Colliery. That assessment, reference 0097271 EA Noise "Wongawilli Colliery, Noise Impact Assessment – 2Mtpa Operations" was completed 1 October 2010 and will be referred to as ERM's Report for the remainder of this document.

A Project Approval was provided by the Minister for Planning and Infrastructure (Application Number 09_0161) on 2 November, 2011 with Conditions of Approval (CoA). Part of the Approval Conditions (Schedule 4 – Specific Environmental Conditions – General – Noise Audit, Condition 7) outline the requirements of a Noise Audit.

Wilkinson Murray Pty Limited (WMPL) was commissioned by Gujarat NRE Wonga Pty Ltd (Gujarat) to carry out the independent noise audit of the Wongawilli Colliery operations including rail movements along the spur.

Following a review of the ERM's Report, Project Approval and discussions with Gujarat personnel, the following aspects have been reviewed by WMPL:

1. Background noise monitoring including updated data and development of noise criteria by WMPL for additional receivers.
2. Noise model inputs and assumptions, such as scenarios, sound power levels, assessment location and weather data. Additional noise modelling by WMPL is included.
3. Reasonable and feasible mitigation measures regarding Colliery operation including rail movements.
4. Action plan to implement any audit recommendations and a monitoring plan to confirm the effectiveness of any audit recommendations.
5. Development of vibration criteria and assessment of impacts.

With respect to the above five items, in the opinion of WMPL, Item 5 which addressed the vibration impacts associated with the Colliery operations including rail movements are considered to be negligible. WMPL agree with the conclusions of ERM that rail movements are likely to be barely noticeable and any building damage would be highly unlikely. Vibration associated with other Colliery operations are also expected to be barely noticeable. As a result, further detailed assessment is, in the professional opinion of WMPL not warranted.

It is recommended that this Audit be read in conjunction with ERM's report and the CoA.

As per the requirements of the Approval, a draft version of this report has been issued for review by Environment Protection Authority (EPA).

The EPA concluded (ref EF13/3970:DOC13/59293:ATC dated 20 September, 2013) that the audit adequately addressed the issues and can be submitted to NSW Planning.

Some general EPA comments were provided for consideration in finalising the report. The comments primarily agreed with more detailed attended and unattended noise monitoring to assess compliance with the noise criteria. These comments will be addressed in detail as part of the Noise Monitoring and Management Plan to be prepared in consultation with Gujarat.

Discussion of Noise Criteria & Noise Goals related to Site Noise

Within the approval there are noise criteria, which must be met as part of the approval and noise goals which are levels that are to be aimed for over time. The relevant Tables from the approval have been reproduced below:

Noise Criteria

1. *The Proponent shall ensure that the noise generated by the project (including train loading and shunting within the yard but excluding train movements on the Wongawilli rail spur) does not exceed the criteria in Table 3 and Table 4 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.*

Table 3 Noise Criteria dB(A) – Intrusive Noise Limits – Existing Residences

Receiver Area	Day	Evening	Night	
	$L_{Aeq,15min}$	$L_{Aeq,15min}$	$L_{Aeq,15min}$	$L_{A1,1min}$
RA1	43	43	43	59
RA2	44	43	43	60
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

Table 4 Noise Criteria dB(A) – Amenity Noise Limits – All Residences

Receiver Area	Day	Evening	Night
	$L_{Aeq,11hr}$	$L_{Aeq,4hr}$	$L_{Aeq,9hr}$
All privately-owned land	60	50	45

Notes to Table 3 & 4:

- *To interpret the locations referred to Table 2 and 3, see Appendix 4.*
- *Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*

However, these noise criteria do not apply if the Proponent has an agreement with the relevant owner/s of the residence or land to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of this agreement.

Noise Goal

2. *The Proponent shall ensure that the noise generated by the project (including train loading and shunting within the yard but excluding train movements on the Wongawilli rail spur) does not exceed the criteria in Table 3 and Table 4 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.*

Table 5 Noise Criteria dB(A) – Intrusive Noise Goals – Existing Residences

Receiver Area	Day	Evening	Night	
	$L_{Aeq,15min}$	$L_{Aeq,15min}$	$L_{Aeq,15min}$	$L_{A1,1min}$
RA1	40	40	38	51
RA2	40	40	38	51
RA3	40	40	38	48
All other existing residential receivers	40	40	38	48

Notes:

- *To interpret the locations referred to Table 5, see Appendix 4.*
- *Noise generated by the project is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.*
- *The noise goals in Table 5 may be varied by way of direction to the Proponent by the Director-General, following consideration of the results of the noise audit required under Condition 7 below.*

NOISE AUDIT

The following section provides a detailed review of the four remaining audit items.

Item 1 Background Noise Data & Noise Criteria / Goals

Review by Wilkinson Murray

ERM undertook measurements of existing background noise at three locations between 25 February and 12 March 2009 using ARL215 noise loggers in order to derive noise criteria. The locations, known as receiver areas (RA) have been defined by ERM.

In addition, a single 15-minute measurement was taken by ERM at each of the 3 logger locations on 12 March 2009.

Upon review of the background data (tables and the graphs) the following comments are made:

1. In general, the locations selected to obtain background data and the equipment used is considered acceptable and in line with the EPA's *Industrial Noise Policy (INP)*.
2. The RBL's developed are elevated during the evening (2 to 8dB) and night time (4 to 9dB) periods compared to the day with no explanation offered by ERM. Also, the attended measurements were conducted during a non-critical day period and offer no assistance in explaining these elevated noise levels.
3. In the opinion of WMPL, given that each of the three sites shows elevated levels during the evening and night, and given the season, the elevated levels are possibly due to both insects and weather; however, there are many instances where noise levels over time dramatically reduce and or increase. These situations may be attributed to Colliery Operations or in any case mechanical plant/processes. In conclusion, it can be said with confidence that there is insufficient data collected to statistically represent the long term background noise levels in the area. As such, suitable noise criteria cannot be derived.
4. It is important to note that the location address used by ERM identified as Lot 2410 Smiths Lane is actually 111 Smiths Lane. Refer to Appendix A of this report for clarification regarding the location of receivers and loggers together with an aerial identifying each location.

Recommendations by Wilkinson Murray

- It is recommended that additional noise logging be undertaken at a location representing residences (near Richie Crescent and Huxley Drive) further east from the Colliery operations impacted primarily by rail movements.

Assessment by Wilkinson Murray

WMPL undertook updated measurements of existing background noise which are summarised in Table 1. In deriving the summary, the impacts associated with weather and extraneous noise have been considered. For comparison, ERM locations and values have been included.

Appendix B provides the noise data collected by WMPL in graphical format.

Table 1 Summary of Long-Term Background Noise Data (RBL)

Receiver Area	Address of Logger	Logging Conducted by Who & When	Day	Evening	Night
RA1	Lot 2410 Smiths Lane	ERM 25 Feb to 9 Mar 2009	35	40	41
	111 Smiths Lane	WMPL 24 Apr to 4 May 2012	31	31	30
	70 Vista Parkway	WMPL 24 Apr to 2 May 2012	35	35	34
RA2	18 Wongawilli Road	ERM 25 Feb to 12 Mar 2009	35	37	39
		WMPL 24 Apr to 4 May 2012	36	35	31
RA3	Jersey Farm Road	ERM 25 Feb to 12 Mar 2009	32	40	41
		WMPL 24 Apr to 2 May 2012	32	35 (32)	30
RA4	66 Richie Crescent	WMPL 27 Apr to 3 May 2012	37	37	35

The summary in Table 1 clearly shows significant differences in typical background noise levels in the area between the ERM and WMPL measurements. In particular, during the more critical night time period, the WMPL measured levels are between 8 to 11dB lower than those measured by ERM.

It can be concluded that the updated measurements more appropriately describe the typical background noise in the area.

Furthermore, in comparison with the Approval Conditions (Schedule 4 – Specific Environmental Conditions – General – Noise Goals, Condition 2), these assumed Noise Goals are 3dB (higher) than the most stringent goal of 35dBA as derived from the revised WMPL noise level measurements. Although higher, the Noise Goals of the Approval are considered by WMPL to be reasonable goals for a working, established colliery to achieve considering the proximity of existing residential receivers and updated background noise levels.

It is noted that WMPL has undertaken noise logging at two additional locations as follows:

- The location 70 Vista Parkway has been included as noise complaints have been received from this residence. Given the location of this residence, it has been grouped within RA1.
- The location 66 Richie Crescent has been included to represent receivers impacted primarily by freight rail movements associated with the Colliery and has been assigned to be RA4. In consideration of the Approval, the noise goals for these residential receivers would be as per the requirements for "all other existing residential receivers".

Item 2 Noise Model Inputs and Scenarios

Review by Wilkinson Murray

- ERM has constructed a noise model using Bruel and Kjaer's Predictor software (Predictor). That software utilises prediction method associated with International Standards (ISO) as follows:

  9613-1 (1993) Acoustics – Attenuation of Sound during Propagation Outdoors – Part 1: Calculation of the Absorption of Sound by the Atmosphere

  9613-2 (1996) Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation

- It appears that ERM has conducted a basic, typical worst case meteorological analysis in accordance with the *INP*.

- The three scenarios developed are not clear and concise; however, indicate that consideration was given to the noise from scenario 1 (surface operations), scenario 2 (rail movement) and a model that combines scenario 1 and 2 (scenario 3) was also assessed.

- An assessment of sleep disturbance was undertaken.

Upon review of the inputs and assumptions, the following comments are made:

1. In general, the approach and software used is considered acceptable.

2. The assumptions used are neither clear nor concise. Many aspects vary dramatically from our recent discussions with Gujarat personnel and in the opinion of WMPL (following discussions with Gujarat personnel), the predictions are unlikely to represent the worst case impacts associated with typical works required for 2Mtpa operations. It is understood that this may also be partly due to the discussions between Gujarat and ERM at the time and in context of the then anticipated future project scheduling. In order to illustrate this a few examples are provided:

a. Equipment usage during the day, evening and night.

b. Train type and number of wagons.

c. Scenarios developed.

d. Sound power levels used for scenarios.

Recommendations by Wilkinson Murray

- A revised model is to be developed with updated and current scenarios. This process is to be undertaken in consultation with Gujarat personnel.

Assessment by Wilkinson Murray

WMPL undertook the construction of a new and updated acoustic model, revised scenarios and updated predictions. A summary of the methodology is outlined below:

Noise Prediction Software

Operational noise levels at nearby receivers have been calculated using the Environmental Noise Model (ENM) (a proprietary computer program from RTA Technology Pty Ltd). This modelling software is recommended by the *INP* and has been previously accepted by the EPA for use in environmental noise assessments. The assessment models the total noise at each receiver from the operation of the Project. Factors that are addressed in the noise modeling are:

- Equipment (including trains) sound level emissions and locations;
- Screening from structures, earth bunds and noise walls;
- Receiver locations;
- Meteorological impacts;
- Ground topography;
- Noise attenuation due to geometric spreading;
- Ground absorption; and
- Atmospheric absorption.

Noise Model Scenarios

The following three main categories have been considered.

- Site complex noise without the presence of any train movements.
- Site complex noise together with noise associated with train load out process using train loading bin.
- Noise from trains moving past residential receivers.

For site noise a distinction between daytime (7.00am-6.00pm), evening (6.00pm-10.00pm) and night time (10.00pm-7.00am) operations also need to be made as all mobile plant associated with site maintenance and management of the coal stockpiles only operate during the day and mobile plant at the timber yard at the pit top only operate during the day and evening periods.

Train noise is to be assessed during the daytime (7.00am-10.00pm) and night time (10.00pm-7.00am) periods.

From the three categories, eight scenarios have been developed for this assessment which are summarised in Table 2. It is critical to note that these eight scenarios are quite different to the three scenarios as assessed by ERM. Given the input by Gujarat in developing the eight scenarios, it is in the professional opinion of WMPL that such scenarios are more robust and reflects the current understanding of typical worst case scenarios.

Table 2 Modelling Scenarios

Period	Scenario	
Day	SC1	Colliery infrastructure and all mobile plant
	SC2	Colliery infrastructure, all mobile plant and train loading
	SC3	Train movements (this is for both day and evening periods)
Evening	SC4	Colliery infrastructure and pit top mobile plant
	SC5	Colliery infrastructure, pit top mobile plant and train loading
Night	SC6	Colliery infrastructure
	SC7	Colliery infrastructure and train loading
	SC8	Train movements

A summary of all mobile plant and infrastructure items potentially contributing to the overall noise emitted from the Site is provided in Table 3.

Table 3 Summary of Mobile Plant and Infrastructure Items

Activity	Plant Items
Colliery infrastructure	• Loaded surface conveyor system • Vibrating screen/sizer unit • Gearbox driving loading bin conveyor • Gearbox driving coal stockpile conveyor • Train loading bin (only operating during train loading process) • Pit top transfer station • Pit top gearbox
Mobile plant associated with site maintenance and management of the coal stockpiles	• 2x CAT988B Front-End-Loaders • D8 Dozer • Backhoe • Watercart
Pit top mobile plant	• Diesel forklift

When the Colliery infrastructure is operating, it is conservatively assumed that all surface conveyors including those servicing train loading bins and coal stockpiles are operating.

As advised by Gujarat, coal trains accessing the Site consist of trains with two 82 Class locomotives and 21 wagons travelling at an average speed of 20km per hour along the rail spur.

To assess potential sleep disturbance impacts, only Scenario 7 has been considered as this represent the applicable activities with the most potential to generate sleep disturbance.

Sound Power Levels

Table 4 presents a summary of the L_{Aeq} sound power levels (SWLs) utilised in the noise prediction model for the various items of plant and mobile equipment.

Most of the SWLs are based on on-site measurements conducted by WMPL on Friday, 1 June 2012.

Plant associated with the conveyor servicing the coal stockpiles were not operating during the time of the survey and accordingly, the corresponding SWLs were deducted from the measured equipment of similar nature.

SWLs for mobile plant items such as the dozer, backhoe and watercart were obtained from the WM database as these items were not measureable at the time of the survey.

Activities relating to the coal train arriving, loading and departing did not occur during the time of the survey. As such, train SWLs were obtained from the RailCorp NSW standard rail noise database (prepared by WMPL for RailCorp). The database levels are adjusted for speed, number of locomotives, length of trains and audible wheel defects, with no allowance for shielding which is then addressed within the noise model.

SWL for the train load out process was based on values contained in ERM's Report.

Table 4 Summary of L_{Aeq} SWLs Used in Model

Item	L_{Aeq} SWL (dBA)	Reference
Loaded surface conveyor system	74/m	WMPL
Vibrating screen / sizer unit	104	WMPL
Gearbox driving loading bin conveyor	94	WMPL
Gearbox driving coal stockpile conveyor	94	WMPL
Pit top transfer station	94	WMPL
Pit top gearbox	92	WMPL
CAT988B Front-End-Loader	109	WMPL
D8 Dozer	113	WMPL
Backhoe	95	WMPL
Watercart	103	WMPL
Diesel forklift	99	WMPL
Train loading bin	105	ERM
2 X 82 Class Locomotives travelling at average speed of 20km/hr	83/m	RailCorp NSW
21 wagons travelling at average speed of 20km/hr	75/m	RailCorp NSW

Table 5 presents a summary of the $L_{A1,1min}$ SWLs utilised in the noise prediction model addressing potential sleep disturbance. Any potential impact from train movements along the spur has not been assessed given that the Approval does not provide any Noise Criteria.

Table 5 Summary of $L_{A1,1min}$ SWLs Used in Model

Item	L_{A1} SWL (dBA)	Reference
Train loading bin when coal first hits the empty wagon	112	ERM

Meteorology

The *INP* generally directs the use of a single set of meteorological data in the assessment of noise impacts. However, WMPL has adopted the more rigorous approach of predicting noise levels for a range of meteorological conditions based on the statistical distribution of data obtained from the locality.

The noise modelling presented in this assessment is based on hourly data obtained from the Bureau of Meteorology (BoM) Albion Park weather station for the period from 7 April 2011 to 31 December 2012.

The wind speed at; 0.75m/s, 1.25m/s, 1.75m/s, 2.25m/s and 2.75m/s (encompassing a 0.25m/s range either side) and wind direction at every 45 degrees (encompassing a 22.5 degree range either side) are considered plus a calm scenario. A total of 41 conditions are assessed for both the day and evening for each season.

During the night stability class, either Class A to E (0°/100m inversion), or a Class F (3°/100m inversion) are considered. In both cases, the enhancement due to wind is included as well as a calm scenario. A total of 81 conditions are considered for each season.

The probability of occurrence for all the above-mentioned conditions have been calculated and the noise level that occurs 10% of the time for each defined time period (day, evening and night) is presented at each receiver during the worst case season and this is compared against the relevant criteria.

This alternative assessment procedure involves significantly greater computational complexity than the use of a single set of meteorological conditions. However, WMPL believes it provides a more rigorous method of assessing noise exposure, and one that is more easily understood by the community. The approach of using the 10^{th} percentile calculated noise level as a measure of noise impacts has been considered acceptable by the Department of Planning and Infrastructure (DoPI) and the EPA for previous similar mining project assessments.

In accordance with the *INP Application Notes*, noise levels at nearby receivers were also predicted for calm meteorological conditions. At night, those levels refer to calm isothermal meteorological conditions.

Predicted Operational Noise Levels

Noise levels at the identified receivers have been predicted for both calm and relevant weather conditions (i.e. provided as 10th percentile noise levels) within the worst case season (e.g. autumn, winter, spring, summer).

Tables 6, 7 and 8 present predicted $L_{Aeq,15min}$ noise levels emitted from the Site for the daytime, evening and night time assessment periods, respectively.

Table 9 summarises the predicted $L_{A1,1min}$ noise levels emitted from the Site.

Table 10 summarises the predicted $L_{Aeq,period}$ noise levels from train pass-bys.

Exceedances of the Noise Criteria have been predicted and are shown in bold italic font. Given that the exceedances result in non-compliance, it would be of further benefit to undertake more detailed site noise audits and further confirm with Gujarat the scenarios as modelled. This process would also involve either detailed audio or directional monitoring at typically 2 receiver locations over several days.

Table 6 Predicted $L_{Aeq, 15min}$ Noise Levels from the Site – Daytime Assessment Period

NCA	Receiver	L_{Aeq} Noise Level (dBA) 10th Percentile		L_{Aeq} Noise Level (dBA) Calm		Day L_{Aeq} Noise Criteria & Goals (dBA)
		SC1	SC2	SC1	SC2	
		Colliery	Colliery + Train Loading	Colliery	Colliery + Train Loading	
RA1	30 Vista Parkway	***45***	***46***	45	46	43 (40)
	111 Smiths Lane	40	41	38	40	
RA2	18 Wongawilli Road	39	40	37	39	44 (40)
	1 Wongawilli Road	***45***	***46***	45	46	
RA3	80 Shone Avenue	40	40	35	35	40
	Jersey Farm	***47***	***48***	46	46	
RA4	66 Ritchie Crescent	28	29	26	27	40
	61 Huxley Drive	28	28	25	26	

Note: The Noise Goals (shown in brackets when differing from the Noise Criteria) are considered in the Approval as the noise level that the Colliery shall aim for over time.

Note: As advised by Gujarat, although Jersey Farm is residential, it will no longer have residences whilst mining at the Colliery occurs. It has been included in our calculation for completeness as it was included in the ERM assessment.

As can be seen from the table, exceedances are predicted during times when both colliery and train loading occurs as well as colliery only situations. The exceedances range from between 1 and 8dBA and are applicable to NCA's RA1 and RA2. As a result of the predicted exceedances, NRE is currently in non-compliance of the noise criteria outlined in the CoA and immediate action is required.

No exceedances have been predicted for residential receivers within RA3 or RA4.

Table 7 Predicted $L_{Aeq, 15min}$ Noise Levels from the Site – Evening Assessment Period

NCA	Receiver	L_{Aeq} Noise Level (dBA) 10th Percentile		L_{Aeq} Noise Level (dBA) Calm		Evening L_{Aeq} Noise Criteria & Goals (dBA)
		SC4	SC5	SC4	SC5	
		Colliery	Colliery + Train Loading	Colliery	Colliery + Train Loading	
RA1	30 Vista Parkway	43	***46***	40	42	43 (40)
	111 Smiths Lane	40	42	34	38	
RA2	18 Wongawilli Road	40	43	34	37	43 (40)
	1 Wongawilli Road	***44***	***48***	40	44	
RA3	80 Shone Avenue	34	36	29	30	40
	Jersey Farm	39	***42***	35	38	
RA4	66 Ritchie Crescent	28	30	24	25	40
	61 Huxley Drive	27	29	23	24	

Note: The Noise Goals (shown in brackets when differing from the Noise Criteria) are considered in the Approval as the noise level that the Colliery shall aim for over time.

Note: As advised by Gujarat, although Jersey Farm is residential, it will no longer have residences whilst mining at the Colliery occurs. It has been included in our calculation for completeness as it was included in the ERM assessment.

As can be seen from the table, exceedances are predicted during times when both colliery and train loading occurs. The exceedances range from between 2 and 5dBA and are applicable to NCA's RA1 and RA2. As a result of the predicted exceedances, NRE is currently in non-compliance of the noise criteria outlined in the CoA and immediate action is required.

No exceedances have been predicted for residential receivers within RA3 and RA4.

Table 8 Predicted $L_{Aeq, 15min}$ Noise Levels from the Site – Night Time Assessment Period

NCA	Receiver	L_{Aeq} Noise Level (dBA) 10th Percentile		L_{Aeq} Noise Level (dBA) Calm		Night Time L_{Aeq} Noise Criteria & Goals (dBA)
		SC6	SC7	SC6	SC7	
		Colliery	Colliery + Train Loading	Colliery	Colliery + Train Loading	
RA1	30 Vista Parkway	42	***45***	38	40	43 (38)
	111 Smiths Lane	40	42	34	38	
RA2	18 Wongawilli Road	39	42	34	37	43 (38)
	1 Wongawilli Road	***44***	***47***	40	44	
RA3	80 Shone Avenue	33	36	28	30	38
	Jersey Farm	***39***	***41***	35	38	
RA4	66 Ritchie Crescent	27	29	24	25	38
	61 Huxley Drive	26	28	22	24	

Note: The Noise Goals (shown in brackets when differing from the Noise Criteria) are considered in the Approval as the noise level that the Colliery shall aim for over time.

Note: As advised by Gujarat, although Jersey Farm is residential, it will no longer have residences whilst mining at the Colliery occurs. It has been included in our calculation for completeness as it was included in the ERM assessment.

As can be seen from the table, exceedances are predicted during times when both colliery and train loading occurs. The exceedances range from between 1 and 4dBA and are applicable to NCA's RA1 and RA2. As a result of the predicted exceedances, NRE is currently in non-compliance of the noise criteria outlined in the CoA and immediate action is required.

No exceedances have been predicted for residential receivers within RA3 and RA4.

Table 9 Predicted $L_{A1,1min}$ Noise Levels (Sleep Disturbance) from the Site – Night Time Assessment Period

NCA	Receiver	$L_{A1,1min}$ Noise Level (dBA) 10th Percentile SC7 Colliery + Train Loading	$L_{A1,1min}$ Noise Level (dBA) Calm SC7 Colliery + Train Loading	Night Time $L_{A1,1min}$ Noise Criteria & Goals (dBA)
RA1	30 Vista Parkway	45	42	59(51)
	111 Smiths Lane	45	38	
RA2	18 Wongawilli Road	46	40	60(51)
	1 Wongawilli Road	51	48	
RA3	80 Shone Avenue	39	39	48
	Jersey Farm	45	33	
RA4	66 Ritchie Crescent	31	27	48
	61 Huxley Drive	31	25	

Note: The Noise Goals (shown in brackets when differing from the Noise Criteria) are considered in the Approval as the noise level that the Colliery shall aim for over time.

Note: As advised by Gujarat, although Jersey Farm is residential, it will no longer have residences whilst mining at the Colliery occurs. It has been included in our calculation for completeness as it was included in the ERM assessment.

As can be seen from the table, no exceedances are predicted.

Table 10 Predicted $L_{Aeq,\ period}$ Noise Levels from Train Movements along the Spur

NCA	Receiver	L_{Aeq} Noise Level (dBA) 10th Percentile SC3 or SC8 Train Movements		L_{Aeq} Noise Level (dBA) Calm SC3 or SC8 Train Movements		Daytime $L_{Aeq,\ period}$ Noise Criteria (dBA)	Night Time $L_{Aeq,\ period}$ Noise Criteria (dBA)
		Day	Night	Day	Night		
RA1	30 Vista Parkway	36	35	34	33	65	60
	111 Smiths Lane	35	34	33	32		
RA2	18 Wongawilli Road	48	48	48	47	65	60
	1 Wongawilli Road	43	42	42	41		
RA3	80 Shone Avenue	38	37	39	38	65	60
	Jersey Farm	41	40	35	34		
RA4	66 Ritchie Crescent	48	47	47	46	65	60
	61 Huxley Drive	45	44	44	43		

Note: As per the approval, during normal operations, four trains are assumed during the day and one during the night.

