

NOISE AND VIBRATION STUDY

Appendix E



Appendix E — NOISE AND VIBRATION STUDY

E



HVO South - Modification 5

Noise Impact Assessment

Prepared for HV Operations Pty Limited | 1 February 2017



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HVO South - Modification 5

Final

Report J15013RP1_Noise | Prepared for HV Operations Pty Limited | 1 February 2017

Approved by **Najah Ishac**

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Signature



Date 1 February 2017

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1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged to assess the noise levels from the proposed modification to Hunter Valley Operations South (HVO South) project approval PA 06_0261.

This assessment forms part of the Environmental Assessment (EA) prepared by EMM to accompany an application by Coal & Allied for the proposed modification, in accordance with Section 75W of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The noise assessment has been completed with reference to the following standards, guidelines and policies:

- the *NSW Industrial Noise Policy* (EPA 2000) (INP);
- the *Rail Infrastructure Noise Guideline* (EPA 2013) (RING); and
- the *Integrated Mining Policy, Voluntary Land Acquisition and Mitigation Policy* (NSW Government 2014) (VLAMP).

Acoustic engineers worked closely with Rio Tinto Coal Australia during the mine plan development phase. This enabled important noise mitigation to be incorporated into the design and the development of comprehensive operational noise management regime.

It should be noted that the proposed modification does not seek to extend the consent period and that the operations will remain substantially the same (in noise terms) as the original approved operations, but will include some key changes as described in herein.

1.1 Proposed modification overview

Coal & Allied is seeking to modify project approval PA 06_0261 to allow:

- the progression of mining of the deeper Bayswater seam from Cheshunt Pit into Riverview Pit and mining the Vaux seam below the Bowfield seam in South Lemington Pit 2;
- a modification to the currently approved overburden emplacement strategy resulting in, amongst other changes, the relocation and shape of the evaporative basin in the void and the inclusion of more natural landform with micro-relief design into the post mining landform design;
- an increased rate of extraction from 16 million tonnes per annum (Mtpa) to 20 Mtpa run-of-mine (ROM) coal at peak production; and an increased processing rate of coal extracted from HVO South from 16 Mtpa to 20 Mtpa of ROM coal across HVO coal preparation plants; and
- removal of redundant prescriptive blasting conditions and replacement with contemporary outcome based conditions.

The proposed modification will not change the approved footprint of disturbance, mining method, employee numbers, integrated tailings and water management across HVO or extend the project approval period.

Figure 1.1 shows the location of the relevant modification components, in the context of the HVO South mining operations and surrounds. The 'project area' comprises the depth extension of the Riverview Pit and South Lemington Pit 2 and the modification of the overburden emplacement strategy within the existing approved disturbance area of HVO South. All land within the project area is owned by Coal & Allied.

Table 1.1 provides a comparison of the current approved operations and the proposed modification. Proposed modification components are discussed in the sections below.

Table 1.1 Comparison of key components of the proposed modification with existing operations

Key component	Existing operations	Proposed modification
Approval timeframes	<ul style="list-style-type: none"> Operations at HVO South are approved until 23 March 2030. 	<ul style="list-style-type: none"> No change to the project approval period.
Mining areas	<ul style="list-style-type: none"> Extraction is approved to the base of the Bowfield seam within South Lemington Pits; base of the Vaux seam within the Riverview Pit; and base of the Bayswater seam in the Cheshunt Pit. Approved disturbance areas are shown in Figure 1.1. 	<ul style="list-style-type: none"> Extraction to the base of the deeper Bayswater seam in the Riverview Pit. Extraction to the base of the deeper Vaux seam in South Lemington Pit 2. No change to approved disturbance areas: mining of the deeper seams will occur within the existing approved disturbance footprint.
Extraction rate	<ul style="list-style-type: none"> HVO South has approval to extract up to 16 Mtpa of ROM coal. 	<ul style="list-style-type: none"> Maximum rate of ROM coal extraction increased to 20 Mtpa.
ROM coal processing and transport	<ul style="list-style-type: none"> The ROM/product coal may be transported from all HVO South pits via internal haul roads to all coal processing plants within the HVO mining complex (HVCPP, HCPP, NCPP and LCPP) for processing. ROM coal from HVO South can also be transported via overland conveyor to HVCPP. 	<ul style="list-style-type: none"> No change to transport methods or destinations. Increase processing of ROM coal to 20 Mtpa.
Product coal transport	<ul style="list-style-type: none"> Transport product coal by truck or overland conveyor (OLC) from all coal preparation plants to all loading points (LP) (Hunter Valley LP, Newdell LP and Lemington LP and/ adjacent to short rail loop south of South Lemington Pit 1). 	<ul style="list-style-type: none"> No change to volumes, methods or destination of load out of product coal.
Overburden emplacement	<ul style="list-style-type: none"> Ability to dispose of overburden within all pits and out-of-pit emplacement areas within the HVO complex. 	<ul style="list-style-type: none"> No change to the ability to dispose of overburden within all pits and out-of-pit emplacement areas within the HVO complex.
Coarse reject	<ul style="list-style-type: none"> Ability to emplace coarse rejects within overburden emplacement areas across HVO. 	<ul style="list-style-type: none"> No change to coarse rejects management.
Tailings	<ul style="list-style-type: none"> Approved and integrated tailings management with HVO North. 	<ul style="list-style-type: none"> No change to tailings management.

Table 1.1 Comparison of key components of the proposed modification with existing operations

Key component	Existing operations	Proposed modification
Infrastructure	<ul style="list-style-type: none"> Infrastructure includes: workshops; vehicle washing facilities; bulk oil and fuel storages and explosive magazines; water and tailings management infrastructure; storage hoppers and crushers; coal stockpiles; LCPP; erection pads; bathhouse; general stores; administration offices; and other facilities and incidental activities. 	<ul style="list-style-type: none"> Potential upgrades to infrastructure as part of normal operations.
Operating hours	<ul style="list-style-type: none"> Continuous operations, 24 hours per day, seven days per week. 	<ul style="list-style-type: none"> No change to operating hours.
Employee and contractor numbers	<ul style="list-style-type: none"> Approximately 1,500. 	<ul style="list-style-type: none"> No change to employee numbers.
Rehabilitation	<ul style="list-style-type: none"> Progressive rehabilitation. Final land use and final landform described in a number of approval documents. 	<ul style="list-style-type: none"> Continued progressive rehabilitation. Modified final landform which includes micro-relief design of the post mining landform design and relocation of evaporative basin in the void further away from the Hunter River.

2 Glossary

A number of technical terms are required for the discussion of noise and vibration. These are explained in Table 2.1.