Note: As advised by Gujarat, although Jersey Farm is residential, it will no longer have residences whilst mining at the Colliery occurs. It has been included in our calculation for completeness as it was included in the ERM assessment.

As can be seen from the table, no exceedances are predicted.

Item 3 Discussion of Noise Mitigation

Review by Wilkinson Murray

The ERM report assumed the following at source noise mitigation as part of the noise modelling:

1. At source mitigation to reduce the individual noise from the following plant by 5dB:
    a. Exhaust noise and engine bay noise of front end loaders to an assumed sound power level of 103dBA (from 108dBA). This could be achieved by installing mufflers, acoustic louvres or upgrading/lining enclosures.
    b. Coal hopper noise (coal striking walls/base of hopper). This could be achieved by lining the walls/base with a hard wearing rubber and prevent coal to metal contact.
    c. Coal elevator noise (coal striking metal chute). This could be achieved by operational changes by maintaining a minimum coal level preventing (or reducing) the coal striking the metal chute.
    d. Compressor noise. This could be achieved by a suitable enclosure and acoustic lining.

Other at source mitigation recommend in the ERM report to be investigated includes:

    e. Procurement of low noise equipment, in particular conveyor systems, transfer stations and coal hoppers.
    f. All mufflers of any on-site fixed and mobile diesel plant to be upgraded and maintained. This excludes road vehicles.

In addition, the ERM report assumed the following noise mitigation measures to be considered.

2. The use of barriers to reduce noise associated with rail pass-bys along the rail spur impacting residences within Wongawilli Village and Horsley. The barrier is to achieve at least 5dB reduction from rail pass-bys.
3. A noise management plan to include:
    a. Complaints handling protocol
    b. Noise monitoring plan
    c. Mitigation measures
    d. Compliance reporting

Recommendations by Wilkinson Murray

WPML has reviewed these mitigations and following our predicted noise levels, the following comments and recommendations are made in and will be dealt with in more detail in the Noise Monitoring and Management Plan:

Colliery Operations

From our predictions and a review of the main plant/processes that contribute to the exceedances, the following is recommended:

i. Use of quieter mobile plant or reduce the noise from the existing plant by at least 5dB. This is particular the case for both front end loaders and the dozer, however it is important to point out the SWL used by ERM for these plant items is much lower than used for our predictions. It is our professional opinion that the ERM values will be very difficult to achieve and not practical.

ii. Reduction in noise emanating from the screen/sizer building and main conveyor by at least 5dB. It is noted that considerable work has already been undertaken by Gujarat on the screen / sizer building.

iii. Audit of all reversing alarms with the commitment to ensure tonal alarms are replaced with non-tonal or quacker type alarms.

iv. Any procurement of new plant will need to allow for low noise upgrades.

v. Further on-site noise audits to ensure the noise from all major plant/processes are confirmed.

It is noted that compressor noise was not identified by WMPL to be a major noise source and as such mitigation is not required at this instance.

Train Loading Operations

From our predictions and a review of the main plant/processes that contribute to the exceedances, the following is recommended:

i. Reduction in noise emanating from the loading bin operation by at least 5dB. This is in line with ERM's recommendations.

ii. Further on-site noise audits to ensure the noise from all major plant/processes are confirmed.

Rail Operations

Gujarat has, over the last few years focussed on reducing noise from their rail operations. The following is a summary of the mitigations thus far:

- Use of quieter locomotives that meet the noise limits contained within RailCorp's EPL.
- Increase the number of carriages from 17 to the current 21.
- Minimise train movements during night time.

On the basis of the above and considering average movements (as per the Approval) during the day and night and normal operations, the predicted noise levels (refer Table 10) are well below noise criteria.

It is noted that given the current site configuration, the current number of wagon cannot be increased unless considerable changes to the infrastructure is undertaken with significant capital cost. Such an approach is considered neither reasonable nor necessary.

Further to this, the ERM recommended barrier to achieve 5dB reduction is, at this stage not considered necessary.

In the opinion of WMPL, the following reasonable mitigation measures are to be detailed as part of the noise management plan.

i. Continued use of the quieter locomotives.

ii. Track maintenance plan.

iii. More scheduled movements (when possible) during the day and less at night.

iv. Confirmation of noise levels from the locomotives and carriages at the typically most impacted residential receivers.

Item 4 Action Plan to Confirm Effectiveness of Audit Recommendations

In summary, the audit recommendations by WMPL are as follows:

i. Noise logging be undertaken again and include background data at a location representing residences (near Richie Crescent and Huxley Drive) further east from the Colliery operations impacted primarily by rail movements – COMPLETED

ii. A revised model is to be developed with updated and current scenarios. This process is to be undertaken in consultation with Gujarat personnel – COMPLETED

iii. Use of quieter mobile plant or reduce the noise from the existing plant by at least 5dB. This is particular the case for both front end loaders and the dozer – TO BE CONFIRMED

iv. Reduction in noise emanating from the screen/sizer building and main conveyor by at least 5dB. – TO BE CONFIRMED

v. Audit of all reversing alarms with the commitment to ensure tonal alarms are replaced with non-tonal or quacker type alarms – TO BE CONFIRMED

vi. Procurement of low noise plant – AS REQUIRED

vii. Reduction in noise emanating from the loading bin operation by at least 5dB – TO BE CONFIRMED

viii. Further on-site noise audits to ensure the noise from all major plant/processes are confirmed – TO BE ORGANISED AS PART OF NOISE MONITORING AND MANAGEMENT PLAN

The next stage would be to prepare a detailed Noise Monitoring and Management Plan in consultation with Gujarat.

CONCLUSION

Wilkinson Murray has conducted a noise audit of the EA and associated Approval for NRE Wongawilli Colliery located in Wongawilli, New South Wales. This assessment is required as part of the Approval Conditions.

WMPL identified the four items considered requiring review with respect to noise:

1. Background noise monitoring including updated data and development of noise criteria by WMPL for additional receivers.
2. Noise model inputs and assumptions, such as scenarios, sound power levels, assessment location and weather data. Additional noise modelling by WMPL as required.
3. Reasonable and feasible mitigation measures regarding Colliery operation rail related activities.
4. Action plan to implement any audit recommendations and a monitoring plan to confirm the effectiveness of any audit recommendations.

The main findings of our audit include:

- Background monitoring conducted in the EA was not indicative of the typical existing acoustic environment.
- The revised noise criteria and goals as per the Approval is considered by WMPL as reasonable for an established working mine near residential receivers.
- The existing ERM model has been revised by WMPL to include more up to date assumptions and scenarios. In particular, the SWL's and scenarios appear to be underestimated by ERM; as a consequence, exceedances have been predicted. This has resulted in non-compliance for RA1, RA2 and RA3 which need to be addressed immediately.
- A discussion of suitable mitigation has been undertaken and will be appropriately detailed as part of a Noise Monitoring and Management Plan in consultation with Gujarat.

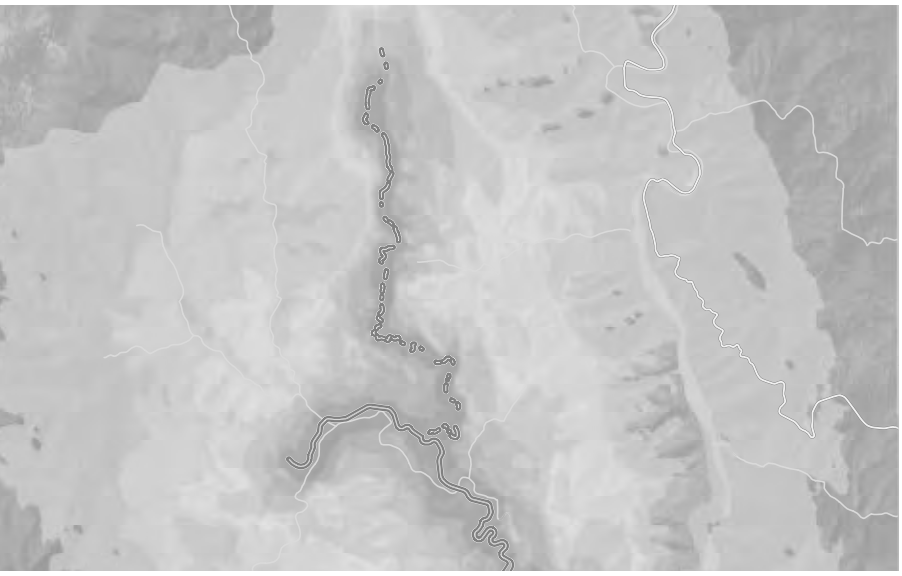
APPENDIX A

AERIAL OF RECEIVER & LOGGER LOCATIONS

Figure A-1 Noise Sensitive Receivers / Logger Locations

Appendix B

Measured ambient noise levels

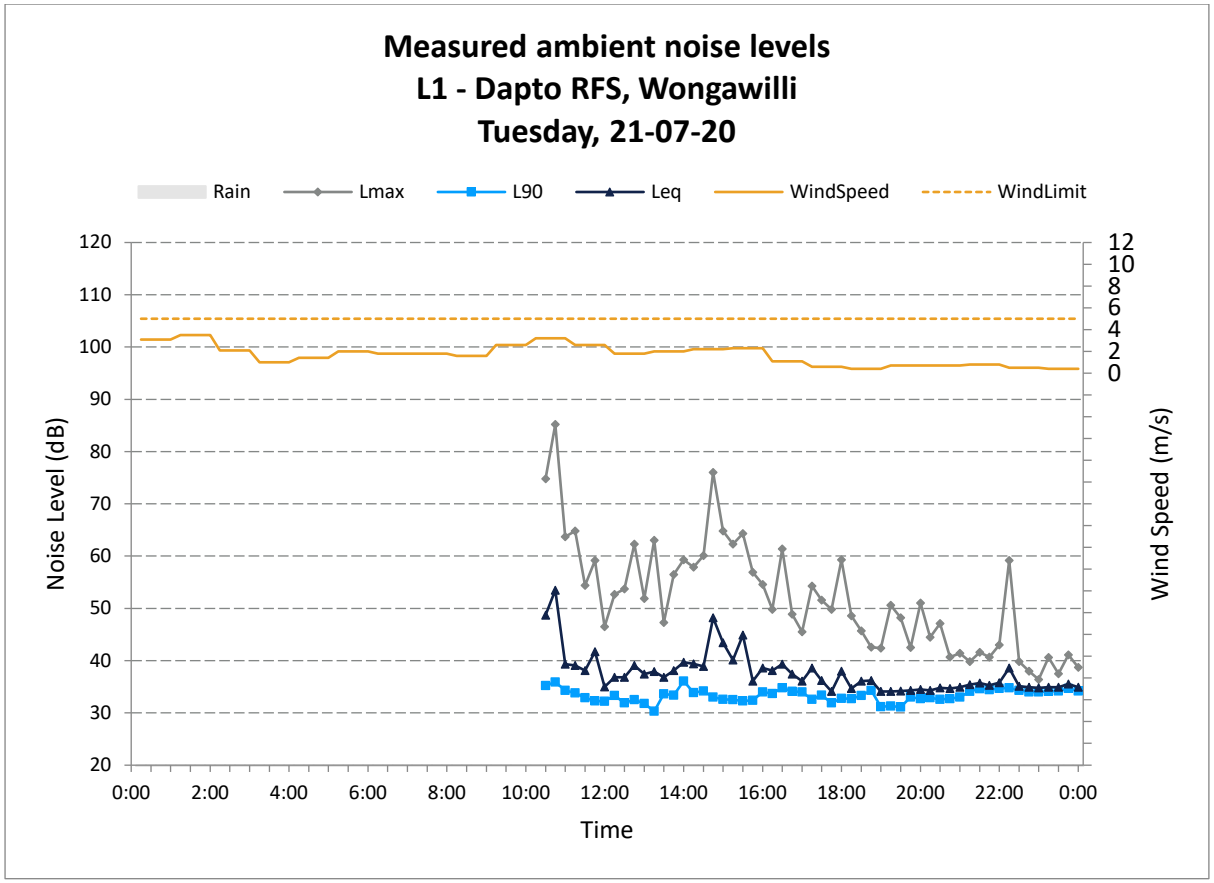


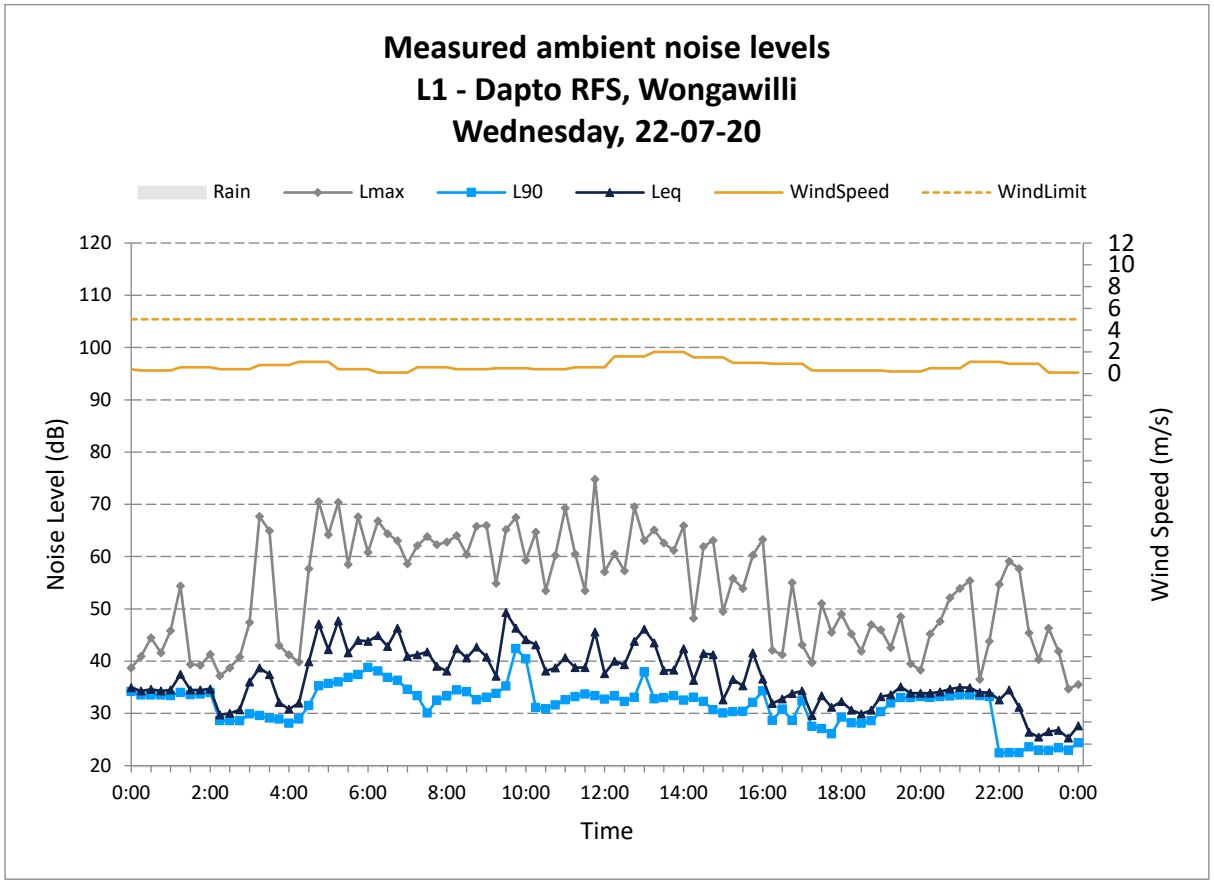
Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11\ hour}$ Day	$L_{Aeq,4\ hour}$ Evening	$L_{Aeq,9\ hour}$ Night	$L_{Aeq,15\ hour}$ Day	$L_{Aeq,24\ hour}$ Day	$L_{Aeq,8\ hour}$ Night
Tuesday, 21-07-20	0	31	29	0	35	40	0	41	39
Wednesday, 22-07-20	29	28	23	41	34	43	40	41	43
Thursday, 23-07-20	29	23	26	40	32	50	38	46	50
Friday, 24-07-20	26	24	32	42	32	56	41	52	55
Saturday, 25-07-20	27	0	0	49	0	0	0	0	0
Sunday, 26-07-20	0	0	0	0	0	0	0	0	0
Monday, 27-07-20	0	0	0	0	0	0	0	0	0
Tuesday, 28-07-20	0	32	32	0	45	45	0	43	45
Wednesday, 29-07-20	32	35	30	40	41	42	40	41	43
Thursday, 30-07-20	31	34	29	37	43	46	40	43	44
Friday, 31-07-20	0	0	0	0	0	0	0	0	0
Saturday, 01-08-20	0	0	0	0	0	0	0	0	0
Sunday, 02-08-20	0	0	0	0	0	0	0	0	0
Summary Values	29	31	29	44	40	49	40	46	49

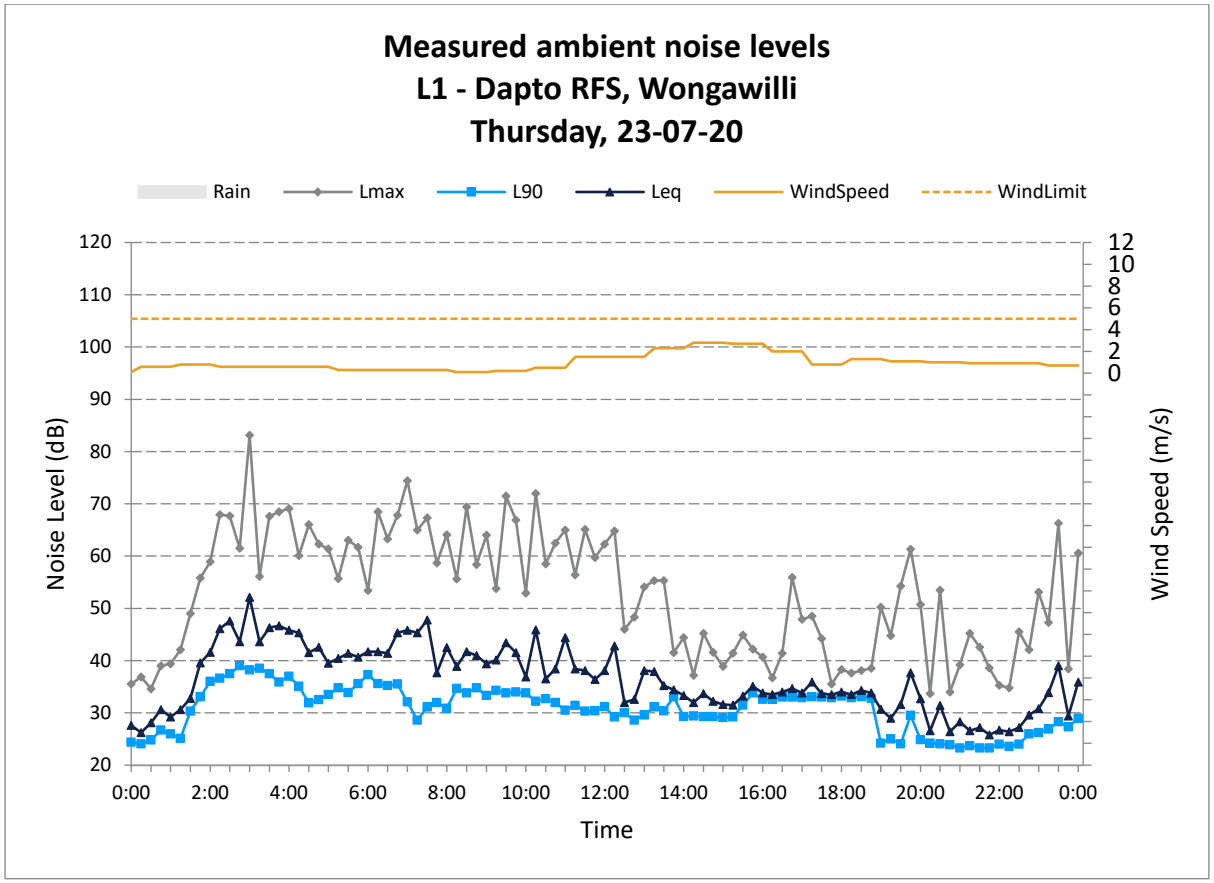
Notes:

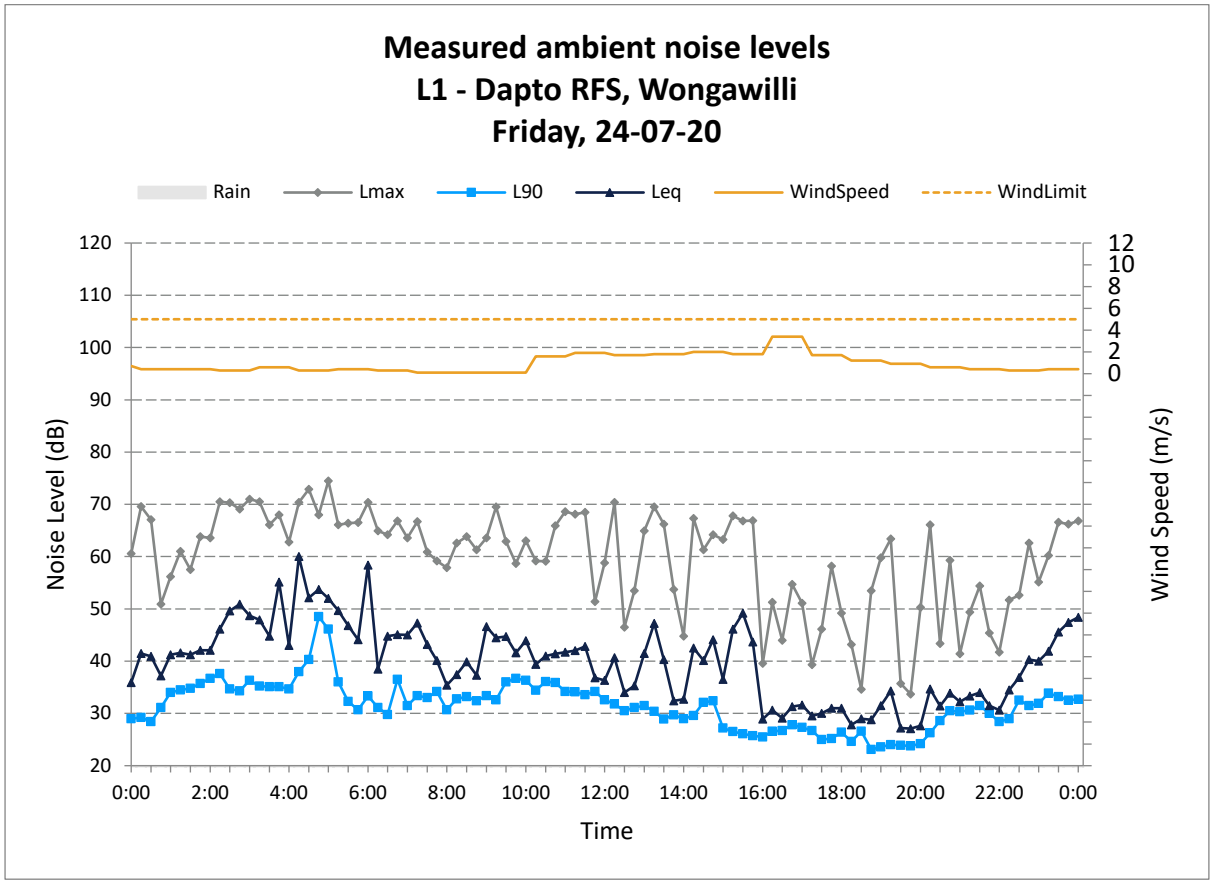
0 indicates periods with too few valid samples due to weather or logger operation

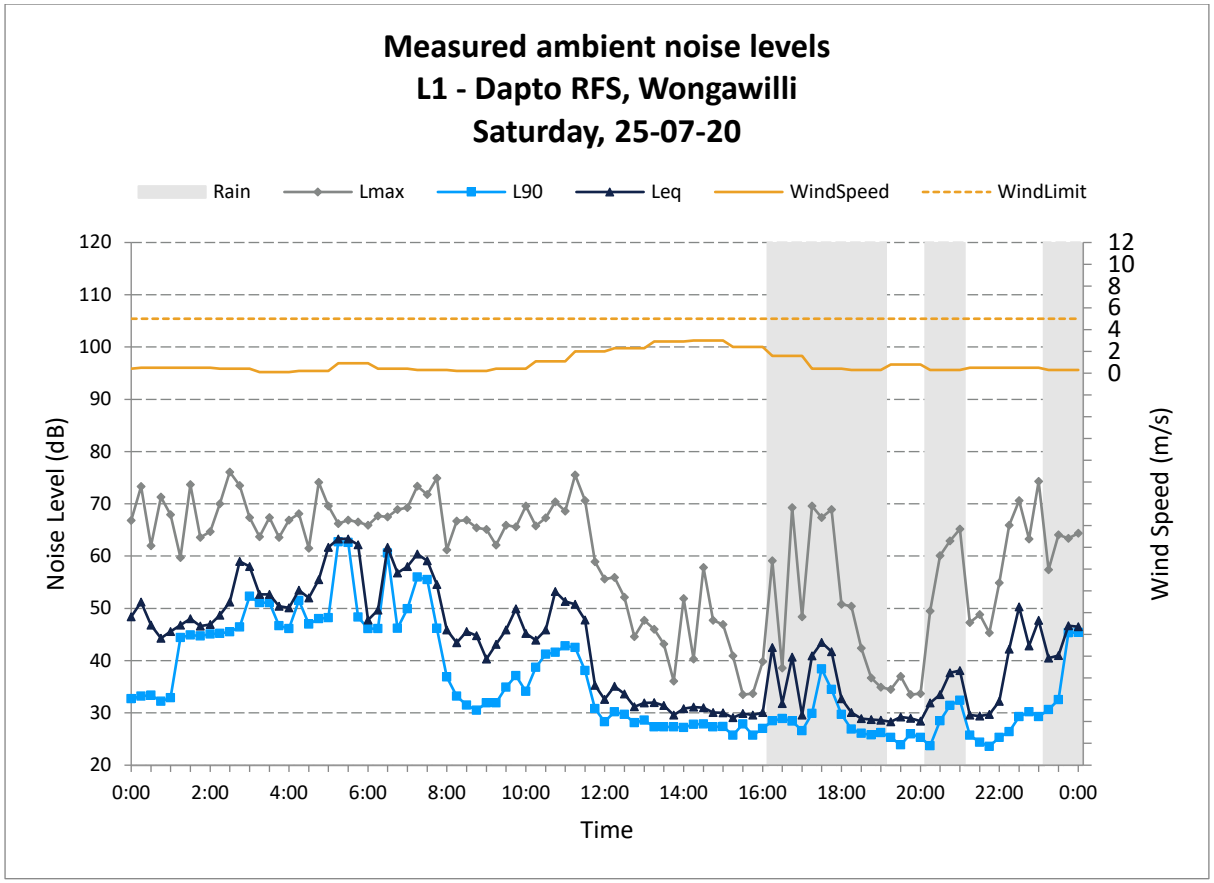
Leq24hr encompasses the period 7am to 7am

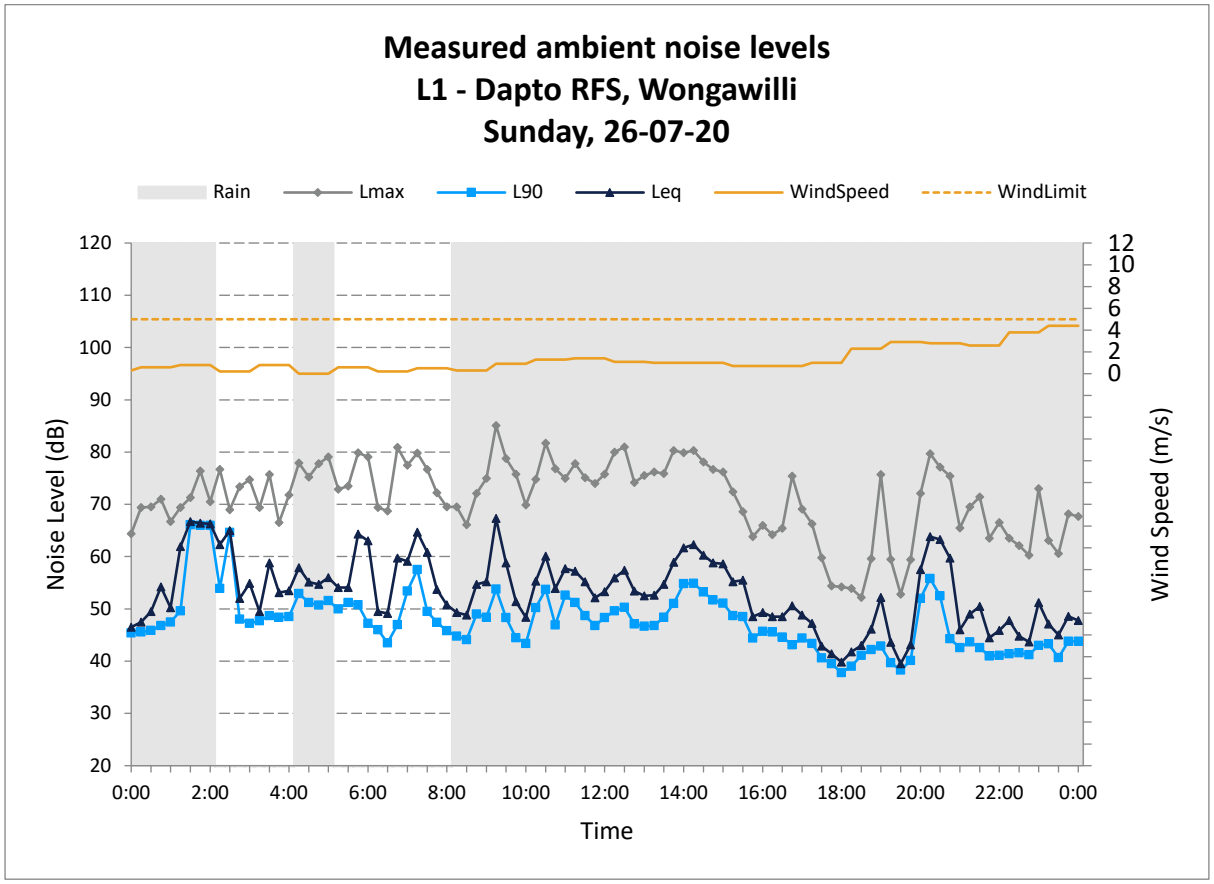

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Tuesday, 21-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

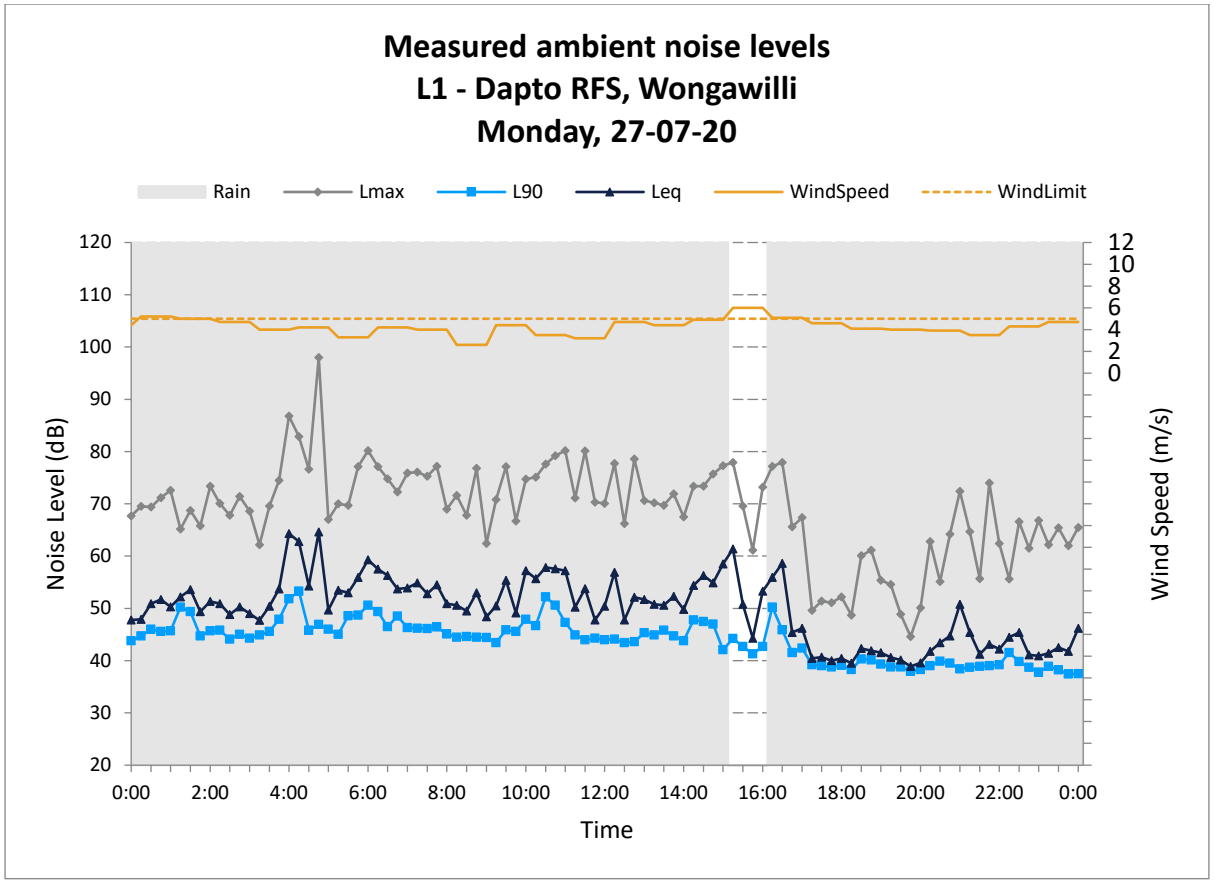

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Wednesday, 22-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

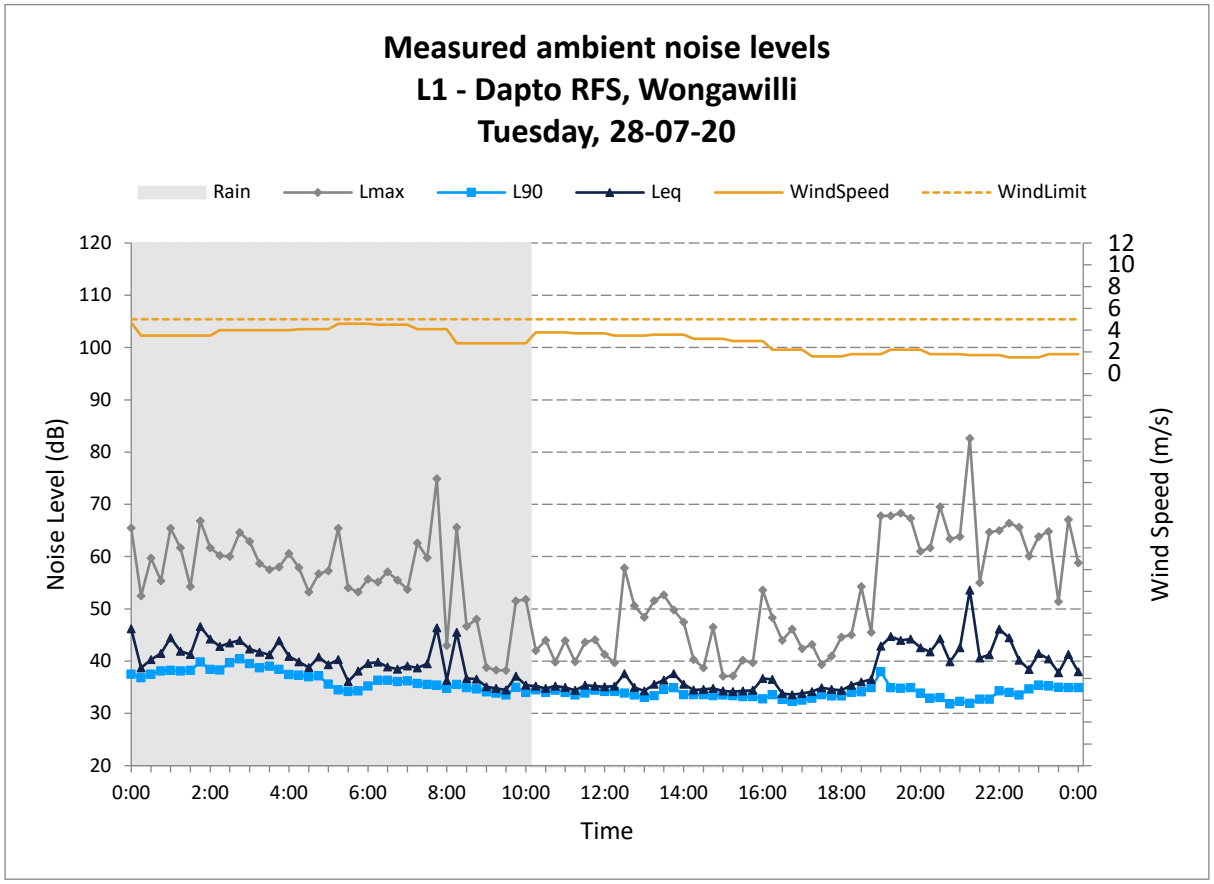

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Thursday, 23-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

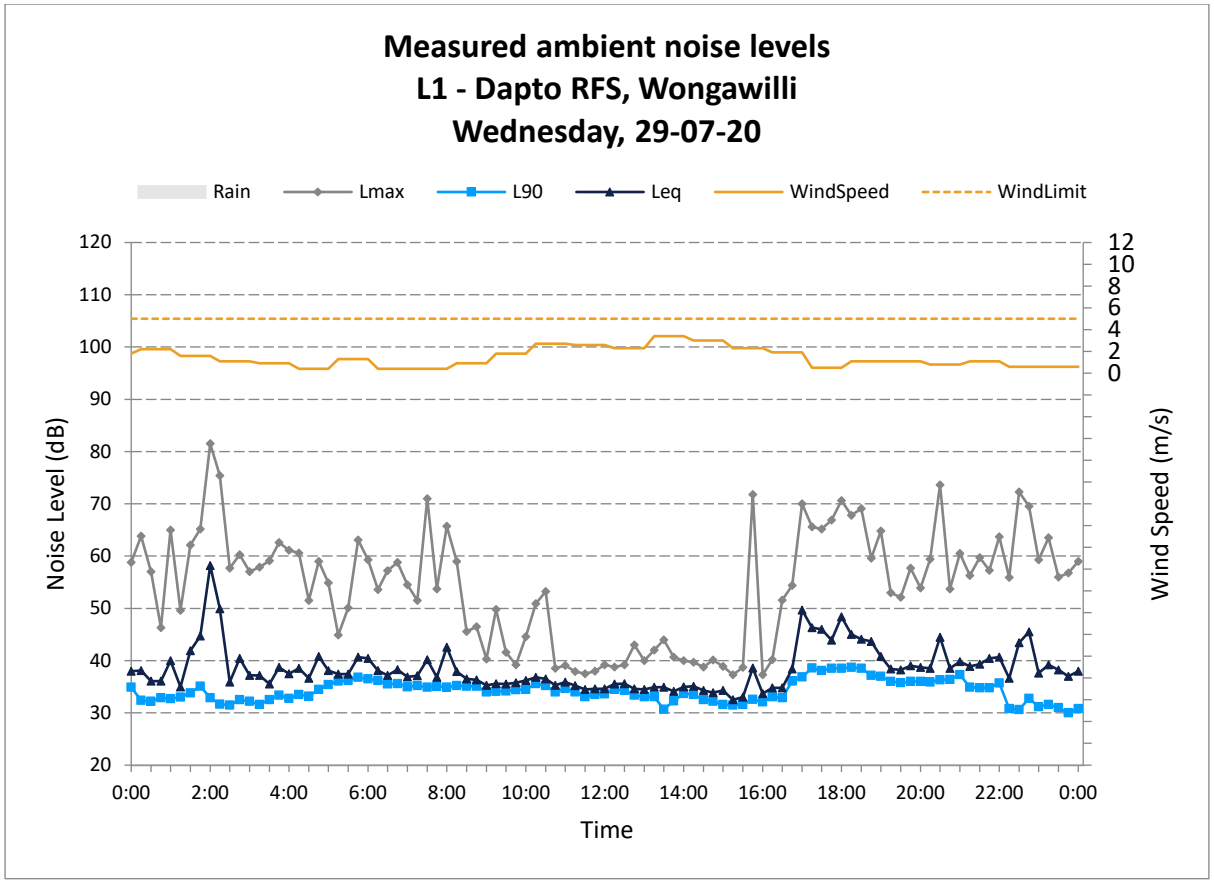

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Friday, 24-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

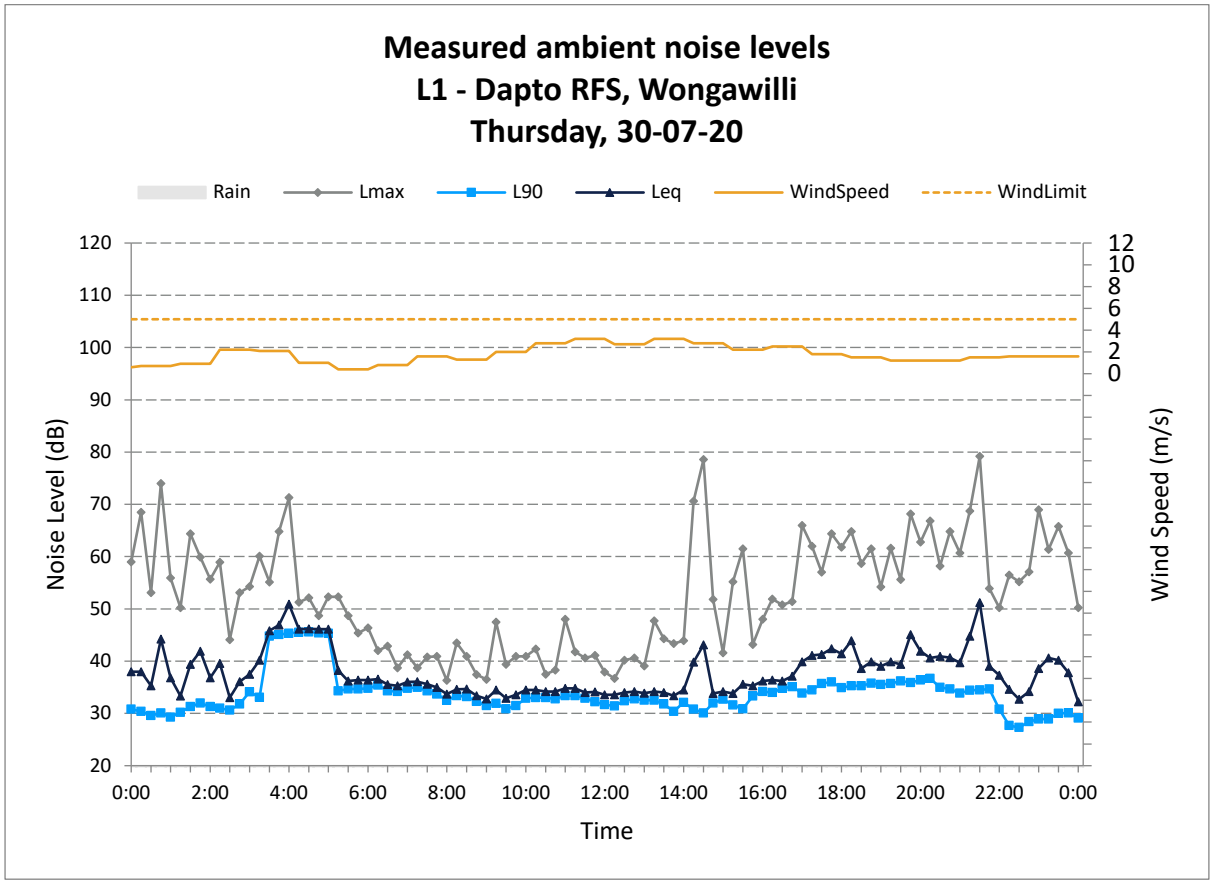

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Saturday, 25-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

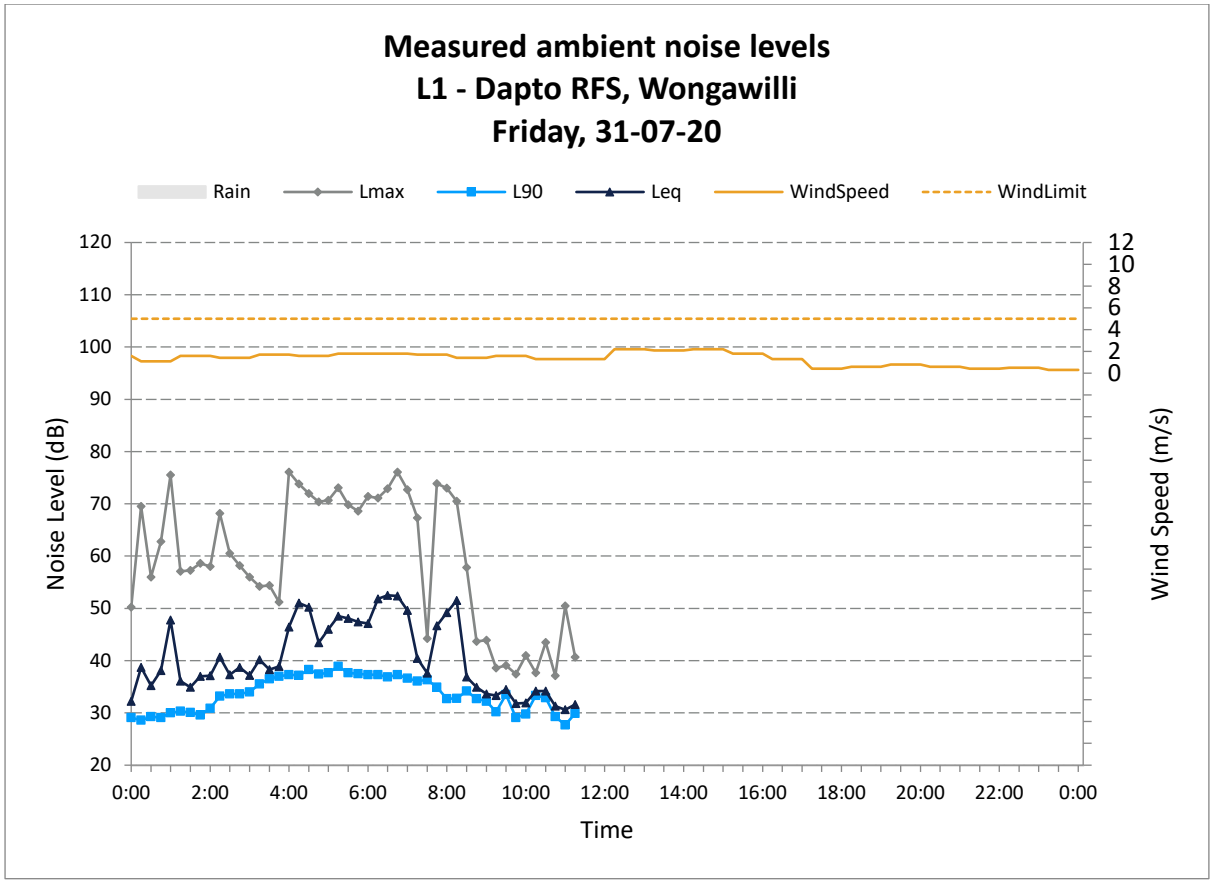

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Sunday, 26-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Monday, 27-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Tuesday, 28-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Wednesday, 29-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Thursday, 30-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