Table 2.1 Glossary of acoustic terms

Abbreviation or term	Description
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 L90 statistical noise levels.
Amenity criteria	The amenity criteria relate to all industrial noise. Where industrial noise approaches base amenity criteria, then noise levels from new industries need to demonstrate that they will not be an additional contributor to existing industrial noise.
ANZECC	Australian and New Zealand Environment Conservation Council
CNMP	Construction noise management plan
Coal & Allied	Coal & Allied Operations Limited
Day period ¹	Monday to Saturday: 7.00 am to 6.00 pm, on Sundays and public holidays: 8.00 am to 6.00 pm.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
DP&E	Department of Planning and Environment (NSW government)
EA	Environmental assessment
EMM	EMGA Consulting Pty Limited
EPA	NSW Environment Protection Authority
EP&A Act	Environmental and Planning Assessment Act 1979 (NSW)
Evening period ¹	Monday to Saturday: 6.00 pm to 10.00 pm, on Sundays and public holidays: 6.00 pm to 10.00 pm.
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy (NSW EPA 2000)
Intrusive criteria	The intrusive criteria refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness criterion is described in detail in this report.
L ₁	The noise level exceeded for 1% of the time.
L ₁₀	The noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L ₉₀	The noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L _{eq}	The energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The L _{eq(15min)} descriptor refers to an L _{eq} noise level measured over a 15-minute period.
Linear peak	The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.
L _{max}	The maximum sound pressure level received during a measuring interval.
Night period ¹	Monday to Saturday: 10.00 pm to 7.00 am, on Sundays and public holidays: 10.00 pm to 8.00 am.
NMP	Noise management plan
PSNL	The project-specific noise level (PSNL) are criteria for a particular industrial noise source or industry. The PSNL is the lower of either the intrusive criteria or amenity criteria.

Table 2.1 **Glossary of acoustic terms**

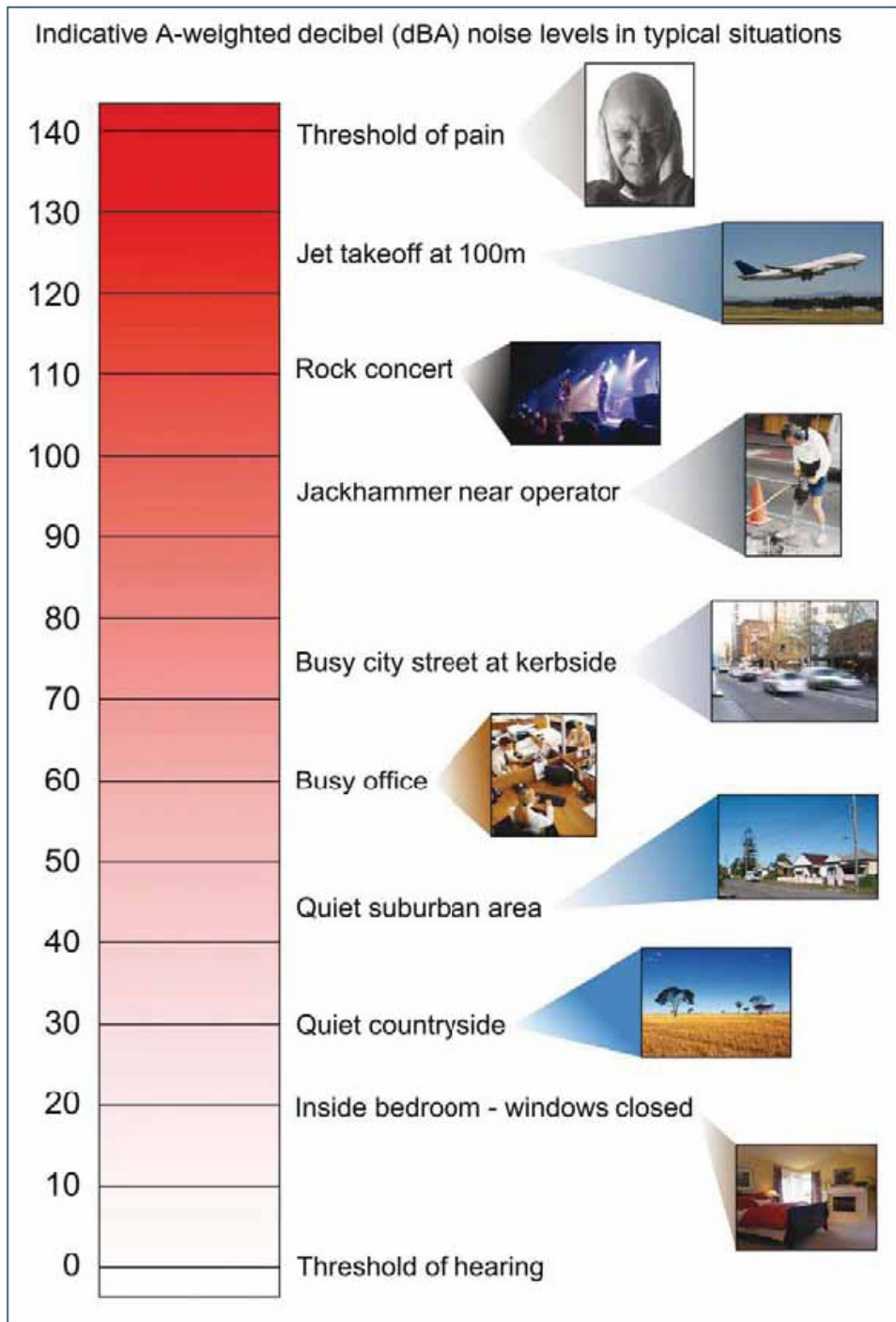
Abbreviation or term	Description
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RING	Rail Infrastructure Noise Guideline
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.
The proposed modification	Hunter Valley South Modification 5
The Site	Area covered by application
Vibration	A motion that can be measured in terms of its displacement, velocity or acceleration. The common unit for velocity is millimetres per second (mm/s).

2.1 Common noise levels

Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels encountered on a daily basis are provided in Figure 2.1.

Table 2.2 **Perceived change in noise**

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



Source: Road Noise Policy (DECCW 2011).

Figure 2.1 Common sources of noise with levels

3 Noise management

The site is managed and operated adopting a site specific and approved noise management plan (NMP). The plan includes noise control considerations, operational management options and monitoring requirements.

3.1 Noise control

The key expectation of the EPA's Industrial Noise Policy (INP) is that all feasible and reasonable mitigation is applied taking into account economic, social and environmental considerations of the modified project.