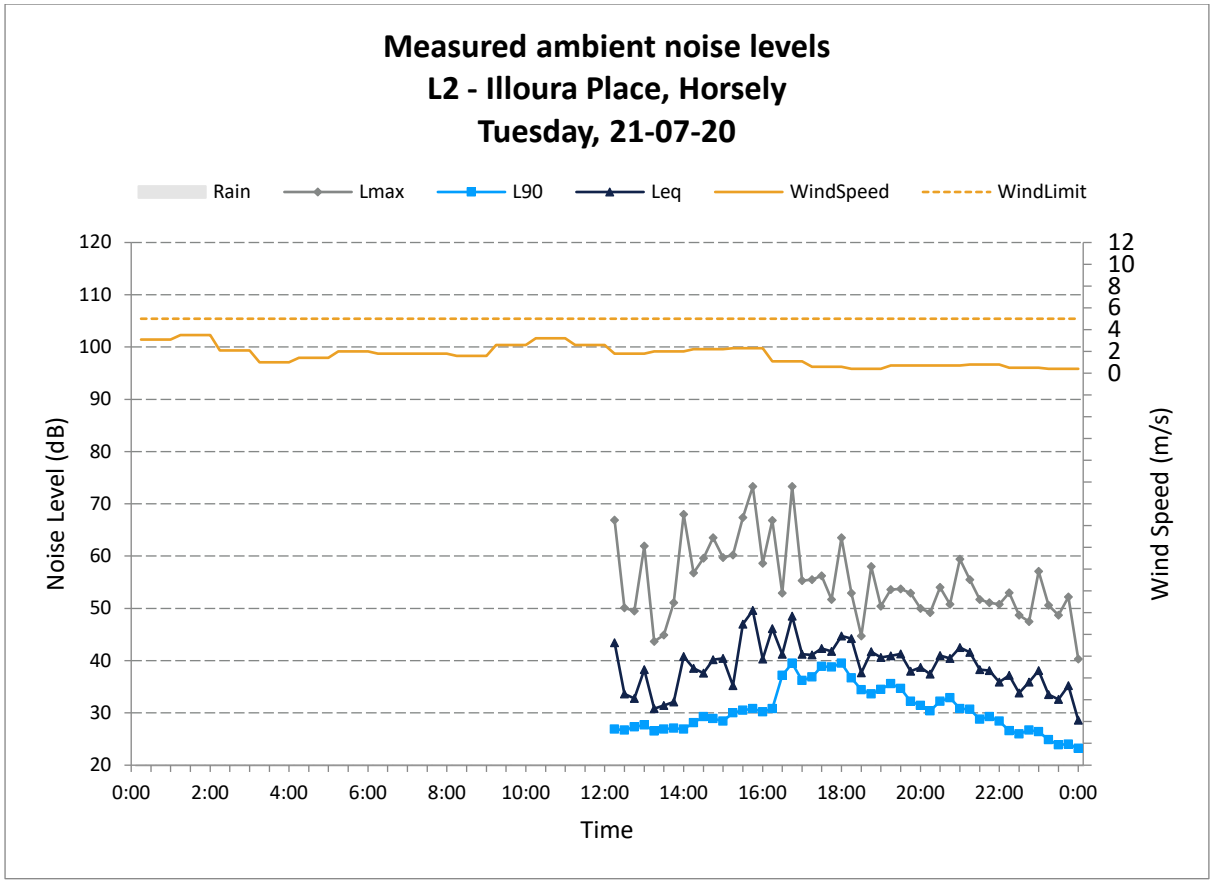

Measured ambient noise levels
L1 - Dapto RFS, Wongawilli
Friday, 31-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

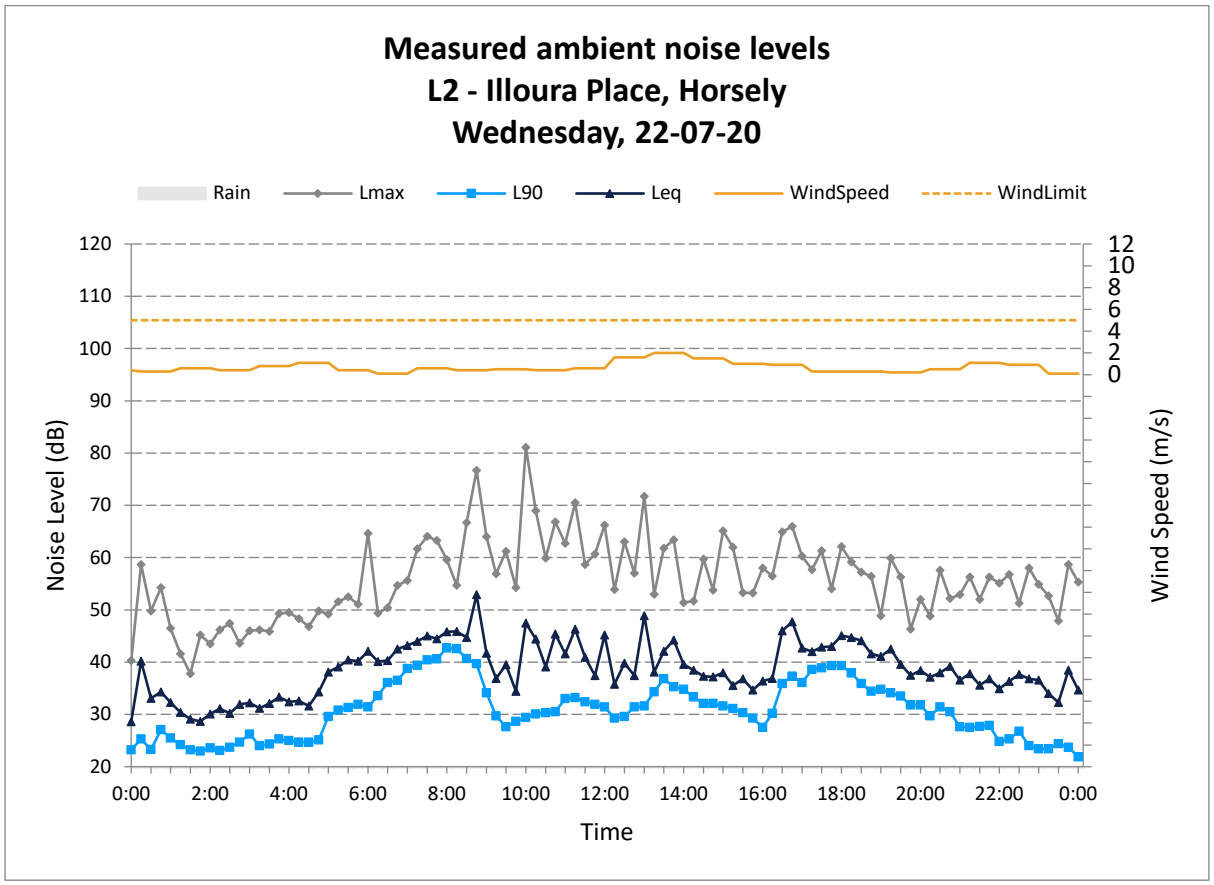
Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11\ hour}$ Day	$L_{Aeq,4\ hour}$ Evening	$L_{Aeq,9\ hour}$ Night	$L_{Aeq,15\ hour}$ Day	$L_{Aeq,24\ hour}$ Day	$L_{Aeq,8\ hour}$ Night
Tuesday, 21-07-20	0	29	23	0	40	37	0	0	36
Wednesday, 22-07-20	29	28	22	44	40	40	43	42	36
Thursday, 23-07-20	27	25	23	41	35	38	40	40	35
Friday, 24-07-20	32	29	25	44	42	35	44	42	34
Saturday, 25-07-20	30	0	0	43	0	0	0	0	0
Sunday, 26-07-20	0	0	0	0	0	0	0	0	0
Monday, 27-07-20	0	0	0	0	0	0	0	0	0
Tuesday, 28-07-20	0	0	0	0	0	0	0	0	0
Wednesday, 29-07-20	0	0	0	0	0	0	0	0	0
Thursday, 30-07-20	0	0	0	0	0	0	0	0	0
Friday, 31-07-20	0	0	0	0	0	0	0	0	0
Saturday, 01-08-20	0	0	0	0	0	0	0	0	0
Sunday, 02-08-20	0	0	0	0	0	0	0	0	0
Summary Values	30	28	23	43	40	38	43	41	35

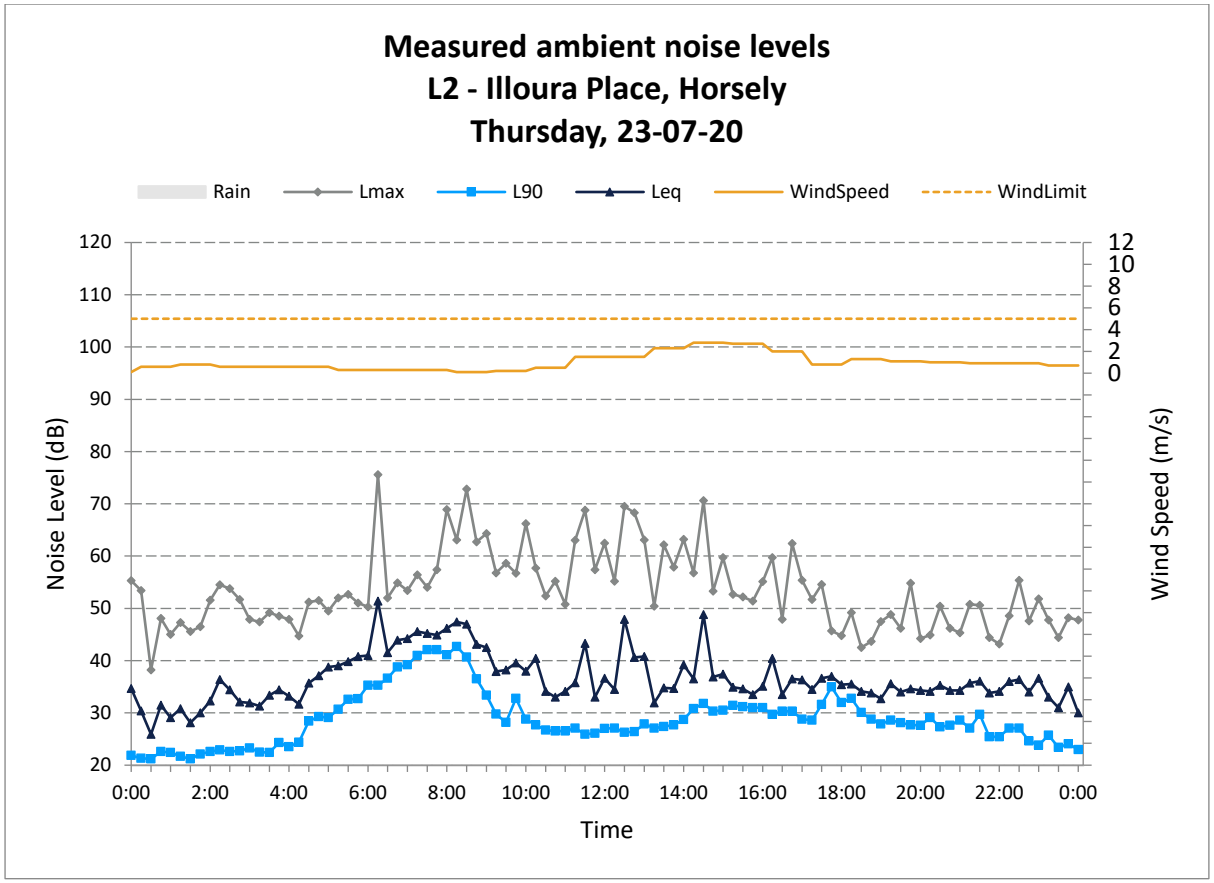
Notes:

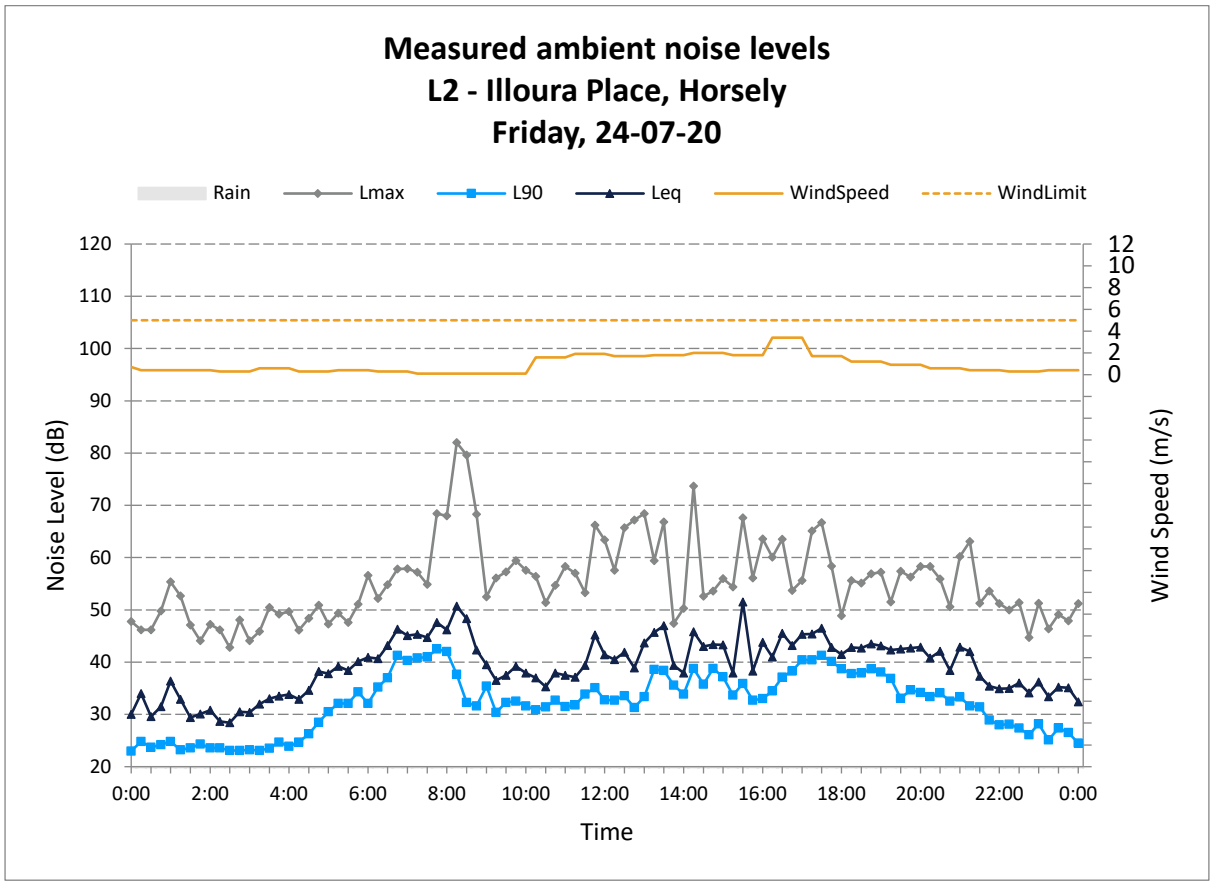
0 indicates periods with too few valid samples due to weather or logger operation

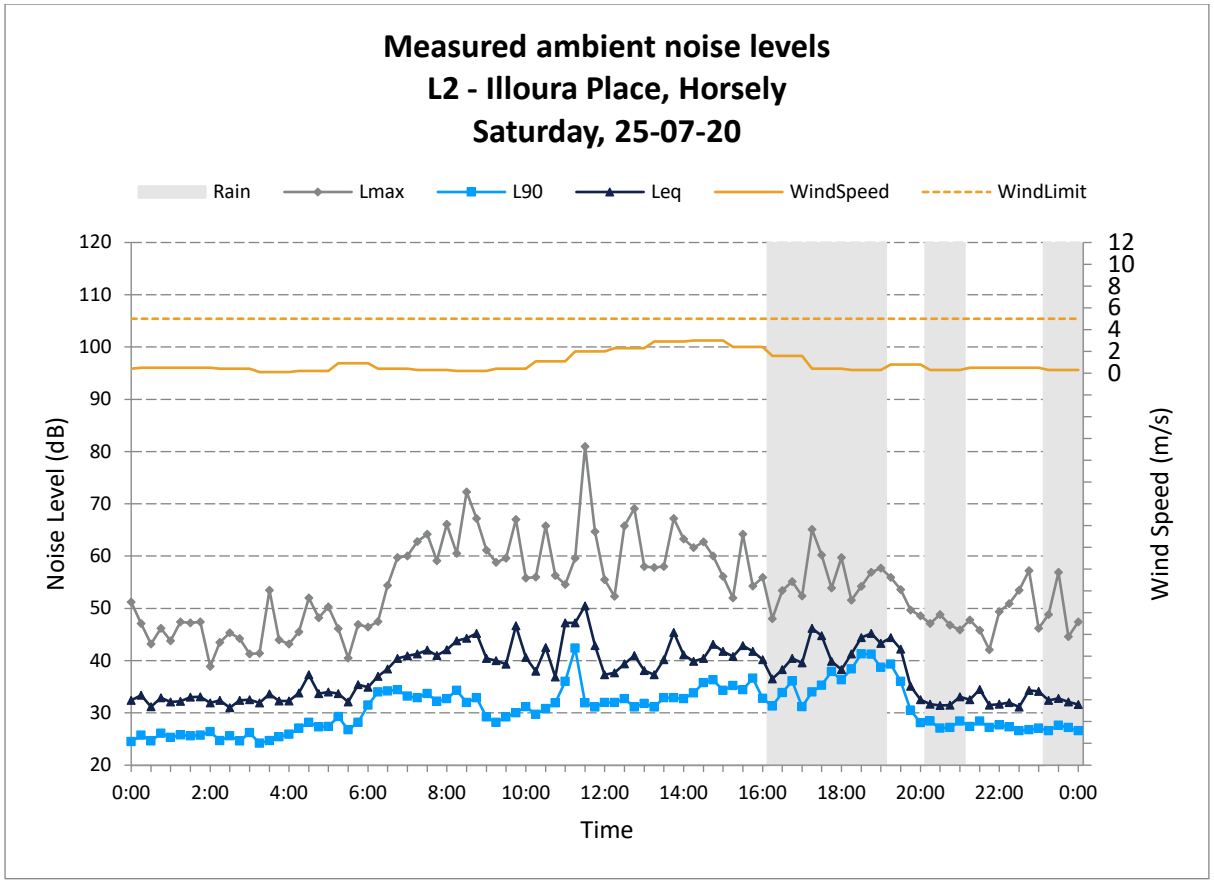
Leq24hr encompasses the period 7am to 7am

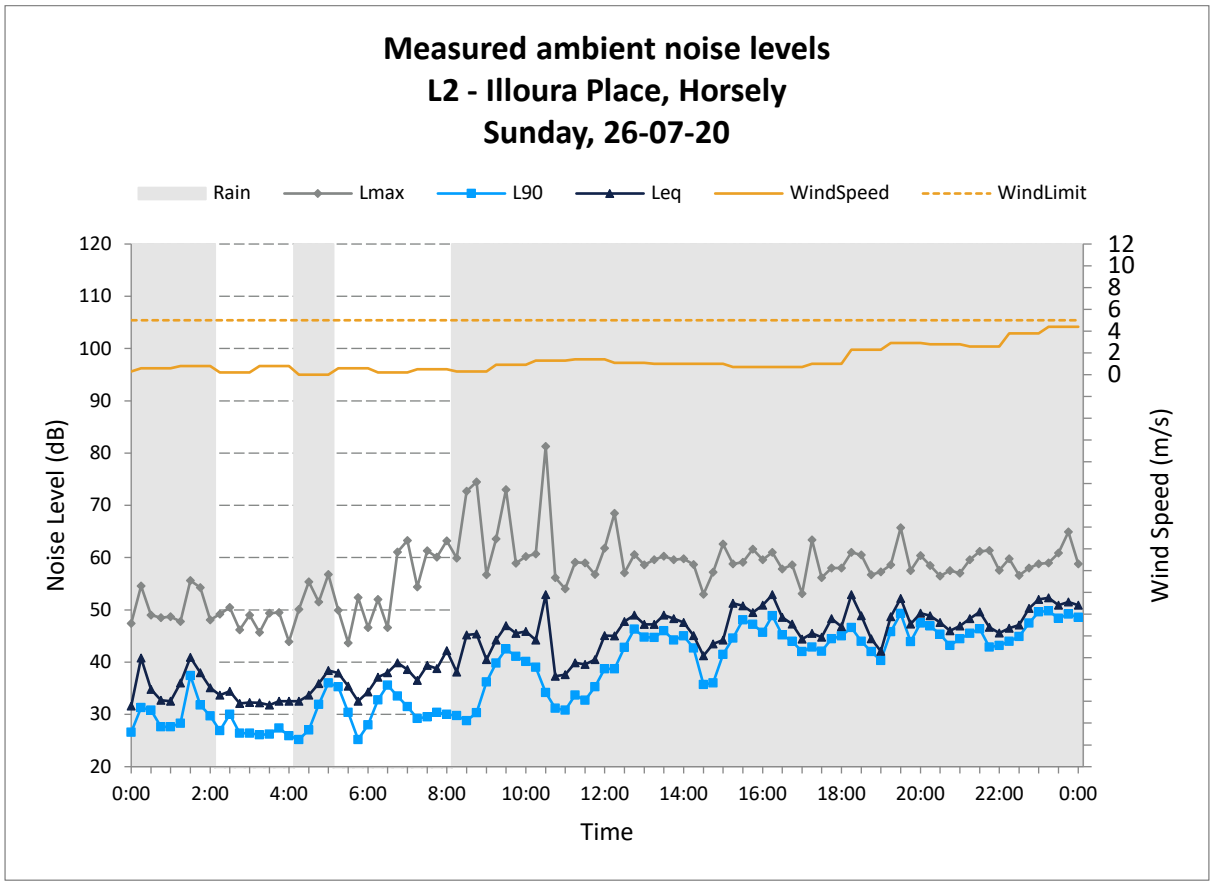

Measured ambient noise levels
L2 - Illoura Place, Horsely
Tuesday, 21-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

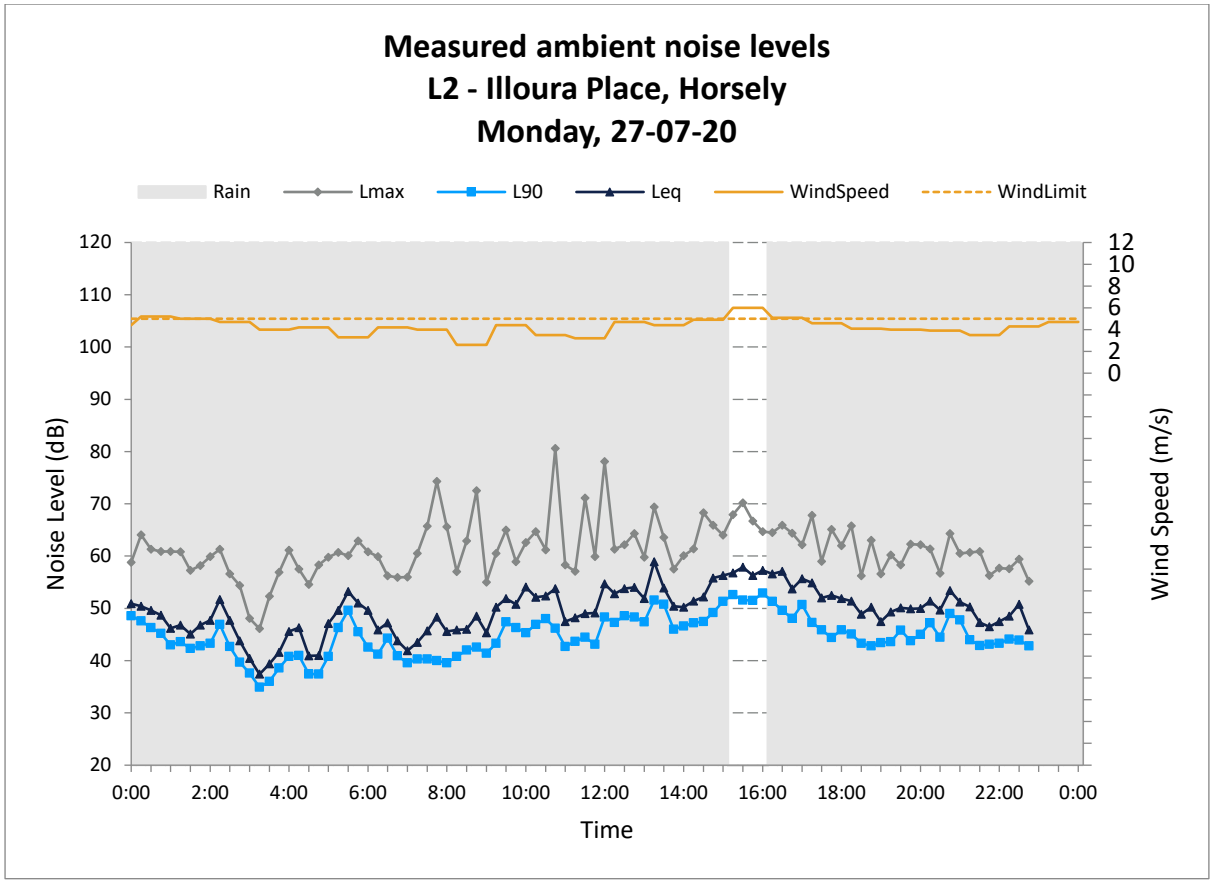

Measured ambient noise levels
L2 - Illoura Place, Horsely
Wednesday, 22-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L2 - Illoura Place, Horsely
Thursday, 23-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L2 - Illoura Place, Horsely
Friday, 24-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L2 - Illoura Place, Horsely
Saturday, 25-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L2 - Illoura Place, Horsely
Sunday, 26-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

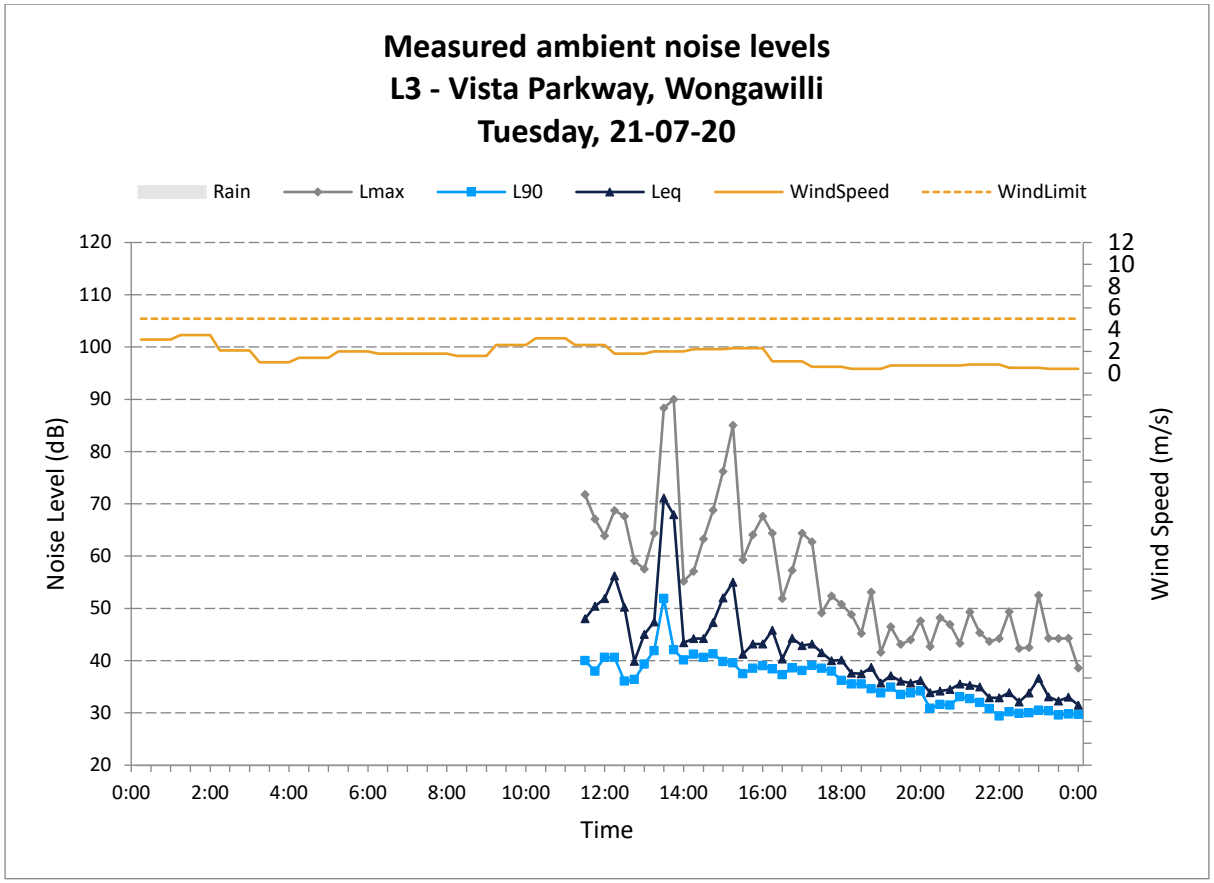

Measured ambient noise levels
L2 - Illoura Place, Horsely
Monday, 27-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

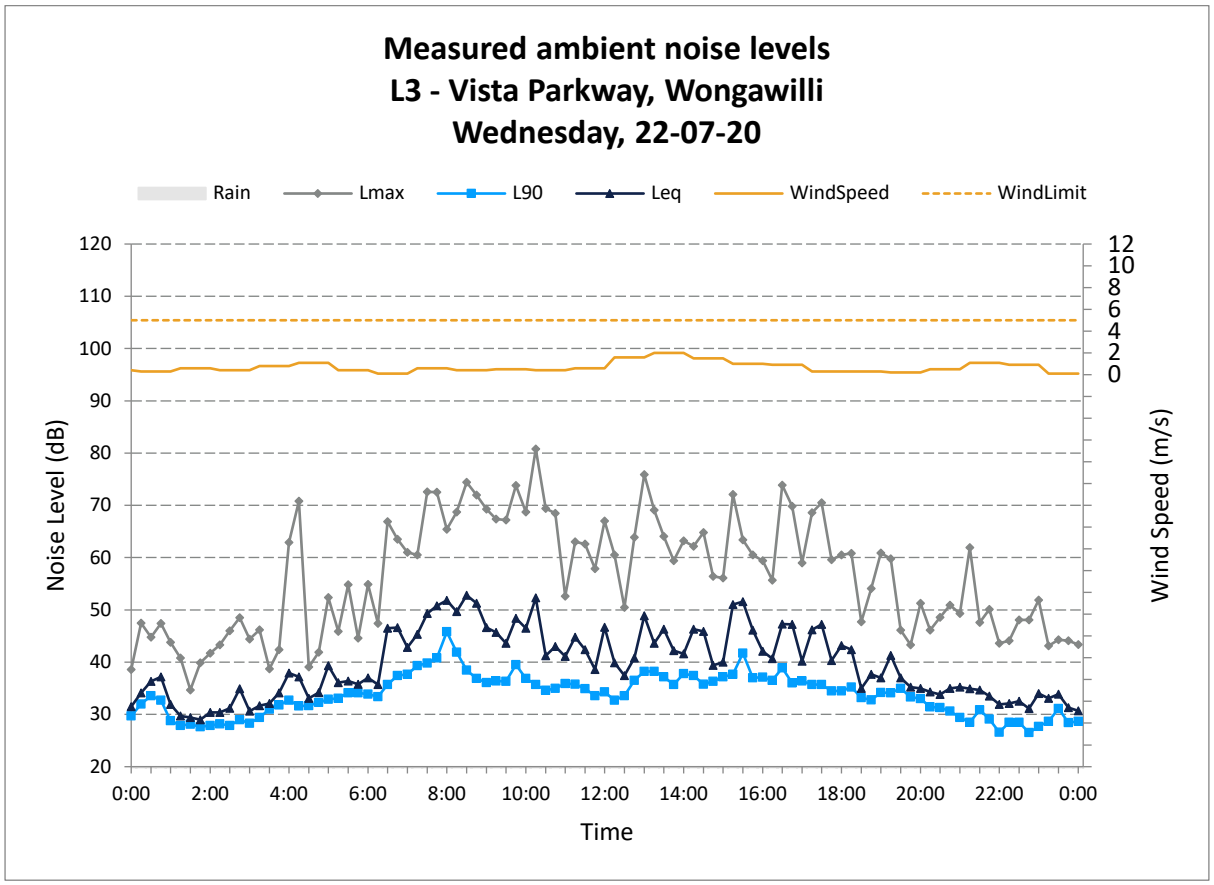
Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11\ hour}$ Day	$L_{Aeq,4\ hour}$ Evening	$L_{Aeq,9\ hour}$ Night	$L_{Aeq,15\ hour}$ Day	$L_{Aeq,24\ hour}$ Day	$L_{Aeq,8\ hour}$ Night
Tuesday, 21-07-20	0	31	28	0	36	38	0	0	35
Wednesday, 22-07-20	35	29	27	47	37	38	46	44	34
Thursday, 23-07-20	37	28	27	49	35	37	48	46	34
Friday, 24-07-20	35	30	25	46	36	37	45	44	35
Saturday, 25-07-20	36	0	0	45	0	0	0	0	0
Sunday, 26-07-20	0	0	0	0	0	0	0	0	0
Monday, 27-07-20	0	0	0	0	0	0	0	0	0
Tuesday, 28-07-20	0	32	30	0	39	36	0	43	35
Wednesday, 29-07-20	35	33	29	46	38	38	45	43	35
Thursday, 30-07-20	36	31	29	46	37	36	45	43	33
Friday, 31-07-20	36	35	29	48	40	39	47	45	35
Saturday, 01-08-20	33	30	26	46	35	35	45	43	32
Sunday, 02-08-20	0	0	0	0	0	0	0	0	0
Summary Values	35	31	28	47	37	37	46	44	34

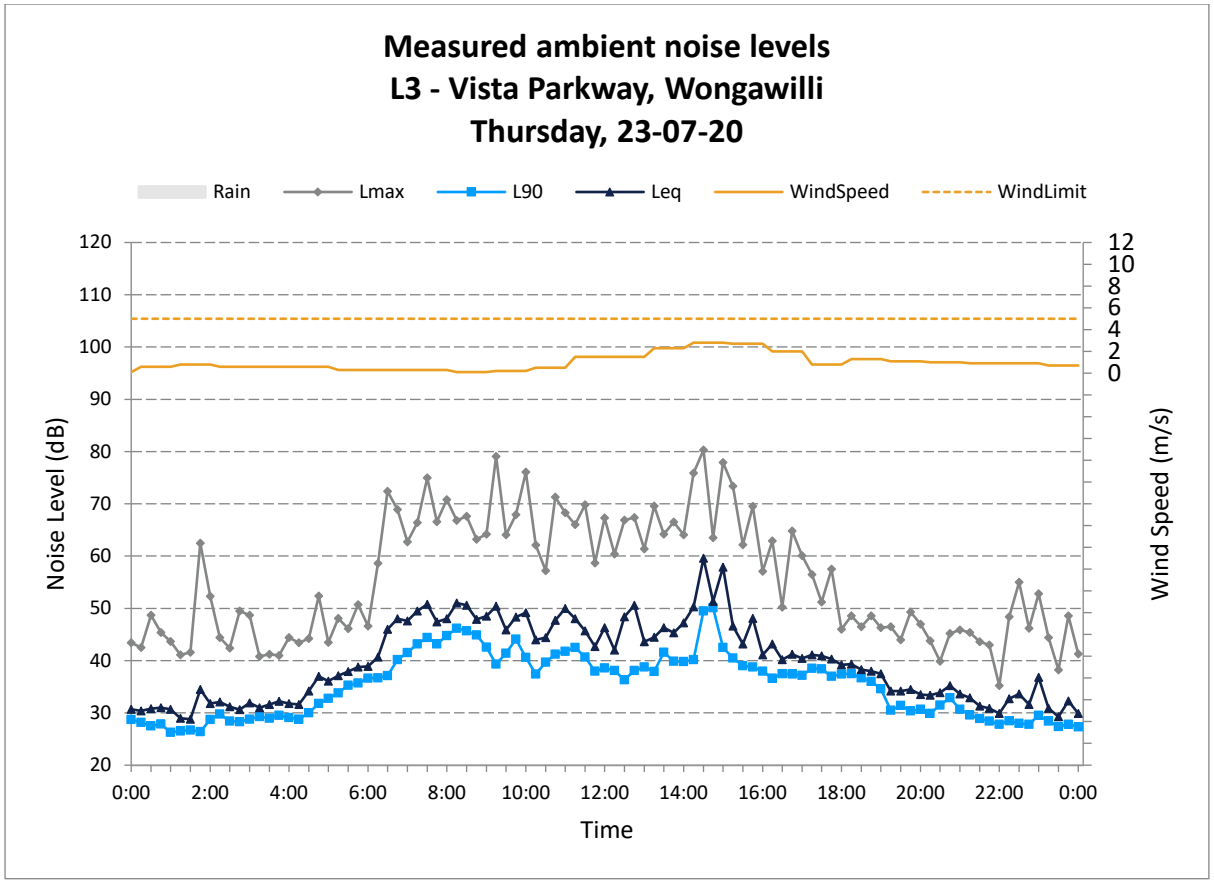
Notes:

0 indicates periods with too few valid samples due to weather or logger operation

Leq24hr encompasses the period 7am to 7am


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Tuesday, 21-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Wednesday, 22-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Thursday, 23-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
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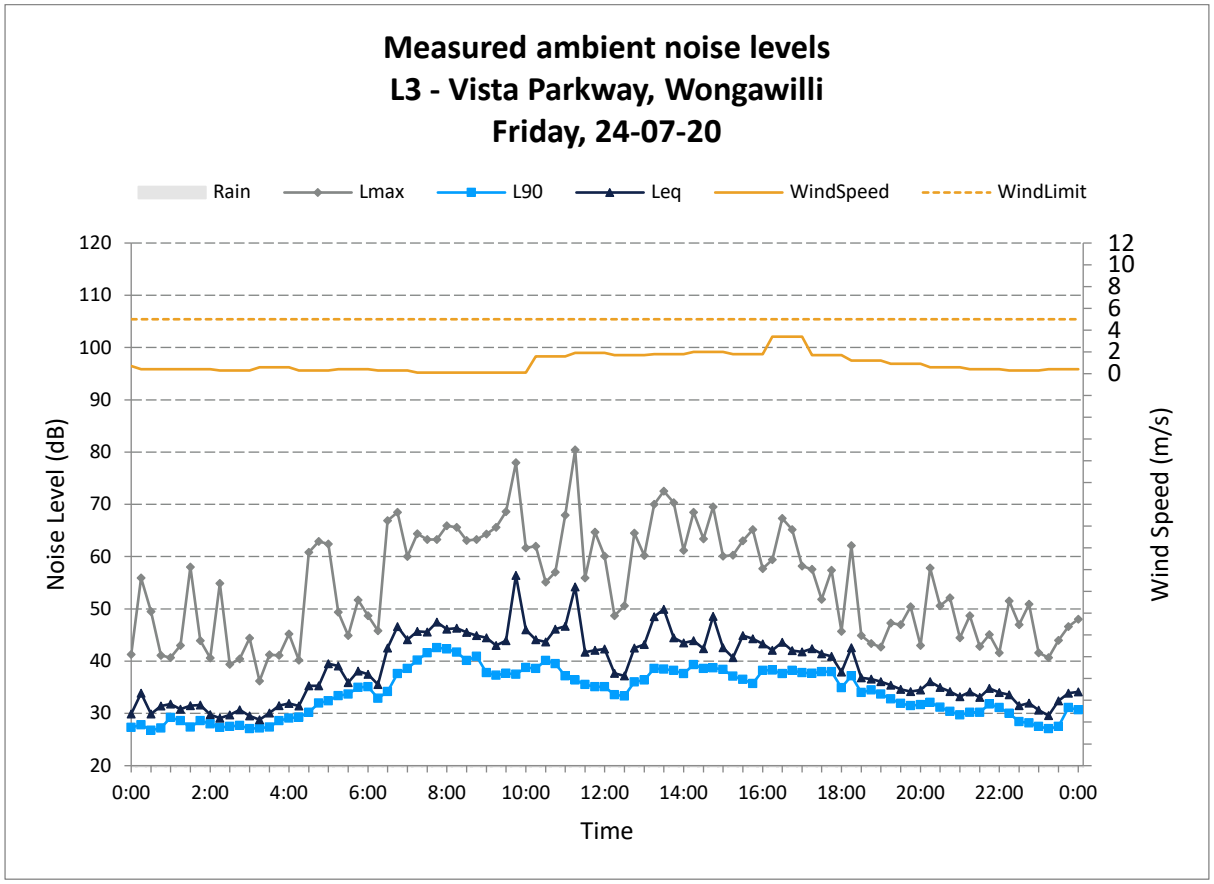
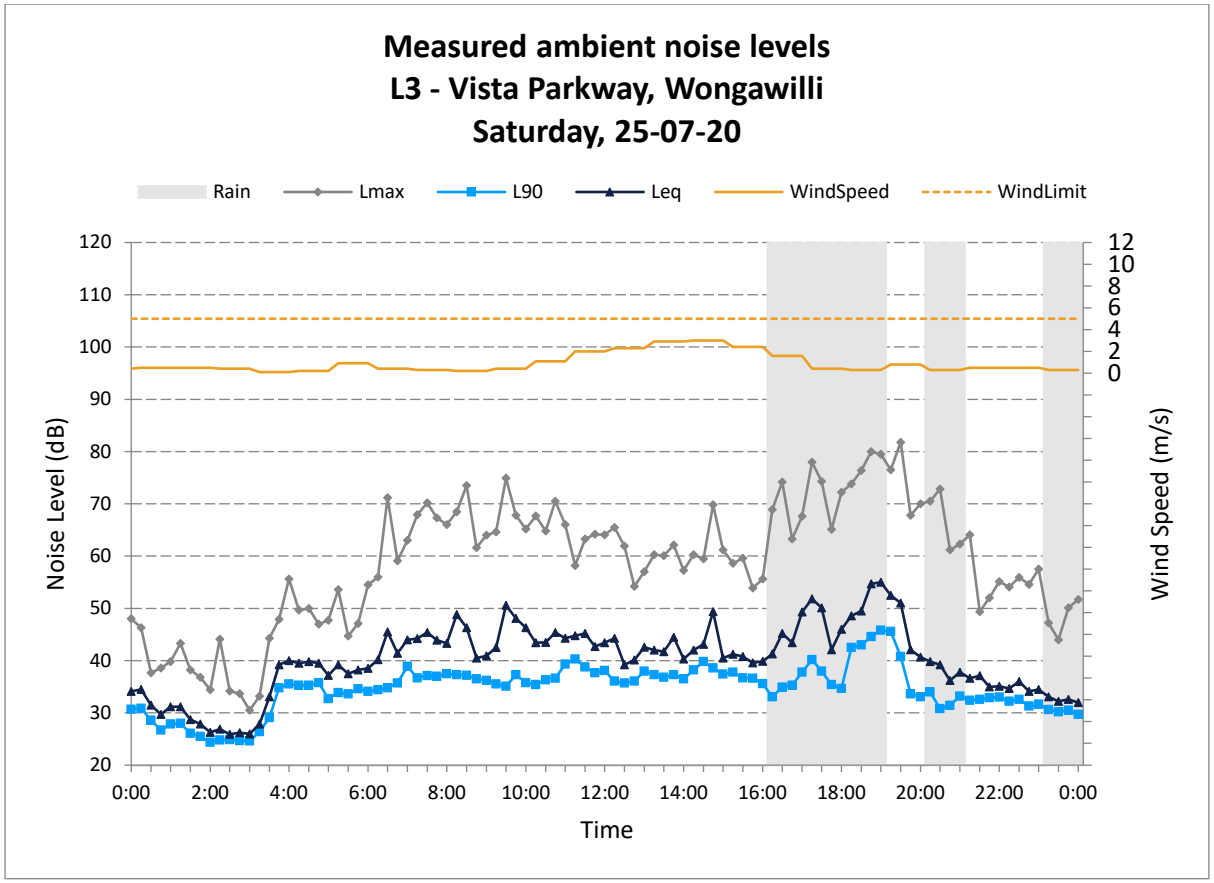
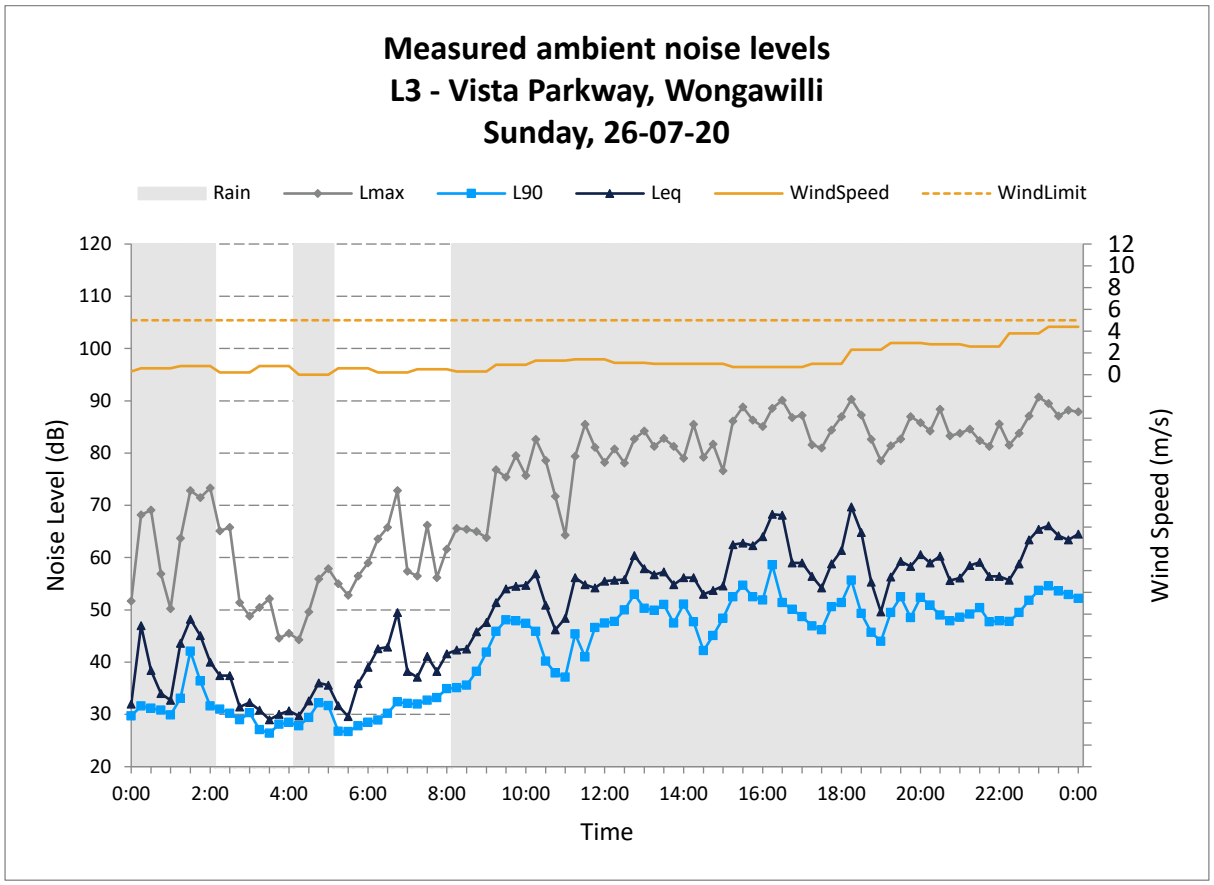
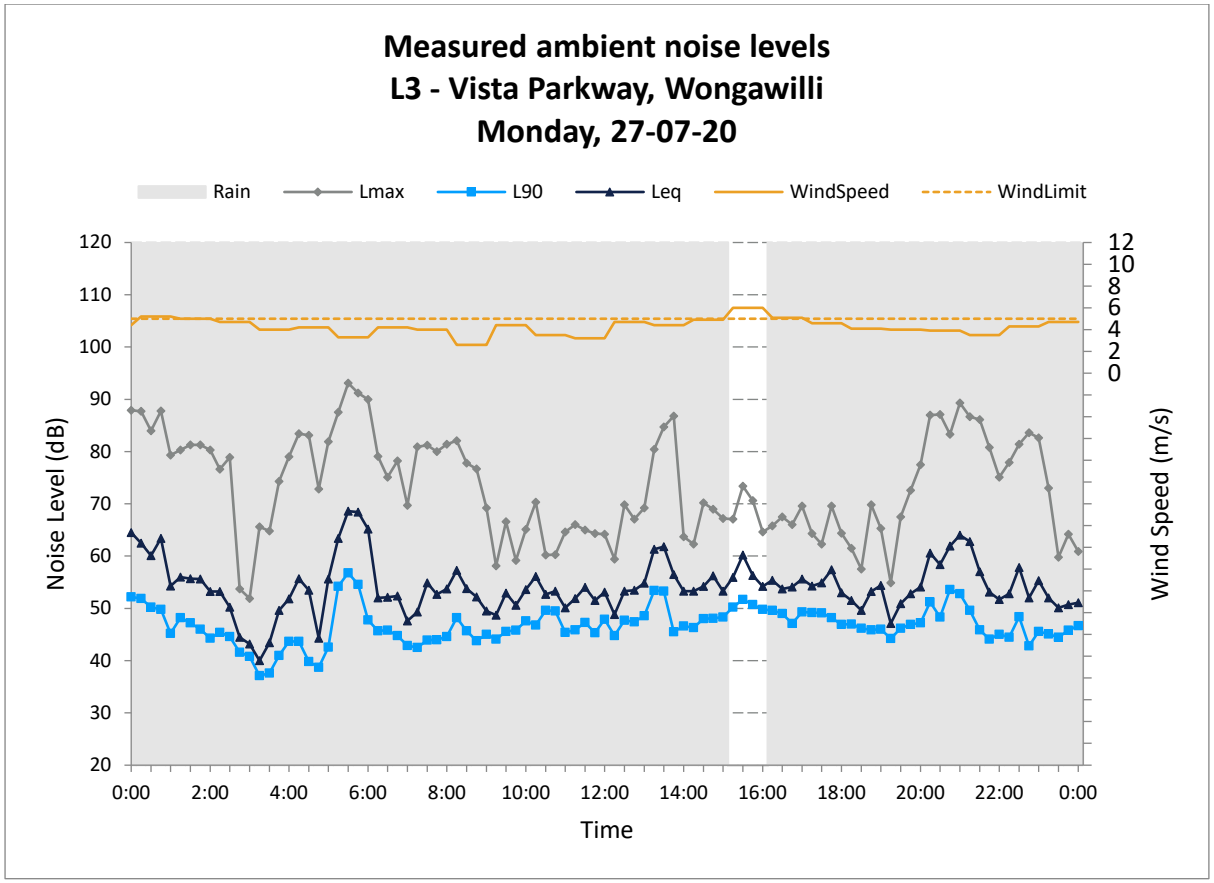
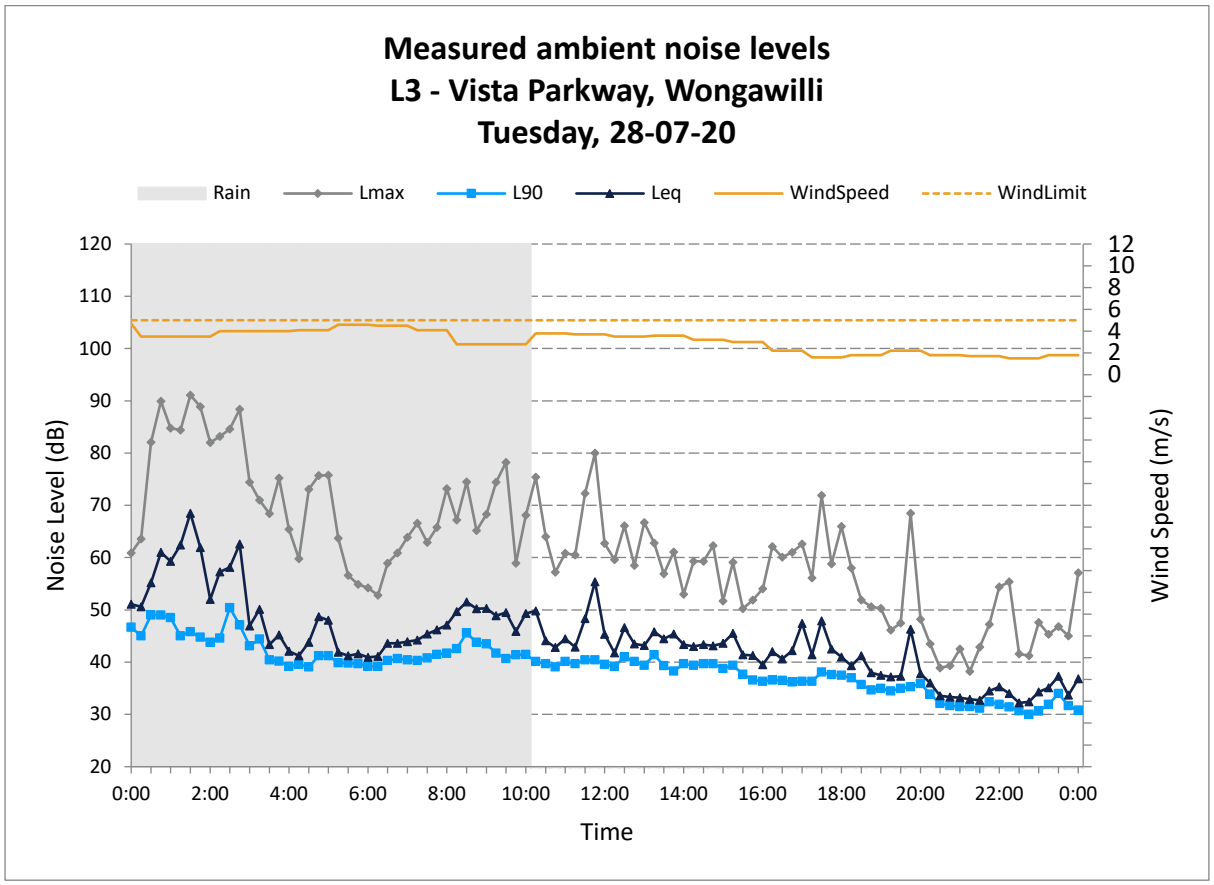
14:00
16:00
18:00
20:00
22:00
0:00