The INP Section 7 "Mitigating noise from industrial sources" states three main strategies for noise control. These are controlling noise at the source, the transmission path and at the receiver. The following main mitigation strategies will apply.

- Mitigation at the source:
 - The proponent has currently attenuated a portion of the haul truck fleet, and is continuing this program;
 - Operational management (mitigation at the source): During adverse weather conditions identified 24 hours ahead of planned operations, a relatively small number of plant are either relocated to in-pit areas or shut down to ensure the operations satisfy the noise criteria. This method is common practice for current operations at the site and is commonly used elsewhere in the mining industry. This measure also results in an annual cost to the business associated with the requisite lost production due to less equipment operating during these conditions; and
 - The mine plans that form the basis of the current assessment were optimised over many iterations of noise modelling for different operating scenarios. In arriving at the mine plans, alternative noise minimisation techniques were identified and applied. Some potential options, however, were rejected for a number of reasons.
- Mitigation at the receiver. A number of homes have been afforded architectural treatment to mitigate noise intrusion in accordance with the requirements and mechanisms within the current project approval which were based on the outcomes of previous studies. These include most of the dwellings of Maison Dieu (eg at Shearers Lane and Knodlers Lane), as identified in the project approval Table 1 and Table 4. Controlling noise at the receiver has been further considered and properties have been identified where treatment to dwellings would be made available in addition to those already treated.
- Noise mitigation along the transmission path was also considered and found to be, in most cases, ineffective for the residences of Maison Dieu and Jerrys Plains given either the relatively flat open and low lying terrain between the site and residences (ie Maison Dieu), or existing topography that already offer obstruction (ie to Jerrys Plains). To that end, topography or additional mounding has some limitations in noise abatement (unless the activity is undertaken in close proximity to the mounding) during adverse weather, which is when it is needed most.

- Mitigation through mine design - Noise mitigation was also considered during the mine design process and improvements were identified to reduce noise for the residents in Maison Dieu. The mine design process (as described in Section 3.3 of the EA) comprised key features enabling reduction of potential noise generation to private dwellings in Maison Dieu. This was afforded through the emplacement of material further north in the Cheshunt emplacement areas away from Maison Dieu. The design of this emplacement also includes a hauling and dumping strategy behind a noise bund. The noise bund is constructed on the outer face of the emplacement during non adverse noise generating conditions (ie when the wind is blowing away from receptors or during the day). Dumping behind the protection of the noise bund would occur during adverse conditions. An existing east west haul route in a valley between the Cheshunt emplacement and the rehabilitated Lemington overburden emplacement was also identified as a noise transmission pathway to Maison Dieu. This noise transmission pathway is designed to be blocked with the strategic emplacement of overburden to fill in the valley. These design principles to avoid and mitigate environmental and amenity impacts were communicated to HVO Community Consultative Committee in November 2016.

3.2 Monitoring

Coal & Allied conducts both routine attended monthly noise monitoring and real time noise monitoring at representative residences. The attended monitoring is used to report on compliance in accordance with the site's project approval conditions.

Coal & Allied has recently invested in new technology with respect to real time noise monitoring at Jerrys Plains, adopting the latest directional monitoring hardware, the 'Noise Compass'. Together with real time monitoring in Maison Dieu and attended monthly monitoring, this constitutes all feasible and reasonable noise management at this time, which will be reviewed on an ongoing basis to ensure leading available practices are adopted as part of the proposed modification. The real time monitoring network is linked to the HVO Mine Monitoring and Control Team, providing alerts on an "as required" basis when noise levels exceed internally derived triggers. Following receipt of an alarm, an investigation is undertaken, with actions implemented to ensure noise levels are managed below regulatory criteria.

With respect to blasting, HVO operates a network of five blast monitors located at nearby privately owned residences which function as regulatory compliance monitors.

Within 24 hours of a blast being 'fired' the drill and blast engineer interrogates the results across relevant blast monitors. Should any results on regulated compliance monitors record a reading higher than 115 dB(L) or 5mm/s, an investigation is conducted.

All blasting is conducted between 7 am and 6 pm Monday to Saturday. Suitable systems are employed to ensure near neighbours are informed of the HVO Blasting schedule.

HVO also liaises with neighbouring mines to coordinate planned blasting times to offset impacts to the community. Drill and blast design is used to minimise the airblast overpressure and ground vibration on neighbours.

HVO also use 'blasting permissions', which are Coal & Allied derived wind speed and direction restrictions that limit blasting when these factors have the potential to cause offsite annoyance or impact. Where possible, blasts are delayed until favourable weather conditions exist to mitigate blasting impacts.

3.3 Compliance history

Compliance monitoring for HVO South has been undertaken via routine compliance assessment from 2009 to present. In more recent years, monitoring has included low frequency noise assessment.

An assessment of monitoring data (publically available via the Rio Tinto Coal Australia website www.riotintocoalaustralia.com.au) demonstrates that operations have predominantly been compliant with noise criteria in the period since the granting of the project approval (PA 06_0261).

Non-compliant noise measurements account for a small percentage of the monitoring dataset at 1.16 per cent ($L_{Aeq,15min}$, seven non-compliances measured from 601 individual assessments undertaken) and 2.86 per cent ($L_{A1,1min}$, 16 non-compliances measured from 560 individual assessments undertaken). These are shown in Table 3.1 and Table 3.2. These tables also demonstrate that there are no sustained exceedances.

Table 3.1 Summary of noise measurements for HVO South (2009 to 2015)

Total measurements (2009-2015, $L_{Aeq, 15min}$)	601
Total measurements (2009-2015, $L_{A1,1min}$)	560
Total number of exceedances (2009-2015, $L_{Aeq, 15min}$)	7
Total number of exceedances (2009-2015, $L_{A1,1min}$)	2
Total number of non-compliances (2009-2015, $L_{Aeq, 15min}$)	7
Total number of non-compliances (2009-2015, $L_{A1, 1min}$)	16
Percentage of non-compliant measurements (2009-2015, $L_{Aeq, 15min}$)	1.16%
Percentage of non-compliant measurements (2009-2015, $L_{A1, 1min}$)	2.86%

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2dB allowable tolerance listed in Chapter 11 of the INP.