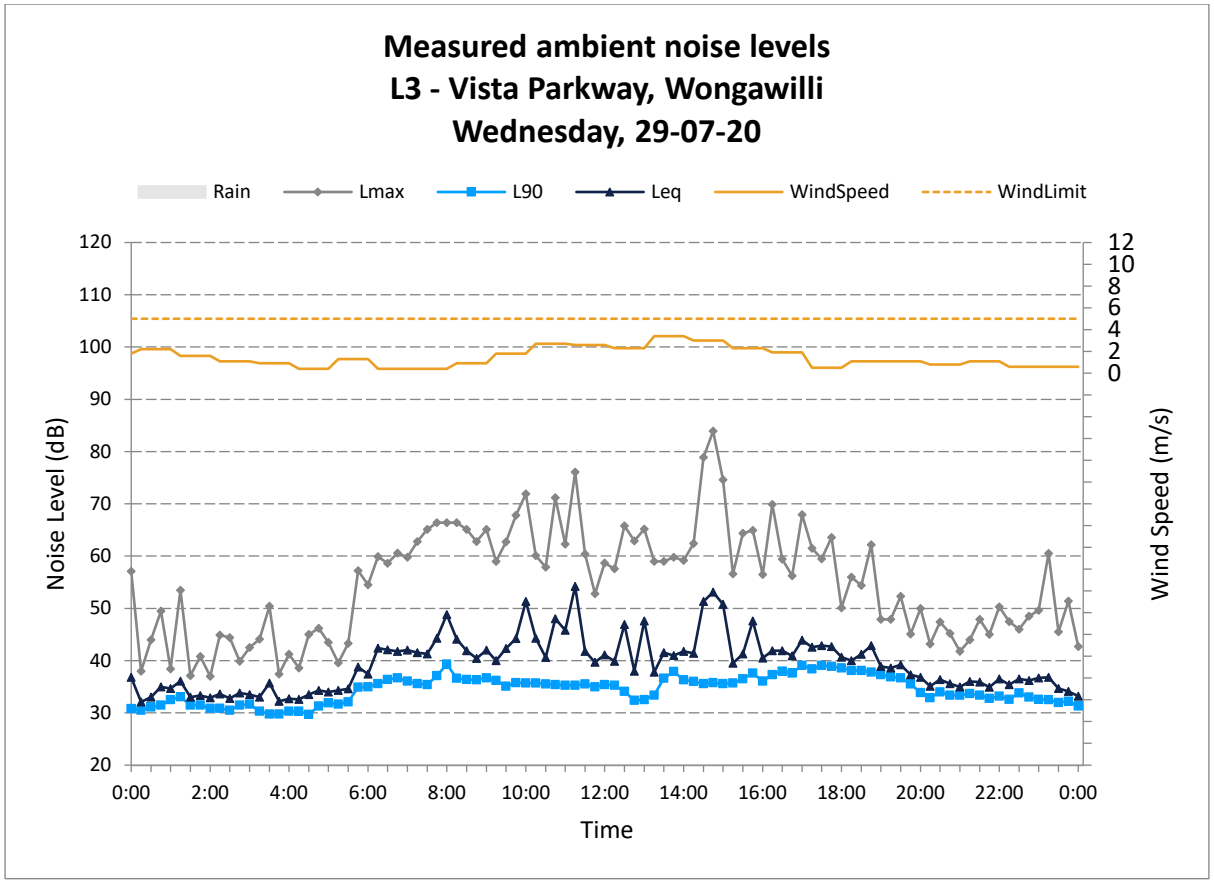

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Friday, 24-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

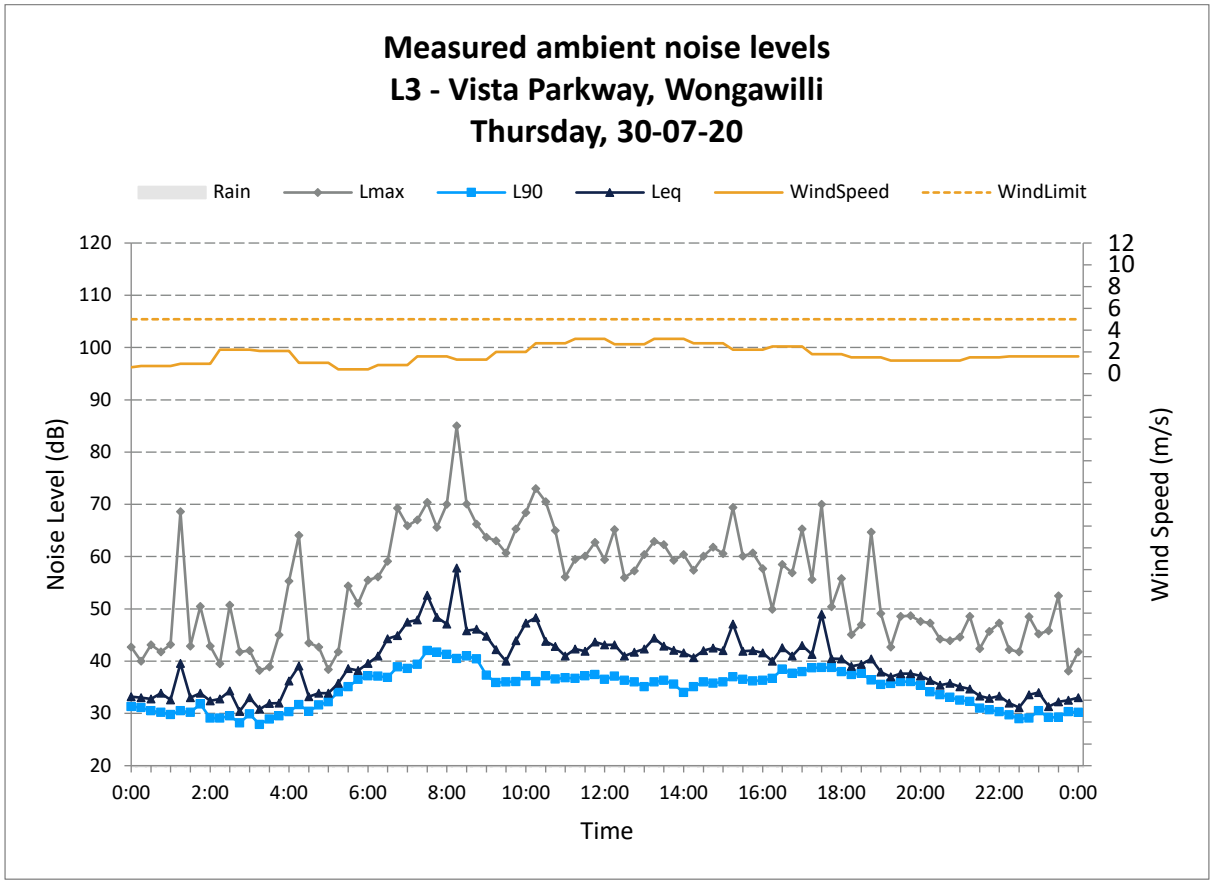

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Saturday, 25-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

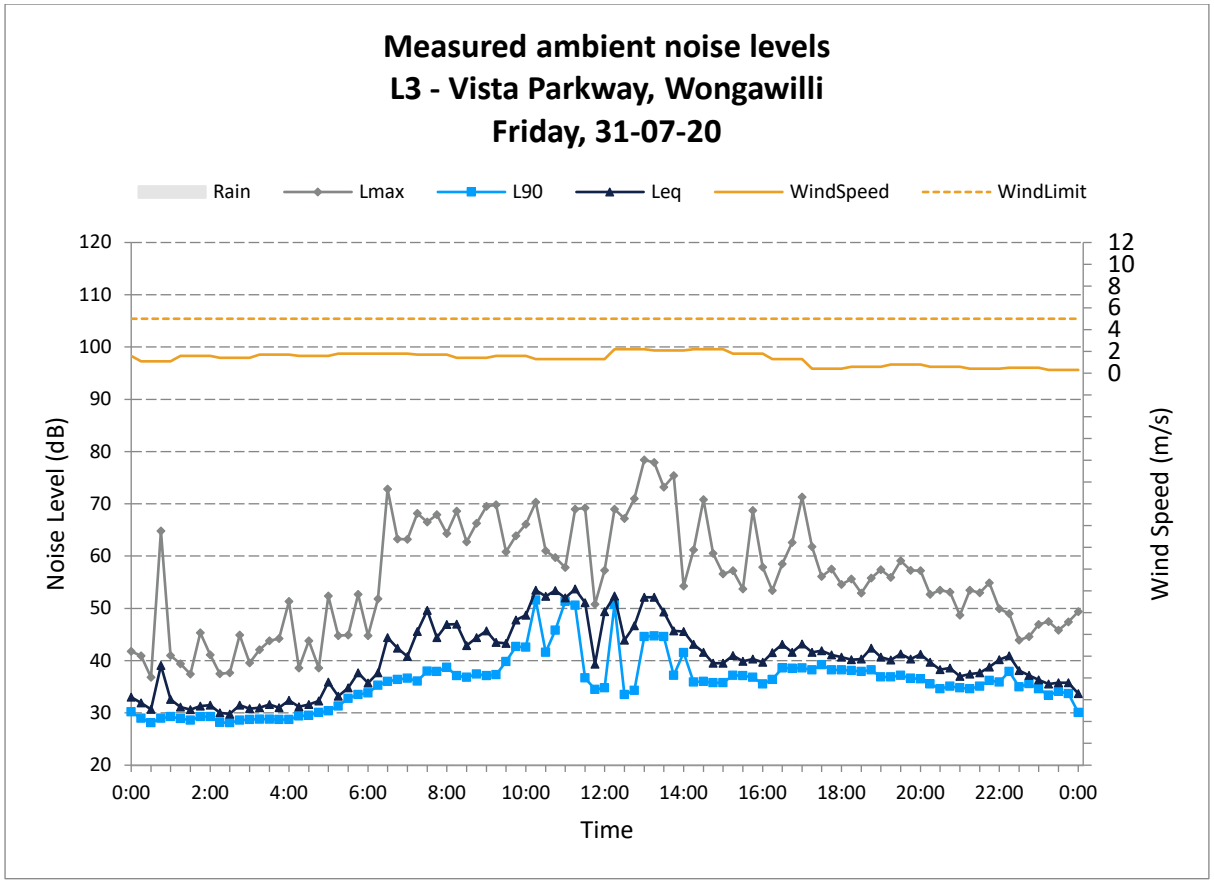

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Sunday, 26-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

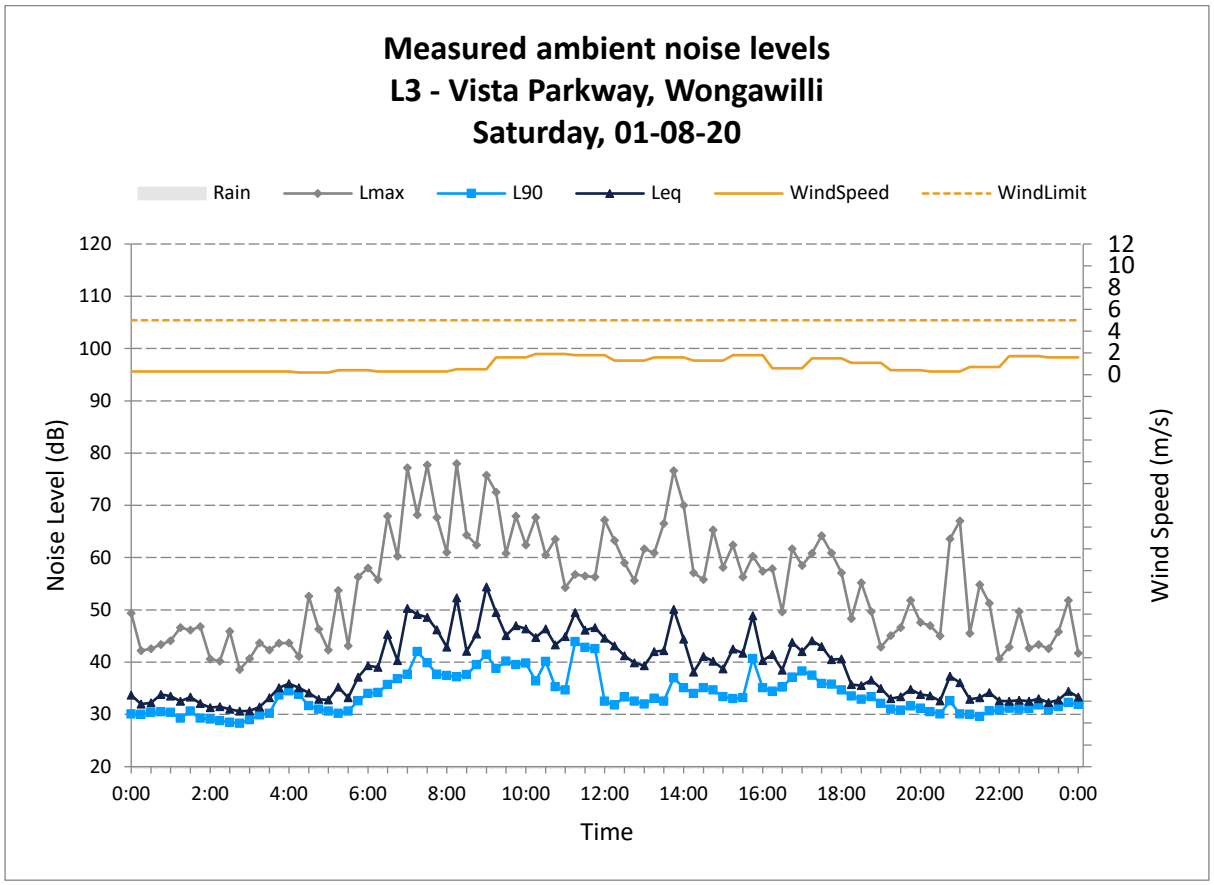

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Monday, 27-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

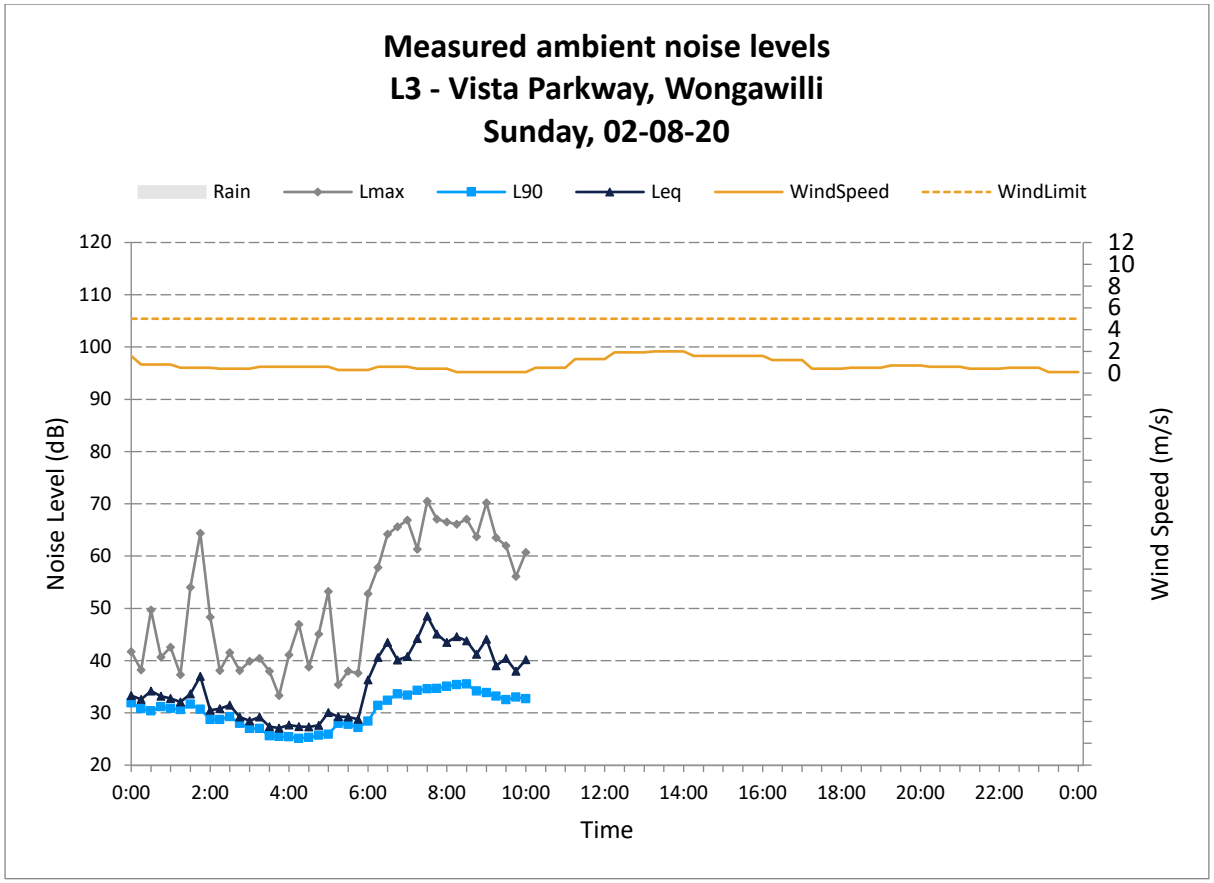

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Tuesday, 28-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Wednesday, 29-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Thursday, 30-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

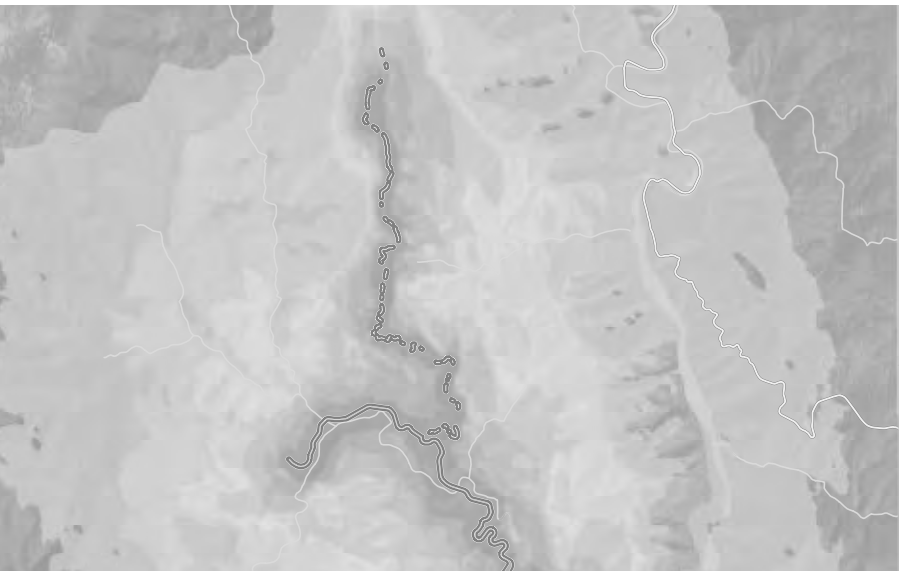

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Friday, 31-07-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Saturday, 01-08-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