Table 3.2 Yearly breakdown of noise measurements for HVO South

	2009	2010	2011	2012	2013	2014	2015
Total number of measurements ($L_{Aeq, 15min}$)	71	114	90	75	85	75	91
Total number of measurements ($L_{A1,1min}$)	43	114	90	74	85	74	80
Total number of exceedances ¹ ($L_{Aeq, 15min}$)	1	3	0	1	1	1	0
Total number of exceedances ¹ ($L_{A1,1min}$)	1	0	0	1	0	0	0
Total number of non-compliances ($L_{Aeq, 15min}$)	1	2	3	0	0	0	1
Total number of non-compliances ($L_{A1,1min}$)	0	8	4	0	2	0	2
Non-compliant measurements (% $L_{Aeq, 15min}$)	1.41	1.75	3.33	0	0	0	1.10
Non-compliant measurements (% $L_{A1,1min}$)	0	7.02	4.44	0	2.35	0	2.5

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2 dB allowable tolerance listed in Chapter 11 of the INP.

4 Properties surrounding the mine

A total of 163 (predominantly privately owned residences) assessment locations potentially exposed to noise from the proposal were identified. Two of these are non-residences (Warkworth Hall and St Phillips Church, also in Warkworth). These assessment locations are listed in Appendix A and illustrated in Figure 4.1. It is noted that the ERM (2008) EA assessed 22 representative assessment locations. The current study therefore provides a considerable expansion on the number of assessment locations and these are numbered in accordance with the numbering system adopted in the EA which is consistent with all supporting technical studies of the proposed modification.

The assessment locations include properties in Maison Dieu to the east, Warkworth to the south, Jerrys Plains Road to the south-west, Jerrys Plains to the west and others further afield (eg Gouldsville, Long Point Road to the south-east and south-west of Camberwell village).

It should be noted that mine owned properties are not included in this list. Such mine owned properties can be vacant or tenanted via tenancy agreements with the mines relating to noise amenity or other emissions. Mine owned residential properties therefore are not considered 'noise sensitive' as defined in the INP. Further, statutory limits are not set on non-private dwellings/properties by the EPA or NSW Department of Planning and Environment (DP&E).

Further, the INP states:

It will be used as a guide by Environment Protection Authority (EPA) officers for setting statutory limits in licences....

The locations of residences were identified by the proponent using land ownership registrations, aerial photographic images and, where possible, verification in the field limited to publicly accessible locations. Notwithstanding, the assessment locations identified are considered representative of all residential locations and catchments surrounding the site.



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5 Noise and vibration criteria

5.1 Project approval (PA 06_0261)

Existing criteria for the approved HVO South activities, are outlined in Schedule 3 of the project approval (PA 06_0261) dated 24 March 2009 (and last modified 31 October 2012). These criteria were derived by adopting INP principles. It should be noted that the operations assessed in this study are additional to those in previous assessments. The previously approved operations will continue for a time before the operations of the subject modification eventuate. Hence, project consent limits need to be maintained into the future.

5.1.1 Noise

Since the project approval (PA 06_0261) was granted in 2009, Coal & Allied has consolidated its dataset for sensitive receptors surrounding its operations in the Hunter Valley (ie HVO and MTW). Therefore, the receptors presented in Table 5.1 to 5.3 show both the new identifier (New ID) as well as the identifier within the project approval (PA 06_0261). Also since the project approval the VLAMP was released (DP&E 2014) and hence is used to contemporise the criteria as appropriate.

Schedule 3, Table 2, of the project approval (PA 06_0261) nominates operational noise impact assessment criteria. This was adopted for the basis of the operational criteria in Table 5.1.

Table 5.1 Noise impact assessment criteria

Locality	PA reference	New ID	PA ID	Noise limits, dB			
				Day/Evening/Night			Night $L_{A1,1\text{minute}}$
				$L_{Aeq,15\text{minutes}}$			
Day	Evening	Night					
-	Hunter Valley Glider Club (HVGC) ¹	-	-	55 (when in use)			-
Warkworth							
	Kelly	77 ²	45	43	43	43	45
All other privately-owned residence in Warkworth village	-	-	-	43	43	43	45
Warkworth Hall ²	-	102	-	65 (when in use)			-
St Phillips Church ²	-	264	-	40 (internal, when in use)			-
Maison Dieu	Shearers Lane	160 ³ , 161, 162, 163, 256, 258, 260, 261	5, 61, n/a, n/a, 47, n/a, n/a, n/a	41	41	41	45
Maison Dieu	-	121 ³ , 123	34, 50	40	40	40	45
	Within 250m of 24	120, 122, 124 ³	n/a, 56, 24	39	39	39	45

Table 5.1 Noise impact assessment criteria

Locality	PA reference	New ID	PA ID	Noise limits, dB			
				Day/Evening/Night			Night $L_{A1,1\text{minute}}$
				$L_{Aeq,15\text{minutes}}$			
Day	Evening	Night					
Maison Dieu	Within 1km of Shearers lane, not otherwise listed in this table	244, 245, 246, 247	n/a	37	37	37	45
Jerrys Plains Rd	Smith	309	36	36	36	36	45
	Jerrys Plains Rd other than Smith	-	-	35	35	35	45
Jerrys Plains	Jerrys Plains village residences	-	-	35	35	35	45
All other privately owned residences				35	35	35	45

Notes:

- Noise impacts at HVGC are to be assessed in the immediate vicinity of its residential facilities and/or clubhouse. Noise impact assessment limits are only applicable during times of use that have been notified by Hunter Valley Gliding Club (HVGC) to the proponent. As required by Conditions 47 to 49 of Schedule 3 of the project approval (PA 06_0261), Coal & Allied has an agreement in place with the HVGC and prepared an Amenity Management Plan in consultation with the HVGC.
- Noise criteria were not specifically included in the PA and hence are derived as per the INP amenity criteria (ie $L_{Aeq,period}$) for a commercial receiver and place of worship for the hall and St Phillips Church respectively. In reality, the resulting noise level will be the lowest criteria achievable by the proposal in this locality (eg if the 40 dB internal criteria for the church is achieved, this will be the noise level exposure of the hall also, given their proximity to one another).
- The project approval PA 06_0261 nominates at Table 4 land subject to additional mitigation upon request and includes locations 77, 121, 124 and 160.

Schedule 3, Table 3, of the project approval prescribes criteria that if exceeded would require the proponent to acquire the land. These are shown in Table 5.2.

Table 5.2 Land acquisition criteria (PA 06_0261), dB

PA ID/ New ID	Day	Evening	Night
	$L_{Aeq,15\text{minute}}$	$L_{Aeq,15\text{minute}}$	$L_{Aeq,15\text{minute}}$
36/309 - Smith	>43	>41	>41
All Maison Dieu residences	>43	>41	>41
All Jerrys Plains Road residences other than Smith (36/309)	>43	>40	>40
All other privately owned residences	>40	>40	>40

Schedule 3, Table 5, of the project approval prescribes additional noise mitigation criteria, as shown in Table 5.3.

Table 5.3 Additional noise mitigation criteria (PA 06_0261), dB

PA ID/ New ID	Day	Evening	Night
	L _{Aeq,15minute}	L _{Aeq,15minute}	L _{Aeq,15minute}
Maison Dieu residences	39	39	39
36/309 - Smith	39	39	39
Jerrys Plains Road residences except Smith (36/309)	38	38	38
All other privately owned residences	38	38	38

The only remaining properties entitled to acquisition upon request are the two vacant lots owned by Keys (Lot 2 DP 7709905 and Lot 84 DP 753792). Since approval was granted in 2009, the landowner has consolidated these two lots into a single parcel of land, referenced as Lot 84 DP 1124139. This consolidation does not affect the existing acquisition rights. Additional context is provided in Section 5.3 on the current government policy for land acquisition entitlements adopted for the assessment of the proposed modification.

5.1.2 Blasting

Schedule 3, Condition 10, of the project approval prescribes blasting hours of 7 am to 6 pm Monday to Saturday and no blasting on Sundays, public holidays, or at any other time without written approval from the EPA.

Schedule 3, Condition 12, of the project approval permits a maximum of three blasts a day and 15 blasts a week.

i Airblast overpressure

Schedule 3, Condition 7, of the project approval requires blasting at the project to not exceed the criteria in Table 5.4.

Table 5.4 Airblast overpressure impact assessment criteria

Airblast overpressure level, dB(Lin peak)	Allowable exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

ii Ground vibration

Schedule 3, Condition 8, of the project approval requires blasting at HVO South to not exceed the criteria in Table 5.5.

Table 5.5 Ground vibration impact assessment criteria

Peak particle velocity, mm/s	Allowable exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Furthermore, Schedule 3, Condition 9 requires a ground vibration limit of 5 mm/s peak particle velocity at the St Philip's Church and the outbuildings at Archerfield.

5.2 NSW Industrial Noise Policy

The INP provides a framework and process for deriving noise criteria for consents and licences that enables the NSW Environment Protection Authority (EPA) to regulate premises that are scheduled under the NSW *Protection of the Environment Operations Act 1997* (POEO Act). The INP objectives are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving project specific noise levels (PSNLs);
- to promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP provides two criteria to assess industrial noise sources, namely, the intrusiveness criteria and the amenity criteria.

5.2.1 Assessing intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dB above the measured background level (L_{A90}).

5.2.2 Assessing amenity

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry must be quantified. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion.

An extract from the INP that relates to the residential amenity criteria relevant to the HVO South is given in Table 5.6.

Table 5.6 Residential amenity criteria - recommended L_{Aeq} noise levels from industrial noise sources

Type of receptor	Indicative noise amenity area	Time of day ¹	Recommended $L_{Aeq(Period)}$ noise level, dB	
			Acceptable	Recommended maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Notes: 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 to 6 pm; Evening 6 pm to 10 pm; Night-time 10 pm to 8 am.

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

5.2.3 Project specific noise levels

PSNL criteria for a development's operation are equal to the lower of the derived intrusiveness and amenity criteria.

For the subject site, and as is always the case for mining projects in our experience, the PSNL is the intrusiveness criteria. The project approval operational noise limits presented earlier in Table 5.1 are intrusiveness criteria, being based on the $L_{Aeq,15minute}$ noise metric and have been derived from application of the INP.

The Director-General's Environmental Assessment Report (February 2009) adopts PSNLs (at Table 3) from the Riverview consent, which it considers is still relevant as follows:

Maison Dieu residences	36 $dBL_{Aeq,15minute}$
Warkworth (closest residences)	36 $dBL_{Aeq,15minute}$
Jerrys Plains village (closest residences)	35 $dBL_{Aeq,15minute}$
All other privately owned land	35 $dBL_{Aeq,15minute}$

The above PSNLs are considered conservative given possible influences from other neighbouring operations. For example, the Jerrys Plains PSNL of 35 dB is based on adopting the lowest possible according to the INP. Notwithstanding, these PSNLs have resulted in the current project approval noise limits and therefore adopt the INP approach.

5.3 Voluntary Land Acquisition and Mitigation Policy

The *Voluntary Land Acquisition and Mitigation Policy* (VLAMP, November 2014) seeks to balance acquisition and mitigation obligations for mining operators that provide appropriate protections for landholders, where impacts are significant. The VLAMP states:

The Government has established a range of policies and guidelines to guide the assessment of the potential impacts of mining, petroleum and extractive industry developments in NSW. These policies and guidelines include assessment criteria to protect the amenity, health and safety of people. They typically require applicants to implement all reasonable and feasible avoidance and/or mitigation measures to minimise the impacts of a development.

In some circumstances however, it may not be possible to comply with these assessment criteria even with the implementation of all reasonable and feasible avoidance and/or mitigation measures. This can occur with large resource projects – such as large open cut mines - where the resources are fixed, and there is limited scope for avoiding and/or mitigating impacts.

However, it is important to recognise that:

- Not all exceedances of the relevant assessment criteria equate to unacceptable impacts;
- Consent authorities may decide that it is in the public interest to allow the development to proceed, even though there would be exceedances of the relevant assessment criteria, because of the broader social and economic benefits of the development; and
- Some landowners may be prepared to accept higher impacts on their land, subject to entering into suitable negotiated agreements with applicants, which may include the payment of compensation.

Consequently, the assessment process can lead to a range of possible outcomes.

Figure 5.1 provides the general decision making process that will be applied by consent authorities at the development application stage when assigning voluntary mitigation and acquisition obligations.