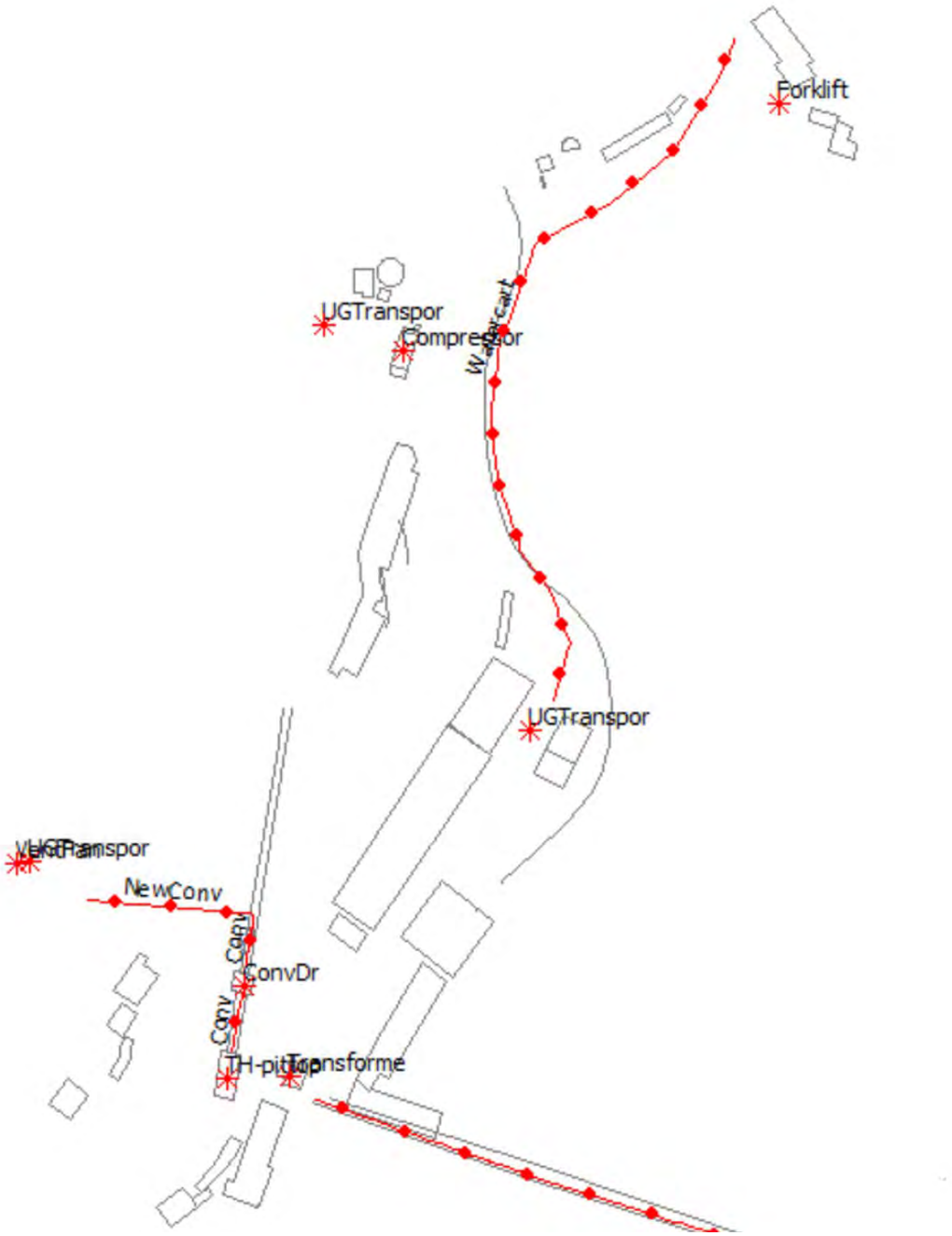

Measured ambient noise levels
L3 - Vista Parkway, Wongawilli
Sunday, 02-08-20
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
Wind Speed (m/s)
Time
120
110
100
90
80
70
60
50
40
30
20
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

Appendix C

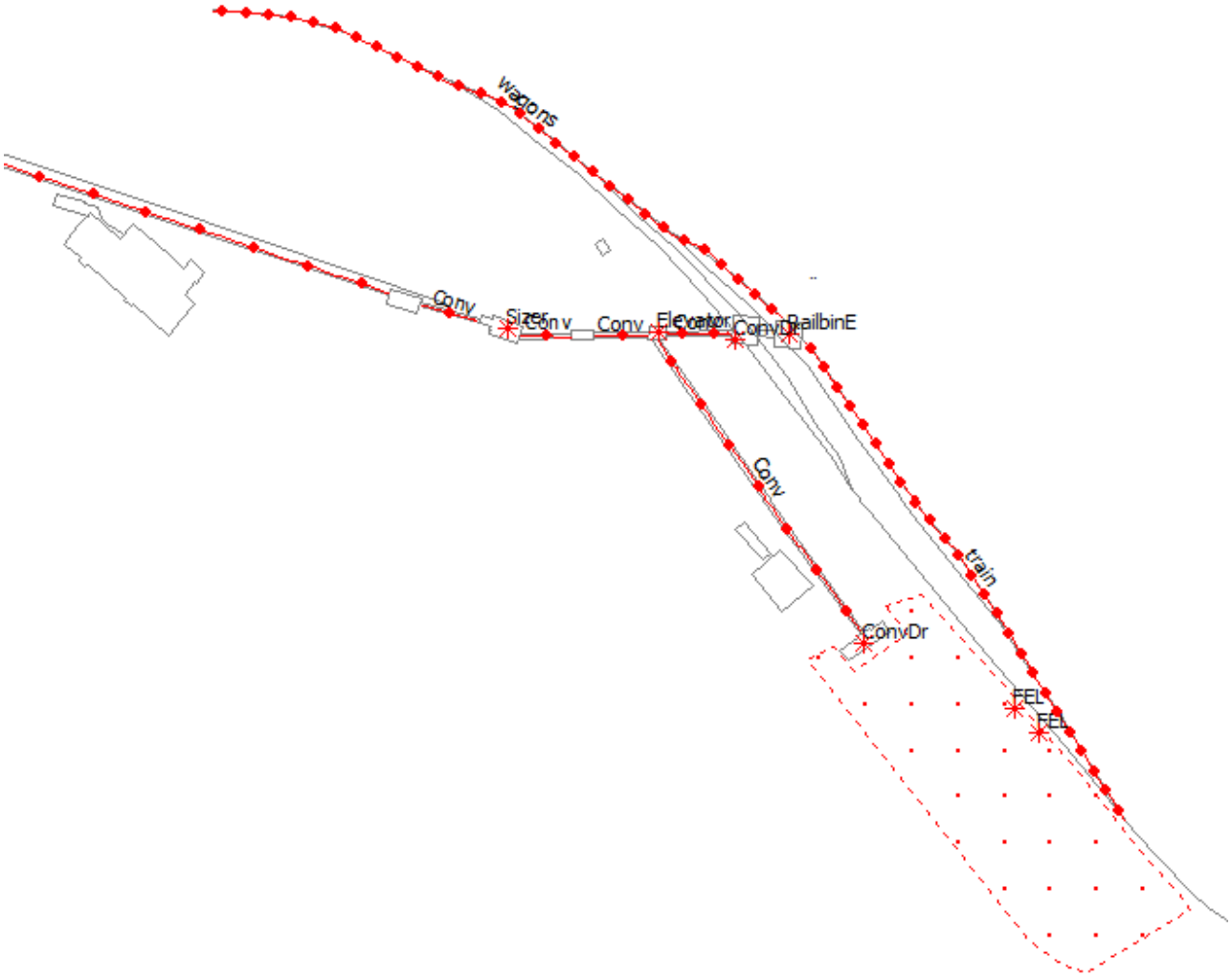
Modelled plant and equipment locations



C.1 Pit-top area sources

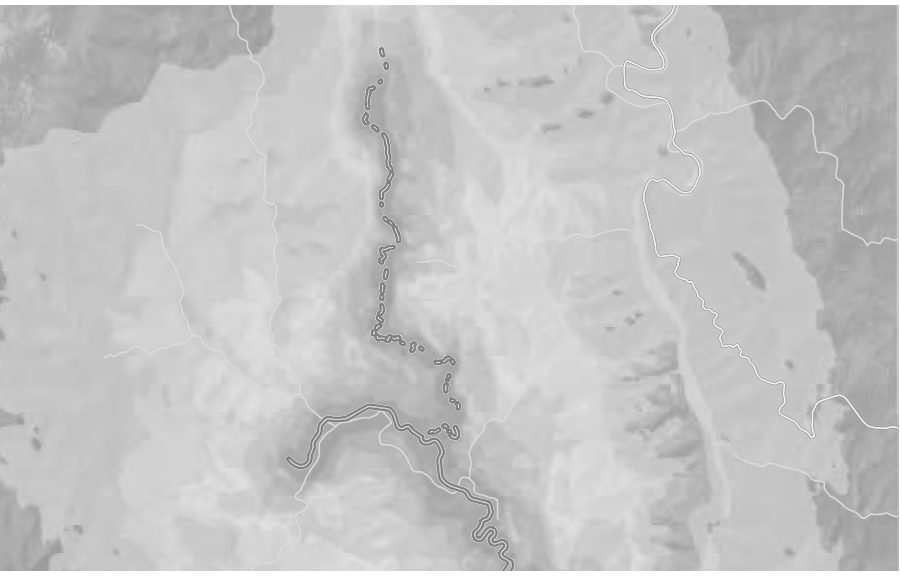


C.2 Loading and stockpile area sources



Appendix D

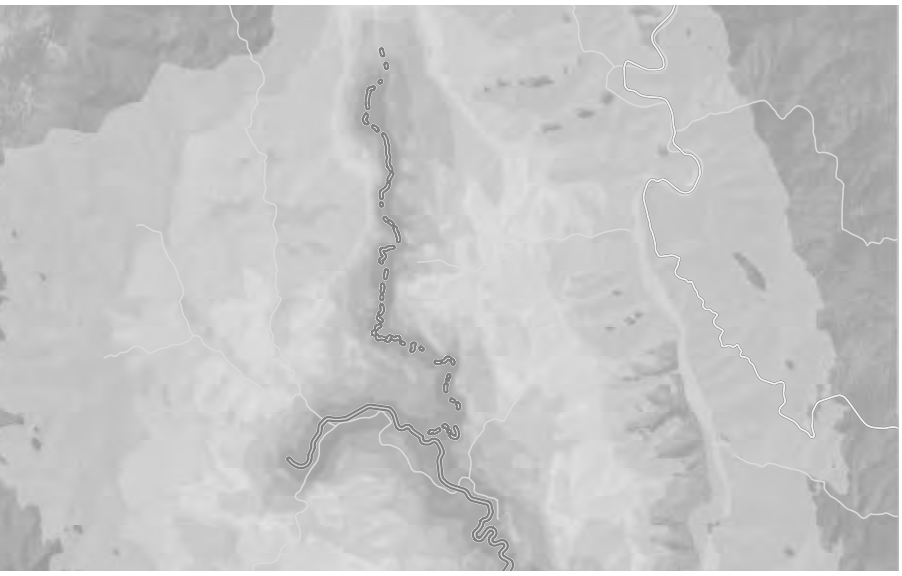
Predicted noise emissions - approved operations

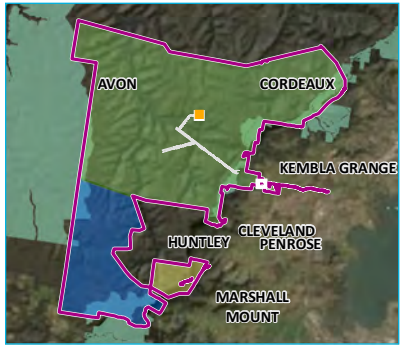


							NPfl noise goals						Existing limit						Train via bins - LAeq,15min															1	Train via FEL - LAeq,15min																		1
				Assumed LFN mod factor			PNTL			Amenity			Intrusive			Amenity			Intrusive	Compared to PNTL			Compared to existing noise limit			Amenity			Compared to NPfl Amenity			Compared to existing amenity limit			Impact Category	Intrusive	Compared to PNTL			Compared to existing noise limit			Amenity			Compared to NPfl Amenity			Compared to existing amenity limit			Impact Category
Assessment	Description	NCA	Amenity type	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt		Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	
R1	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	41	35	35	1	0	0	-2	-8	-8	38	32	32	-20	-16	-11	-22	-18	-13	Negligible	42	35	35	2	0	0	-1	-8	-8	39	32	32	-19	-16	-11	-21	-18	-13	Negligible
R2	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	44	41	41	4	6	6	1	-2	-2	41	38	38	-17	-10	-5	-19	-12	-7	Significant	45	41	41	5	6	6	2	-2	-2	42	38	38	-16	-10	-5	-18	-12	-7	Significant
R3	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	44	38	38	4	3	3	1	-5	-5	41	35	35	-17	-13	-8	-19	-15	-10	Marginal	44	38	38	4	3	3	1	-5	-5	41	35	35	-17	-13	-8	-19	-15	-10	Marginal
R4	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	42	36	36	2	1	1	-1	-7	-7	39	33	33	-19	-15	-10	-21	-17	-12	Negligible	42	36	36	2	1	1	-1	-7	-7	39	33	33	-19	-15	-10	-21	-17	-12	Negligible
R5	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	43	39	39	3	4	4	0	-4	-4	40	36	36	-18	-12	-7	-20	-14	-9	Marginal	43	39	39	3	4	4	0	-4	-4	40	36	36	-18	-12	-7	-20	-14	-9	Marginal
R6	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	43	39	39	3	4	4	0	-4	-4	40	36	36	-18	-12	-7	-20	-14	-9	Marginal	43	39	39	3	4	4	0	-4	-4	40	36	36	-18	-12	-7	-20	-14	-9	Marginal
R7 (RA1b)	Residence	RA1b	Suburban	0	0	0	40	35	35	58	48	43	43	43	43	60	50	45	41	37	37	1	2	2	-2	-6	-6	38	34	34	-20	-14	-9	-22	-16	-11	Negligible	42	37	37	2	2	2	-1	-6	-6	39	34	34	-19	-14	-9	-21	-16	-11	Negligible
R8 (RA1a)	Residence	RA1a	Suburban	0	2	2	45	45	43	58	48	43	43	43	43	60	50	45	46	43	43	1	-2	0	3	0	0	43	40	40	-15	-8	-3	-17	-10	-5	Negligible	46	43	43	1	-2	0	3	0	0	43	40	40	-15	-8	-3	-17	-10	-5	Negligible
R9	Residence	RA1a	Suburban	0	2	2	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	47	45	45	2	0	2	###	###	###	44	42	42	-14	-6	-1	-16	-8	-3	Negligible	47	45	45	2	0	2	####	####	####	44	42	42	-14	-6	-1	-16	-8	-3	Negligible
R10	Residence	RA1a	Suburban	0	2	2	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	41	39	38	-4	-6	-5	###	###	###	38	36	35	-20	-12	-8	-22	-14	-10	None	40	39	38	-5	-6	-5	####	####	####	37	36	35	-21	-12	-8	-23	-14	-10	None
R11	Residence	RA1a	Suburban	0	2	2	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	43	40	40	-2	-5	-3	###	###	###	40	37	37	-18	-11	-6	-20	-13	-8	None	43	40	40	-2	-5	-3	####	####	####	40	37	37	-18	-11	-6	-20	-13	-8	None
R12	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	42	42	2	-3	-3	###	###	###	44	39	39	-19	-14	-9	-16	-11	-6	Negligible	47	42	42	2	-3	-3	####	####	####	44	39	39	-19	-14	-9	-16	-11	-6	Negligible
R13	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	48	42	42	3	-3	-3	###	###	###	45	39	39	-18	-14	-9	-15	-11	-6	Marginal	48	42	42	3	-3	-3	####	####	####	45	39	39	-18	-14	-9	-15	-11	-6	Marginal
R14	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	43	43	4	-2	-2	###	###	###	46	40	40	-17	-13	-8	-14	-10	-5	Marginal	49	43	43	4	-2	-2	####	####	####	46	40	40	-17	-13	-8	-14	-10	-5	Marginal
R15	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	44	44	4	-1	-1	###	###	###	46	41	41	-17	-12	-7	-14	-9	-4	Marginal	49	44	44	4	-1	-1	####	####	####	46	41	41	-17	-12	-7	-14	-9	-4	Marginal
R16	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	51	46	46	6	1	1	###	###	###	48	43	43	-15	-10	-5	-12	-7	-2	Moderate	50	46	46	5	1	1	####	####	####	47	43	43	-16	-10	-5	-13	-7	-2	Marginal
R17	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	51	47	47	6	2	2	###	###	###	48	44	44	-15	-9	-4	-12	-6	-1	Moderate	51	47	47	6	2	2	####	####	####	48	44	44	-15	-9	-4	-12	-6	-1	Moderate
R18	Rural fire service	RA2	Commercial	0	0	0	68	68	68	68	68	68	n/a	n/a	n/a	n/a	n/a	n/a	54	47	47	-14	-21	-21	###	###	###	51	44	44	-17	-24	-24	####	####	####	None	53	47	47	-15	-21	-21	####	####	####	50	44	44	-18	-24	-24	#####	#####	#####	None
R19	Wongawilli Community Hall	RA2	Active recreation	0	0	0	58	58	58	58	58	58	n/a	n/a	n/a	n/a	n/a	n/a	55	49	49	-3	-9	-9	###	###	###	52	46	46	-6	-12	-12	####	####	####	None	55	49	49	-3	-9	-9	####	####	####	52	46	46	-6	-12	-12	#####	#####	#####	None
R20	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	52	48	48	7	3	3	###	###	###	49	45	45	-14	-8	-3	-11	-5	0	Moderate	52	48	48	7	3	3	####	####	####	49	45	45	-14	-8	-3	-11	-5	0	Moderate
R21	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	52	48	48	7	3	3	###	###	###	49	45	45	-14	-8	-3	-11	-5	0	Moderate	51	48	48	6	3	3	####	####	####	48	45	45	-15	-8	-3	-12	-5	0	Moderate
R22	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	52	48	48	7	3	3	###	###	###	49	45	45	-14	-8	-3	-11	-5	0	Moderate	51	48	48	6	3	3	####	####	####	48	45	45	-15	-8	-3	-12	-5	0	Moderate
R23	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	45	45	4	0	0	###	###	###	46	42	42	-17	-11	-6	-14	-8	-3	Marginal	49	45	45	4	0	0	####	####	####	46	42	42	-17	-11	-6	-14	-8	-3	Marginal
R24	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	50	46	46	5	1	1	###	###	###	47	43	43	-16	-10	-5	-13	-7	-2	Marginal	49	46	46	4	1	1	####	####	####	46	43	43	-17	-10	-5	-14	-7	-2	Marginal
R25	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	50	46	46	5	1	1	###	###	###	47	43	43	-16	-10	-5	-13	-7	-2	Marginal	50	46	46	5	1	1	####	####	####	47	43	43	-16	-10	-5	-13	-7	-2	Marginal
R26	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	50	47	47	5	2	2	###	###	###	47	44	44	-16	-9	-4	-13	-6	-1	Marginal	50	47	47	5	2	2	####	####	####	47	44	44	-16	-9	-4	-13	-6	-1	Marginal
R27	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	51	47	47	6	2	2	###	###	###	48	44	44	-15	-9	-4	-12	-6	-1	Moderate	51	47	47	6	2	2	####	####	####	48	44	44	-15	-9	-4	-12	-6	-1	Moderate
R28	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	50	46	46	5	1	1	###	###	###	47	43	43	-16	-10	-5	-13	-7	-2	Marginal	50	46	46	5	1	1	####	####	####	47	43	43	-16	-10	-5	-13	-7	-2	Marginal
R29	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	46	46	4	1	1	###	###	###	46	43	43	-17	-10	-5	-14	-7	-2	Marginal	49	46	46	4	1	1	####	####	####	46	43	43	-17	-10	-5	-14	-7	-2	Marginal
R30	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	45	45	4	0	0	###	###	###	46	42	42	-17	-11	-6	-14	-8	-3	Marginal	48	45	45	3	0	0	####	####	####	45	42	42	-18	-11	-6	-15	-8	-3	Marginal
R31	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	45	45	4	0	0	###	###	###	46	42	42	-17	-11	-6	-14	-8	-3	Marginal	49	45	45	4	0	0	####	####	####	46	42	42	-17	-11	-6	-14	-8	-3	Marginal
R32	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	45	45	4	0	0	###	###	###	46	42	42	-17	-11	-6	-14	-8	-3	Marginal	49	45	45	4	0	0	####	####	####	46	42	42	-17	-11	-6	-14	-8	-3	Marginal
R33	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	46	46	4	1	1	###	###	###	46	43	43	-17	-10	-5	-14	-7	-2	Marginal	49	46	46	4	1	1	####	####	####	46	43	43	-17	-10	-5	-14	-7	-2	Marginal
R34	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	46	46	4	1	1	###	###	###	46	43	43	-17	-10	-5	-14	-7	-2	Marginal	49	46	46	4	1	1	####	####	####	46	43	43	-17	-10	-5	-14	-7	-2	Marginal
R35	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	49	45	45	4	0	0	###	###	###	46	42	42	-17	-11	-6	-14	-8	-3	Marginal	49	45	45	4	0	0	####	####	####	46	42	42	-17	-11	-6	-14	-8	-3	Marginal
R36	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	48	44	44	3	-1	-1	###	###	###	45	41	41	-18	-12	-7	-15	-9	-4	Marginal	48	44	44	3	-1	-1	####	####	####	45	41	41	-18	-12	-7	-15	-9	-4	Marginal
R37	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	48	44	44	3	-1	-1	###	###	###	45	41	41	-18	-12	-7	-15	-9	-4	Marginal	48	44	44	3	-1	-1	####	####	####	45	41	41	-18	-12	-7	-15	-9	-4	Marginal
R38	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	48	44	44	3	-1	-1	###	###	###	45	41	41	-18	-12	-7	-15	-9	-4	Marginal	48	44	44	3	-1	-1	####	####	####	45	41	41	-18	-12	-7	-15	-9	-4	Marginal
R39	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	44	44	2	-1	-1	###	###	###	44	41	41	-19	-12	-7	-16	-9	-4	Negligible	48	44	44	3	-1	-1	####	####	####	45	41	41	-18	-12	-7	-15	-9	-4	Marginal
R40	Residence	RA2	Urban	0	2	2	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	43	43	2	-2	-2	###	###	###	44	40	40	-19	-13	-8	-16	-10	-5	Negligible	47	43	43	2	-2	-2	####	####	####	44	40	40	-19	-13	-8	-16	-10	-5	Negligible
R41	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	46	41	41	1	-4	-4	###	###	###	43	38	38	-20	-15	-10	-17	-12	-7	Negligible	47	41	41	2	-4	-4	####	####	####	44	38	38	-19	-15	-10	-16	-12	-7	Negligible
R42	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	46	40	40	1	-5	-5	###	###	###	43	37	37	-20	-16	-11	-17	-13	-8	Negligible	46	40	40	1	-5	-5	####	####	####	43	37	37	-20	-16	-11	-17	-13	-8	Negligible
R43	Project-related	RA2	Urban	0	2	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	48	44	44	###	###	###	###	###	###	45	41	41	#####	#####	#####	#####	#####	#####	n/a	48	44	44				####	####	####	45	41	41	#####	#####	#####	#####	#####	#####	n/a
R44 (RA2b)	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	47	41	41	2	-4	-4	3	-2	-2	44	38	38	-19	-15	-10	-16	-12	-7	Negligible	47	41	41	2	-4	-4	3	-2	-2	44	38	38	-19	-15	-10	-16	-12	-7	Negligible
R45	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible
R46	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible
R47	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible	46	40	40	1	-5	-5	2	-3	-3	43	37	37	-20	-16	-11	-17	-13	-8	Negligible
R48	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	45	39	39	0	-6	-6	1	-4	-4	42	36	36	-21	-17	-12	-18	-14	-9	None	46	39	39	1	-6	-6	2	-4	-4	43	36	36	-20	-17	-12	-17	-14	-9	Negligible
R49 (RA2a)	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	41	35	35	-4	-10	-10	-3	-8	-8	38	32	32	-25	-21	-16	-22	-18	-13	None	41	35	35	-4	-10	-10	-3	-8	-8	38	32	32	-25	-21	-16	-22	-18	-13	None
R50	Residence	RA2	Urban	0	0	0	45	45	45	63	53	48	44	43	43	60	50	45	37	32	32	-8	-13	-13	-7	-11	-11	34	29	29	-29	-24	-19	-26	-21	-16	None	37	32	32	-8	-13	-13	-7	-11	-11	34	29	29	-29	-24	-19	-26	-21	-16	None
R51 (RA4a)	Residence	RA4	Urban	0	0	0	40	35	35	63	53	48	n/a	n/a	n/a	60	50	45	27	23	22	-13	-12	-13	###	###	###	24	20	19	-39	-33	-29	-36	-30	-26	None	28	23	22	-12	-12	-13	####	####	####	25	20	19	-38	-33	-29	-35	-30	-26	None
R52 (RA4b)	Residence	RA4	Urban	0	0	0	40	35	35	63	53	48	n/a	n/a	n/a	60	50	45	26	22	22	-14	-13	-13	###	###	###	23	19	19	-40	-34	-29	-37	-31	-26	None	27	22	22	-13	-13	-13	####	####	####	24	19	19	-39	-34	-29	-36	-31	-26	None
R53 (RA3a)	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	40	40	38	60	50	45	35	29	29	-5	-6	-6	-5	-11	-9	32	26	26	-26	-22	-17	-28	-24	-19	None	36	29	29	-4	-6	-6	-4	-11	-9	33	26	26	-25	-22	-17	-27	-24	-19	None
R54	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	40	40	38	60	50	45	35	30	30	-5	-5	-5	-5	-10	-8	32	27	27	-26	-21	-16	-28	-23	-18	None	36	30	30	-4	-5	-5	-4	-10	-8	33	27	27	-25	-21	-16	-27	-23	-18	None
R55	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	40	40	38	60	50	45	36	30	30	-4	-5	-5	-4	-10	-8	33	27	27	-25	-21	-16	-27	-23	-18	None	37	30	30	-3	-5	-5	-3	-10	-8	34	27	27	-24	-21	-16	-26	-23	-18	None
R56	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	40	40	38	60	50	45	36	30	30	-4	-5	-5	-4	-10	-8	33	27	27	-25	-21	-16	-27	-23	-18	None	37	30	30	-3	-5	-5	-3	-10	-8	34	27	27	-24	-21	-16	-26	-23	-18	None
R57 (RA3b)	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	40	40	38	60	50	45	33	29	29	-7	-6	-6	-7	-11	-9	30	26	26	-28	-22	-17	-30	-24	-19	None	34	29	29	-6	-6	-6	-6	-11	-9	31	26	26	-27	-22	-17	-29	-24	-19	None
R58	Residence	RA3	Suburban	0	0	0	40	35	35	58	48	43	n/a	n/a	n/a	60	50	45	36	33	33	-4	-2	-2	###	###	###	33	30	30	-25	-18	-13	-27	-20	-15	None	38	33	33	-2	-2	-2	####	####	####	35	30	30	-23	-18	-13	-25	-20	-15	None