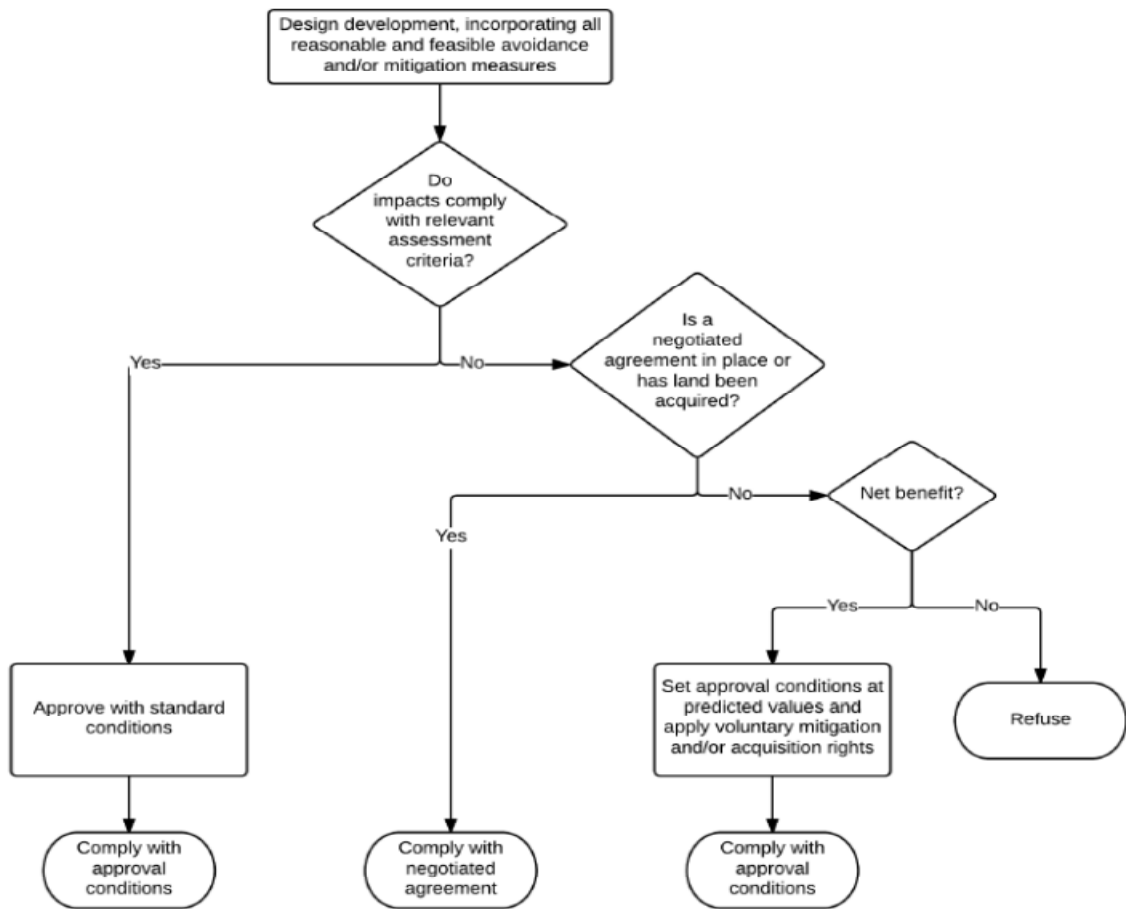


Figure 5.1 General approach to decision making during the assessment process

5.3.1 Characterisation of noise impacts

Voluntary mitigation and acquisition rights in the VLAMP are assigned to privately owned dwellings based on the level of predicted noise above the project noise criteria, or the PSNL. This is explained in Table 5.7.

Table 5.7 Characterisation of noise impacts and potential treatments

Residual noise exceeds INP criteria by	Characterisation of impacts	Potential treatment
0-2 dB(A) above the PSNL	Impacts are considered to be negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3-5 dB(A) above the PSNL in the INP <u>but</u> the development would contribute less than 1 dB to the total industrial noise level	Impacts are considered to be marginal	Provide mechanical ventilation / comfort condition systems to enable windows to be closed without compromising internal air quality / amenity.

Table 5.7 Characterisation of noise impacts and potential treatments

Residual noise exceeds INP criteria by	Characterisation of impacts	Potential treatment
3-5 dB(A) above the PSNL in the INP <u>and</u> the development would contribute more than 1 dB to the total industrial noise level	Impacts are considered to be moderate	As for marginal impacts but also upgraded façade elements like windows, doors, roof insulation etc. to further increase the ability of the building façade to reduce noise levels.
>5 dB(A) above the PSNL in the INP	Impacts are considered to be significant	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions.

The impact characterisations likely to apply to the proposed modification are any of the above.

5.3.2 Acquisition of privately owned land

The VLAMP provides noise acquisition criteria for privately owned land parcels. The policy assigns acquisition rights if the noise generated by a development contributes to an exceedance of the recommended maximum noise levels in Table 2.1 of the INP on more than 25 per cent of any privately owned land, where a dwelling could be built on the land under existing planning controls.

The VLAMP defines land as “...the whole of a lot, including contiguous lots owned by the same landowner”.

For the proposed modification this results in acquisition criteria of 55 dB, 50 dB and 45 dB ($L_{Aeq,period}$) for the day, evening and night periods, respectively, on more than 25 per cent of privately owned land where a dwelling could be built under existing planning controls.

5.3.3 VLAMP application

The relevance and application of the VLAMP to the proposed modification is important. To that end, the VLAMP at page 1 states:

This policy is to be applied by consent authorities when assessing and determining development applications and modification applications for mining, petroleum and extractive industry developments subject to the State significant development provisions of the Environmental Planning and Assessment Act 1979 (EP&A Act).

According to the above application clause, the VLAMP does not strictly apply to the subject modification as it is not a State significant development.

Furthermore, at page 11 the VLAMP states:

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 non-network rail lines (private rail lines), on or exclusively servicing industrial sites (see Appendix 3 of the RING).

But not:

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

The last point above is relevant to the proposed modification as the changes in noise impacts are marginal as will be demonstrated in Section 6.

Irrespective of the above, the current project approval includes noise criteria that require mitigation or acquisition of properties that were derived on the same or similar principles as the criteria in the VLAMP. Hence, residents will be afforded the same or similar rights under the project approval as they would with the more recent VLAMP.

5.4 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) was recently amended and now includes clause 12AB Non-discretionary development standards for mining. The clauses relevant to the proposed modification are listed below.

Clause 12AB(1):

The object of this clause is to identify development standards on particular matters relating to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters (but that does not prevent the consent authority granting consent even though any such standard is not complied with).

Clause 12AB(3) Cumulative noise level:

The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings.

Other clauses of interest for this project are listed below.

Clause 12AB(5) Airblast overpressure:

Airblast overpressure caused by the development does not exceed:

- (a) 120 dB (Lin Peak) at any time, and
- (b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

Clause 12AB(6) Ground vibration:

Ground vibration caused by the development does not exceed:

- (a) 10 mm/sec (peak particle velocity) at any time, and
- (b) 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.

The above clauses are consistent with the project approval and are considered in Section 6.

6 Operational noise impact assessment

6.1 Overall approach

The objective of the modified project in noise terms is to achieve the existing criteria as shown in Schedule 3 of the project approval (PA 06_0261), as provided in Section 5, and otherwise to comply with the requirements of the INP. To that end, Section 10 of the INP provides a methodology for the assessment of a project where a modification is proposed to an existing operation.

In accordance with the INP, this noise impact assessment has:

- identified the noise sensitive locations likely to be affected by activities from the proposed modification (Section 4);
- identified all noise sources of the project and their emission characteristics (Section 6.3);
- identified times of operations (Section 6);
- considered the influence of prevailing meteorology (wind and temperature inversions) (Section 6);
- applied feasible and reasonable noise mitigation as described in Section 3;
- determined the noise levels at potentially the most affected assessment locations during prevailing adverse weather conditions and compared these to the existing project approval noise conditions (Section 6); and
- where residual noise levels remain, identified further ameliorative measures to be adopted (for example, operational noise management of plant as considered in the HVO South Coal Project EA (ERM 2008)) (Section 6.7).

6.2 Noise modelling method

To assess the potential for noise impacts on residences, a total of four indicative mine scenarios have been assessed over the remaining life of the existing project approval (until 2030). These indicative mine plans reflect the worst-case operating scenarios in respect of the potential impacts to surrounding residences. These indicative mine plans are referred to as Stage 1, Stage 2, Stage 3 and Stage 4, corresponding to nominally Year 2019, Year 2022, Year 2026 and Year 2028, each indicating the approximate time after the anticipated commencement date of 2017.

Furthermore, the construction of the Lemington Coal Preparation Plant (LCPP) and associated infrastructure represents a significant investment of capital. This capital is unlikely to be available in current market conditions. The construction of the LCPP, associated infrastructure and the mining of South Lemington Pit 1 are not currently scheduled in the near to mid term planning horizon but are included in the mine plans so that worst case impacts can be modelled.

6.2.1 Stage 1

Extraction has progressed from the Cheshunt Pit to the south-west into the central part and south-eastern parts of Riverview Pit in Stage 1. Mining has ceased to the north of the western portion of Riverview Pit but continues in its south-western corner. There is no active mining in either of the South Lemington Pits at this stage.

Overburden emplacement continues in the Cheshunt Pit and is extended to the north-east. Emplacement has ceased to west of the LCPP envelope and extended in Riverview Pit.

Completed rehabilitation has extended to the northern part of Cheshunt Pit and central portion and north-western section of Riverview Pit and to the west of the LCPP envelope. The area to the north-west of Riverview Pit has been temporarily rehabilitated.

Water storages are as per Stage 1.

6.2.2 Stage 2

Extraction in Stage 2 is focused on the western and south-western parts of Cheshunt Pit, the central and northern areas of Riverview Pit, and a small section in Riverview Pit's south-western corner. Mining has commenced in South Lemington Pit 2, with coal being extracted and hauled for processing. Mining is expected to recommence in South Lemington Pit 1 in the south-western section. South Lemington Pit 1 has been dewatered and is no longer used for water storage.

Overburden emplacements extend further to the south of Cheshunt Pit into the LCPP envelope. Overburden emplacements also extend across the central section of South Lemington Pit 1.

The area of completed rehabilitation continues to expand to the north and east of Cheshunt Pit.

With the exception of the change of use in South Lemington Pit 2, water storage remains as per Stage 1 and 2.

6.2.3 Stage 3

Extraction is limited to the south-western sections of Riverview Pit and the southern section of South Lemington Pit 1. Extraction in Cheshunt Pit and South Lemington Pit 2 has ceased.

Overburden emplacement extends to the southern and western parts of Cheshunt Pit, South Lemington Pit 2 and remains in the central part of South Lemington Pit 1.

Completed rehabilitation extends towards the central parts of Cheshunt Pit.

6.2.4 Stage 4

Extraction in Stage 4 is focused on the south-western section of Riverview Pit. Extraction in all other pits has ceased.

Overburden emplacement extends in the central part of the Riverview Pit.

Completed rehabilitation extends further in Cheshunt Pit and South Lemington Pit 1.

The majority of South Lemington Pit 2 is used for water storage. The south-western part of South Lemington Pit 1, southern section of Riverview Pit and the eastern limit of the approved disturbance area are used for tailings storage.

6.2.5 Indicative mine plans

During operations, alternative mine plans may be used to the indicative plans above, provided that the environmental impacts remain within the envelope as assessed in this EA. The mining operations can therefore retain some flexibility within the constraints of the identified and assessed environmental envelope.

Each indicative mine plan also identifies the approximate location of mining equipment in these typical plausible worst case operational scenarios.

Noise modelling was based on three-dimensional digitised ground contours for the surrounding land, mine pits and overburden emplacement areas for four stages of the proposed modification. The indicative mine plans represent plausible worst case snapshots and equipment was placed at various locations and heights, representing realistic operating conditions in each of these indicative stages of the mine.

The noise model was configured to predict the total L_{eq} noise levels from mining operations based on the sound power levels presented in Table 6.2. These sound power levels are short term L_{eq} values of generally pass-by events and are therefore conservative representations of the INP's assessment metric, the $L_{eq,15minute}$. It should be noted that the model includes the entire spectral emissions for each individual plant item and therefore uses these spectra to predict received levels. This accounts for the spectral characteristics of each source and not just the overall dB(A) level. The results presented assume all plant and equipment to be operating simultaneously and at full power. In practice, such an operating scenario would occur very infrequently.

6.3 Noise modelling parameters

The prediction of noise from the proposed modification was undertaken using the Predictor software by Bruel & Kjaer. The software predicts total noise levels at residences from the concurrent operation of multiple noise sources. The model included consideration of factors such as the lateral and vertical location of plant, source-to-receiver distances, ground effects, atmospheric absorption, topography of the mine and surrounding area and meteorological conditions. This section outlines the base parameters used in the noise modelling.

In EMM's experience on many similar projects, the EPA, has encouraged site specific validation of noise predictions wherever possible to better represent potential impacts from industrial operations. The results of an extensive field validation exercise, part of and as documented in the 2008 noise assessments, were adopted in the current prediction of noise levels for adverse weather. Similar studies have been conducted and results of which published in technical journals (eg *Experimental Outdoor Sound Propagation' 13th International Congress on Sound & Vibration, 2006* and *Experimental Outdoor Sound Propagation vs ENM Australian and New Zealand Acoustic Society Conference, 2007*). These studies concluded that the prediction of L_{eq} noise is consistently overestimated during weather enhanced conditions, a finding also consistent with a NSW Australian Acoustic Society presentation by Dr Robert Bullen in 2009 about such modelling software algorithms.

Furthermore, compliance monitoring completed in April and May 2015 for Maison Dieu and Jerrys Plains was used to verify predictions and 'fine-tune' the noise model to ensure modelled and measured values aligned.