Appendix E

Rail noise barrier - proposed



KEY

- Project application area
- Real-time noise monitor
- Rail barrier (6 m height)
- Proposed rail barrier extension

Site infrastructure

- ETL - 33 kV
- Access roads and tracks
- Conveyor belt
- Wongawilli Colliery rail
- Existing surface infrastructure
- Water collection and treatment

Exitisting environment

- Minor road
- Watercourse/drainage line

INSET KEY

- Vent shaft
- Underground workings
- NPWS reserve

Mining title

- ML 1565
- ML 1596
- CCL 766

\\Emmsvr1\emm3\2020\J200053 - Wongawilli Mod 2 NW Mains\GIS\02 Maps\ NVIA\NVIA009 NoiseBarrierExtension 20201002 01.mxd 5/11/2020

Source: EMM (2020); Wollongong Coal Limited (2020); NearMap (2020); DFSI (2017); GA (2011); ASGC (2006)

0 50 100 m

GDA 1994 MGA Zone 56

N

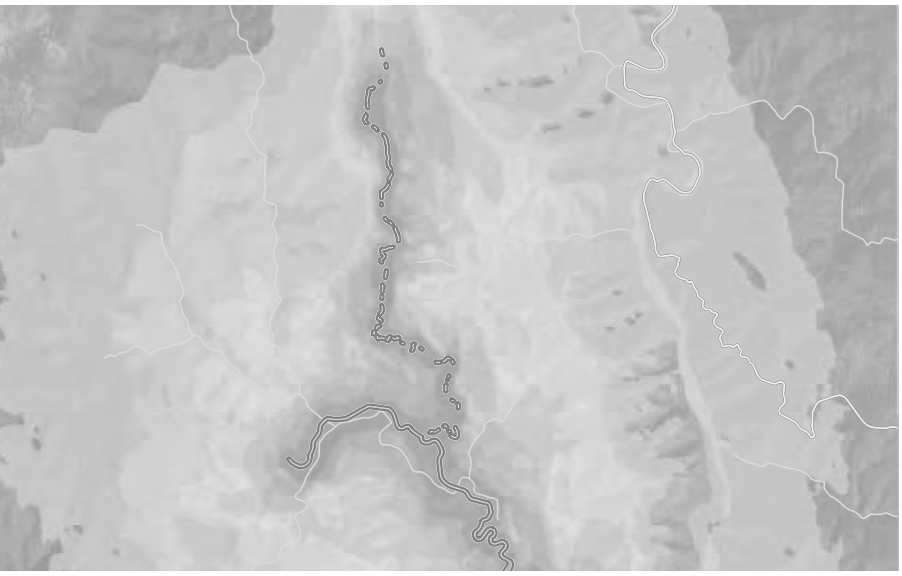
Proposed noise barrier extension

Wollongong Coal Limited
Wongawilli Modification 2 North West Mains
Noise and vibration impact assessment
Figure E.1

EMM
creating opportunities

Appendix F

Predicted noise emissions - mitigated



				NPfl noise goals						Existing limit						Train via bins - mit																0
				PNTL			Amenity			Intrusive			Amenity			Intrusive			mpared to Unmitigat			Compared to PNTL			Compared to existing noise limit			Amenity			Compared to NPfl Amenity			Compared to existing amenity limit			Impact Category
Assessment	Description	NCA	Amenity type	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Impact Category
R1	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	37	31	31	4	4	4	-3	-4	-4	-6	-12	-12	34	28	28	-24	-20	-15	-26	-22	-17	None
R2	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	41	38	38	3	3	3	1	3	3	-2	-5	-5	38	35	35	-20	-13	-8	-22	-15	-10	Marginal
R3	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	40	33	33	4	5	5	0	-2	-2	-3	-10	-10	37	30	30	-21	-18	-13	-23	-20	-15	None
R4	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	38	32	32	4	4	4	-2	-3	-3	-5	-11	-11	35	29	29	-23	-19	-14	-25	-21	-16	None
R5	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	38	32	32	5	7	7	-2	-3	-3	-5	-11	-11	35	29	29	-23	-19	-14	-25	-21	-16	None
R6	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	37	32	32	6	7	7	-3	-3	-3	-6	-11	-11	34	29	29	-24	-19	-14	-26	-21	-16	None
R7 (RA1b)	Residence	RA1b	Suburban	40	35	35	58	48	43	43	43	43	60	50	45	36	31	31	5	6	6	-4	-4	-4	-7	-12	-12	33	28	28	-25	-20	-15	-27	-22	-17	None
R8 (RA1a)	Residence	RA1a	Suburban	45	45	43	58	48	43	43	43	43	60	50	45	40	34	34	6	9	9	-5	-11	-9	-3	-9	-9	37	31	31	-21	-17	-12	-23	-19	-14	None
R9	Residence	RA1a	Suburban	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	41	35	35	6	10	10	-4	-10	-8	####	####	####	38	32	32	-20	-16	-11	-22	-18	-13	None
R10	Residence	RA1a	Suburban	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	38	34	33	3	5	5	-7	-11	-10	####	####	####	35	31	30	-23	-17	-13	-25	-19	-15	None
R11	Residence	RA1a	Suburban	45	45	43	58	48	43	n/a	n/a	n/a	60	50	45	38	32	32	5	8	8	-7	-13	-11	####	####	####	35	29	29	-23	-19	-14	-25	-21	-16	None
R12	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	35	35	4	7	7	-2	-10	-10	####	####	####	40	32	32	-23	-21	-16	-20	-18	-13	None
R13	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	35	35	5	7	7	-2	-10	-10	####	####	####	40	32	32	-23	-21	-16	-20	-18	-13	None
R14	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	36	36	5	7	7	-1	-9	-9	####	####	####	41	33	33	-22	-20	-15	-19	-17	-12	None
R15	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	37	37	4	7	7	0	-8	-8	####	####	####	42	34	34	-21	-19	-14	-18	-16	-11	None
R16	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	46	38	38	5	8	8	1	-7	-7	####	####	####	43	35	35	-20	-18	-13	-17	-15	-10	Negligible
R17	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	39	39	4	8	8	2	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	Negligible
R18	Rural fire service	RA2	Commercial	68	68	68	68	68	68	n/a	n/a	n/a	n/a	n/a	n/a	49	41	41	5	6	6	-19	-27	-27	####	####	####	46	38	38	-22	-30	-30	####	####	####	None
R19	Wongawilli Community Hall	RA2	Active recreation	58	58	58	58	58	58	n/a	n/a	n/a	n/a	n/a	n/a	51	42	42	4	7	7	-7	-16	-16	####	####	####	48	39	39	-10	-19	-19	####	####	####	None
R20	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	39	39	5	9	9	2	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	Negligible
R21	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	39	39	5	9	9	2	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	Negligible
R22	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	47	39	39	5	9	9	2	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	Negligible
R23	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	37	37	4	8	8	0	-8	-8	####	####	####	42	34	34	-21	-19	-14	-18	-16	-11	None
R24	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	38	38	5	8	8	0	-7	-7	####	####	####	42	35	35	-21	-18	-13	-18	-15	-10	None
R25	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	38	38	5	8	8	0	-7	-7	####	####	####	42	35	35	-21	-18	-13	-18	-15	-10	None
R26	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	38	38	5	9	9	0	-7	-7	####	####	####	42	35	35	-21	-18	-13	-18	-15	-10	None
R27	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	46	38	38	5	9	9	1	-7	-7	####	####	####	43	35	35	-20	-18	-13	-17	-15	-10	Negligible
R28	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	37	37	5	9	9	0	-8	-8	####	####	####	42	34	34	-21	-19	-14	-18	-16	-11	None
R29	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	37	37	5	9	9	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None
R30	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	37	37	5	8	8	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None
R31	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	37	37	5	8	8	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None
R32	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	37	37	5	8	8	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None
R33	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	37	37	5	9	9	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None
R34	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	45	37	37	4	9	9	0	-8	-8	####	####	####	42	34	34	-21	-19	-14	-18	-16	-11	None
R35	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	44	36	36	5	9	9	-1	-9	-9	####	####	####	41	33	33	-22	-20	-15	-19	-17	-12	None
R36	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	36	36	5	8	8	-2	-9	-9	####	####	####	40	33	33	-23	-20	-15	-20	-17	-12	None
R37	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	36	36	5	8	8	-2	-9	-9	####	####	####	40	33	33	-23	-20	-15	-20	-17	-12	None
R38	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	35	35	5	9	9	-2	-10	-10	####	####	####	40	32	32	-23	-21	-16	-20	-18	-13	None
R39	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	43	35	35	4	9	9	-2	-10	-10	####	####	####	40	32	32	-23	-21	-16	-20	-18	-13	None
R40	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	42	35	35	5	8	8	-3	-10	-10	####	####	####	39	32	32	-24	-21	-16	-21	-18	-13	None
R41	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	42	34	34	4	7	7	-3	-11	-11	####	####	####	39	31	31	-24	-22	-17	-21	-19	-14	None
R42	Residence	RA2	Urban	45	45	45	63	53	48	n/a	n/a	n/a	60	50	45	41	34	34	5	6	6	-4	-11	-11	####	####	####	38	31	31	-25	-22	-17	-22	-19	-14	None
R43	Project-related	RA2	Urban	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	43	35	35	5	9	9				####	####	####	40	32	32				####	####	####	n/a
R44 (RA2b)	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	42	34	34	5	7	7	-3	-11	-11	-2	-9	-9	39	31	31	-24	-22	-17	-21	-19	-14	None
R45	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	41	34	34	5	6	6	-4	-11	-11	-3	-9	-9	38	31	31	-25	-22	-17	-22	-19	-14	None
R46	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	41	33	33	5	7	7	-4	-12	-12	-3	-10	-10	38	30	30	-25	-23	-18	-22	-20	-15	None
R47	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	41	33	33	5	7	7	-4	-12	-12	-3	-10	-10	38	30	30	-25	-23	-18	-22	-20	-15	None
R48	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	41	33	33	4	6	6	-4	-12	-12	-3	-10	-10	38	30	30	-25	-23	-18	-22	-20	-15	None
R49 (RA2a)	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	36	29	29	5	6	6	-9	-16	-16	-8	-14	-14	33	26	26	-30	-27	-22	-27	-24	-19	None
R50	Residence	RA2	Urban	45	45	45	63	53	48	44	43	43	60	50	45	32	26	26	5	6	6	-13	-19	-19	-12	-17	-17	29	23	23	-34	-30	-25	-31	-27	-22	None
R51 (RA4a)	Residence	RA4	Urban	40	35	35	63	53	48	n/a	n/a	n/a	60	50	45	23	18	18	4	5	4	-17	-17	-17	####	####	####	20	15	15	-43	-38	-33	-40	-35	-30	None
R52 (RA4b)	Residence	RA4	Urban	40	35	35	63	53	48	n/a	n/a	n/a	60	50	45	22	18	18	4	4	4	-18	-17	-17	####	####	####	19	15	15	-44	-38	-33	-41	-35	-30	None
R53 (RA3a)	Residence	RA3	Suburban	40	35	35	58	48	43	40	40	38	60	50	45	31	24	24	4	5	5	-9	-11	-11	-9	-16	-16	28	21	21	-30	-27	-22	-32	-29	-24	None
R54	Residence	RA3	Suburban	40	35	35	58	48	43	40	40	38	60	50	45	31	25	25	4	5	5	-9	-10	-10	-9	-15	-13	28	22	22	-30	-26	-21	-32	-28	-23	None
R55	Residence	RA3	Suburban	40	35	35	58	48	43	40	40	38	60	50	45	32	25	25	4	5	5	-8	-10	-10	-8	-15	-13	29	22	22	-29	-26	-21	-31	-28	-23	None
R56	Residence	RA3	Suburban	40	35	35	58	48	43	40	40	38	60	50	45	32	25	25	4	5	5	-8	-10	-10	-8	-15	-13	29	22	22	-29	-26	-21	-31	-28	-23	None
R57 (RA3b)	Residence	RA3	Suburban	40	35	35	58	48	43	40	40	38	60	50	45	30	24	24	3	5	5	-10	-11	-11	-10	-16	-14	27	21	21	-31	-27	-22	-33	-29	-24	None
R58	Residence	RA3	Suburban	40	35	35	58	48	43	n/a	n/a	n/a	60	50	45	34	31	31	2	2	2	-6	-4	-4	####	####	####	31	28	28	-27	-20	-15	-29	-22	-17	None

				Train via FEL - mit																												0
				Intrusive			mpared to unmitigat			Compared to PNTL			Compared to existing noise limit			Amenity			Compared to NPfl Amenity			Compared to existing amenity limit			Compared to existing amenity limit			Impact Category
Assessment	Description	NCA	Amenity type	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Day	Eve	Nt	Impact Category
R1	Residence	RA1b	Suburban	37	31	31	5	4	4	-3	-4	-4	-6	-12	-12	34	28	28	-24	-20	-15	-26	-22	-17	-26	-22	-17	None
R2	Residence	RA1b	Suburban	41	38	38	4	3	3	1	3	3	-2	-5	-5	38	35	35	-20	-13	-8	-22	-15	-10	-22	-15	-10	Marginal
R3	Residence	RA1b	Suburban	39	33	33	5	5	5	-1	-2	-2	-4	-10	-10	36	30	30	-22	-18	-13	-24	-20	-15	-24	-20	-15	None
R4	Residence	RA1b	Suburban	38	32	32	4	4	4	-2	-3	-3	-5	-11	-11	35	29	29	-23	-19	-14	-25	-21	-16	-25	-21	-16	None
R5	Residence	RA1b	Suburban	37	32	32	6	7	7	-3	-3	-3	-6	-11	-11	34	29	29	-24	-19	-14	-26	-21	-16	-26	-21	-16	None
R6	Residence	RA1b	Suburban	36	31	31	6	6	6	-4	-4	-4	-7	-12	-12	33	28	28	-25	-20	-15	-27	-22	-17	-27	-22	-17	None
R7 (RA1b)	Residence	RA1b	Suburban	39	34	34	7	9	9	-6	-11	-9	-4	-9	-9	36	31	31	-23	-19	-14	-24	-19	-14	-24	-19	-14	None
R8 (RA1a)	Residence	RA1a	Suburban	40	35	35	7	10	10	-5	-10	-8	####	####	####	38	32	32	-22	-18	-13	-23	-18	-13	-23	-18	-13	None
R9	Residence	RA1a	Suburban	38	32	32	4	5	5	-7	-11	-10	####	####	####	35	31	30	-23	-17	-13	-25	-19	-15	-25	-19	-15	None
R10	Residence	RA1a	Suburban	38	32	32	5	8	8	-7	-13	-11	####	####	####	35	29	29	-23	-19	-14	-25	-21	-16	-25	-21	-16	None
R11	Residence	RA1a	Suburban	42	35	35	5	7	7	-3	-10	-10	####	####	####	40	32	32	-23	-21	-16	-20	-18	-13	-21	-18	-13	None
R12	Residence	RA2	Urban	43	36	36	6	7	7	-2	-9	-9	####	####	####	41	33	33	-22	-20	-15	-19	-17	-12	-20	-17	-12	None
R13	Residence	RA2	Urban	44	37	37	6	7	7	-2	-8	-8	####	####	####	42	34	34	-21	-19	-14	-18	-16	-11	-20	-16	-11	None
R14	Residence	RA2	Urban	45	38	38	6	8	8	-1	-7	-7	####	####	####	43	35	35	-20	-18	-13	-17	-15	-10	-19	-15	-10	Negligible
R15	Residence	RA2	Urban	44	38	38	6	8	8	-1	-7	-7	####	####	####	43	35	35	-20	-18	-13	-17	-15	-10	-19	-15	-10	Negligible
R16	Residence	RA2	Urban	45	39	39	6	8	8	0	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	-18	-14	-9	None
R17	Residence	RA2	Urban	47	41	41	6	6	6	-21	-27	-27	####	####	####	46	38	38	-22	-30	-30	####	####	####	####	####	####	None
R18	Rural fire service	RA2	Commercial	48	42	42	7	7	7	-10	-16	-16	####	####	####	48	39	39	-10	-19	-19	####	####	####	####	####	####	None
R19	Wongawilli Community Hall	RA2	Active recreation	46	39	39	6	9	9	1	-6	-6	####	####	####	44	36	36	-19	-17	-12	-16	-14	-9	-17	-14	-9	Negligible
R20	Residence	RA2	Urban	46	39	39	6	9	9	1	-6	-6	####	####	####	43	36	36	-20	-17	-12	-17	-14	-9	Negligible			
R21	Residence	RA2	Urban	46	39	39	5	9	9	1	-6	-6	####	####	####	43	36	36	-20	-17	-12	-17	-14	-9	Negligible			
R22	Residence	RA2	Urban	45	39	39	6	9	9	0	-6	-6	####	####	####	42	36	36	-21	-17	-12	-18	-14	-9	None			
R23	Residence	RA2	Urban	43	37	37	6	8	8	-2	-8	-8	####	####	####	40	34	34	-23	-19	-14	-20	-16	-11	None			
R24	Residence	RA2	Urban	43	38	38	6	8	8	-2	-7	-7	####	####	####	40	35	35	-23	-18	-13	-20	-15	-10	None			
R25	Residence	RA2	Urban	44	38	38	6	8	8	-1	-7	-7	####	####	####	41	35	35	-22	-18	-13	-19	-15	-10	None			
R26	Residence	RA2	Urban	44	38	38	6	9	9	-1	-7	-7	####	####	####	41	35	35	-22	-18	-13	-19	-15	-10	None			
R27	Residence	RA2	Urban	45	38	38	6	9	9	0	-7	-7	####	####	####	42	35	35	-21	-18	-13	-18	-15	-10	None			
R28	Residence	RA2	Urban	44	37	37	6	9	9	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None			
R29	Residence	RA2	Urban	43	37	37	6	9	9	-2	-8	-8	####	####	####	40	34	34	-23	-19	-14	-20	-16	-11	None			
R30	Residence	RA2	Urban	42	37	37	6	8	8	-3	-8	-8	####	####	####	39	34	34	-24	-19	-14	-21	-16	-11	None			
R31	Residence	RA2	Urban	43	37	37	6	8	8	-2	-8	-8	####	####	####	40	34	34	-23	-19	-14	-20	-16	-11	None			
R32	Residence	RA2	Urban	43	37	37	6	8	8	-2	-8	-8	####	####	####	40	34	34	-23	-19	-14	-20	-16	-11	None			
R33	Residence	RA2	Urban	43	37	37	6	9	9	-2	-8	-8	####	####	####	40	34	34	-23	-19	-14	-20	-16	-11	None			
R34	Residence	RA2	Urban	44	37	37	5	9	9	-1	-8	-8	####	####	####	41	34	34	-22	-19	-14	-19	-16	-11	None			
R35	Residence	RA2	Urban	43	36	36	6	9	9	-2	-9	-9	####	####	####	40	33	33	-23	-20	-15	-20	-17	-12	None			
R36	Residence	RA2	Urban	42	36	36	6	8	8	-3	-9	-9	####	####	####	39	33	33	-24	-20	-15	-21	-17	-12	None			
R37	Residence	RA2	Urban	42	36	36	6	8	8	-3	-9	-9	####	####	####	39	33	33	-24	-20	-15	-21	-17	-12	None			
R38	Residence	RA2	Urban	42	35	35	6	9	9	-3	-10	-10	####	####	####	39	32	32	-24	-21	-16	-21	-18	-13	None			
R39	Residence	RA2	Urban	42	35	35	6	9	9	-3	-10	-10	####	####	####	39	32	32	-24	-21	-16	-21	-18	-13	None			
R40	Residence	RA2	Urban	42	35	35	5	8	8	-3	-10	-10	####	####	####	39	32	32	-24	-21	-16	-21	-18	-13	None			
R41	Residence	RA2	Urban	41	34	34	6	7	7	-4	-11	-11	####	####	####	38	31	31	-25	-22	-17	-22	-19	-14	None			
R42	Residence	RA2	Urban	41	34	34	5	6	6	-4	-11	-11	####	####	####	38	31	31	-25	-22	-17	-22	-19	-14	None			
R43	Project-related	RA2	Urban	42	35	35	6	9	9				####	####	####	39	32	32				#######	#######	#######	n/a			
R44 (RA2b)	Residence	RA2	Urban	41	34	34	6	7	7	-4	-11	-11	-3	-9	-9	38	31	31	-25	-22	-17	-22	-19	-14	None			
R45	Residence	RA2	Urban	41	34	34	5	6	6	-4	-11	-11	-3	-9	-9	38	31	31	-25	-22	-17	-22	-19	-14	None			
R46	Residence	RA2	Urban	41	33	33	5	7	7	-4	-12	-12	-3	-10	-10	38	30	30	-25	-23	-18	-22	-20	-15	None			
R47	Residence	RA2	Urban	40	33	33	6	7	7	-5	-12	-12	-4	-10	-10	37	30	30	-26	-23	-18	-23	-20	-15	None			
R48	Residence	RA2	Urban	40	33	33	6	6	6	-5	-12	-12	-4	-10	-10	37	30	30	-26	-23	-18	-23	-20	-15	None			
R49 (RA2a)	Residence	RA2	Urban	36	29	29	5	6	6	-9	-16	-16	-8	-14	-14	33	26	26	-30	-27	-22	-27	-24	-19	None			
R50	Residence	RA2	Urban	32	26	26	5	6	6	-13	-19	-19	-12	-17	-17	29	23	23	-34	-30	-25	-31	-27	-22	None			
R51 (RA4a)	Residence	RA4	Urban	23	18	18	5	5	4	-17	-17	-17	####	####	####	20	15	15	-43	-38	-33	-40	-35	-30	None			
R52 (RA4b)	Residence	RA4	Urban	22	18	18	5	4	4	-18	-17	-17	####	####	####	19	15	15	-44	-38	-33	-41	-35	-30	None			
R53 (RA3a)	Residence	RA3	Suburban	31	24	24	5	5	5	-9	-11	-11	-9	-16	-14	28	21	21	-30	-27	-22	-32	-29	-24	None			
R54	Residence	RA3	Suburban	31	25	25	5	5	5	-9	-10	-10	-9	-15	-13	28	22	22	-30	-26	-21	-32	-28	-23	None			
R55	Residence	RA3	Suburban	32	25	25	5	5	5	-8	-10	-10	-8	-15	-13	29	22	22	-29	-26	-21	-31	-28	-23	None			
R56	Residence	RA3	Suburban	32	25	25	5	5	5	-8	-10	-10	-8	-15	-13	29	22	22	-29	-26	-21	-31	-28	-23	None			
R57 (RA3b)	Residence	RA3	Suburban	30	24	24	4	5	5	-10	-11	-11	-10	-16	-14	27	21	21	-31	-27	-22	-33	-29	-24	None			
R58	Residence	RA3	Suburban	34	31	31	4	2	2	-6	-4	-4	####	####	####	31	28	28	-27	-20	-15	-29	-22	-17	None