In summary, the modelling is considered to represent off-site noise levels at assessment locations as best as practicably possible.

6.3.1 Equipment noise levels

i Overview

Table 6.1 describes the main noise sources associated with the proposed modification.

Table 6.1 Main noise sources of the proposed modification

Mining activity	Typical plant
Mine	Drills, shovels, front-end loaders, trucks, excavators, dozers, graders, draglines, cable reelers.
Overburden emplacements, rejects emplacement and haul roads	Trucks, dozers, graders.
Coal transportation	Trucks and graders on haul roads; CPP and conveyor; stacker-reclaimer; rail load point; rail loop options at South Lemington Pits 1 and 2.

Sound power levels for equipment modelled are listed in Table 6.2. These are short term pass-by values and therefore a conservative representation of $L_{Aeq,15\text{minute}}$. As noted earlier, the attenuation of trucks is ongoing and adopted emission values in the modelling are the final attenuated levels. This and a combination with operational management will be adopted to operate within noise criteria.

Table 6.2 Equipment sound power levels

Typical item	Model	Representative $L_{Aeq,15\text{minute}}$ sound power level, dB
Dozer	CAT D6	114
	CAT D10T	116
	CAT D11R	118
	CAT D11T	118
	RTD CAT 690	120
Water cart	CAT 777	122
	CAT 785	122
Scraper	CAT 637G	107
Cable Reel ¹	CAT 992	115
Float ¹	Haul Max 3900 - G	122
Loader	Letourneau L-1850	119
Shovel	P&H XPB	118
	P&H 4100	118
Dragline	BE 1370	113
Excavator	Hitachi 5500	118
	Hitachi 5600	118
Drill	Atlas Copco DML60	116
	Atlas Copco PV275	116
	Reeddrill SKSS	116

Table 6.2 Equipment sound power levels

Typical item	Model	Representative $L_{Aeq,15\text{minute}}$ sound power level, dB
Grader	CAT 24H	114
	CAT 14H	114
Crusher (mobile) ¹		123
Coal truck	KOM830E (attenuated)	117
Haul truck	DRESSER 830E (attenuated)	117
	KOM830E 240T AC (attenuated)	117
CPP ¹		113
Locomotive ¹		106
Conveyor ¹		110
Conveyor driver ¹		100
Infrastructure area (MIA) ¹		117

Notes: 1. The sound power level for these items are based on EMM's database for similar plant.

ii Attenuation of plant

Coal & Allied has committed to fit all new trucks purchased for use on the site with noise suppression (or attenuated) attenuation kits. The existing fleet of trucks on site will continue to be progressively fitted with suitable noise attenuation packages to achieve a final sound power level of 117 dB L_{Aeq} .

Currently site operations with existing plant and equipment sound power levels are managed to within criteria by modifying operations. For example, plant and equipment can be relocated or “parked up” during adverse weather conditions if noise levels are measured above criteria. This practice will continue throughout the progressive attenuation programme.

6.3.2 Mining equipment schedule

The typical equipment schedules for the four modelled indicative mining scenarios are presented in Table 6.3 and the modelled location of mining equipment is detailed in Appendix B. The figures in parenthesis (in Table 6.3) represent the fleet quantities during worst case prevailing meteorological conditions. This was only needed for specific items as shown and for when emissions required management during adverse weather. As shown the fleet changes are relatively modest and only apply during Stages 3 and 4 of the proposed modification.

Table 6.3 Modelled typical mining equipment schedule

Equipment	STG 1	STG 2	STG 3	STG 4
Coal haul truck	18	18(10)	24	24
Waste haul truck	63	76(61)	56(48)	32
Water cart	3	3	3	3
Drill	6	6	4	3
Shovel	2	2	2	1
Dozer	20	22(19)	21(18)	13
Rubber tyre dozer	2	2	2	1

Table 6.3 Modelled typical mining equipment schedule

Equipment	STG 1	STG 2	STG 3	STG 4
Dragline	1	1	1	1
Grader	3	3	2	2
Loader	2	2	2	1
Excavator	6	9	5	2
Float	1	1(0)	1(0)	1
Scraper	2	2	2	2
Cable reel	1	1	1	1
Road trucks (rail)				6
Infrastructure area:				
CPP	N/A	N/A	1	1
Reclaimer	N/A	N/A	1	1
Crusher/Feed bin	1	1	1	
Conveyor				4
Conveyor drivers				4
Rail construction	N/A	2(0)	2(0)	N/A
Locomotives				2

Notes: 1. The numbers in brackets () represent the reduced and/or re-positioned fleet numbers initiated during worst case prevailing conditions.

6.4 Predicted noise during calm weather - mitigated operations

Operational noise levels to residences were determined for periods with no wind or temperature gradients, which are termed SI (Still Isothermal) or 'calm' conditions. Values for air temperature and relative humidity used in the noise modelling were 20°C and 70 per cent for day, and 10°C and 90 per cent for evening and night periods.

The $L_{Aeq,15min}$ noise levels at assessment locations resulting from mining operations during calm conditions for day, evening and night periods are presented in Appendix C.

Notably, operational noise levels were predicted to comply with the project approval conditions for all assessment locations during calm meteorology for day, evening and night periods.

6.5 Predicted noise during 'prevailing' meteorological conditions

The INP provides guidance on how noise due to varying meteorological conditions is to be assessed. The procedure is based on identifying and combining worst case meteorological conditions at the site (referred to as the 'prevailing meteorology') and assessing the noise levels against the relevant limits.

During wind and temperature gradient conditions, noise levels at residences 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 ground. The level of noise received increases when the wind blows from source to assessment locations or under temperature inversion conditions, and conversely, decreases when the wind blows from receivers to source or under temperature lapse conditions.

Despite the increase in noise at properties caused by adverse winds, ambient noise also increases during such weather conditions (due to wind induced vegetation noise for example) and mine noise can be masked.

6.5.1 Assessment of potential for temperature inversions

The pasquil stability class represents the degree of mixing in the atmosphere, and can be used to gauge the presence and magnitude range of temperature inversions. Stability classes are categorised from Class A to Class G. Stability Class A applies under sunny conditions with light winds when dispersion is most rapid. Stability Class D applies under windy and/or overcast conditions when dispersion is moderately rapid and Stability Class F and G occur at night when winds are light. Stability Classes B, C and E represent the presence of intermediate conditions. Temperature inversions may occur during Classes E, F and G. In particular, Class F generally represents a range of temperature gradients from 1.5°C/100 m up to less than 4°C/100 m.

Records of wind speed, wind direction and sigma-theta (σ - used to approximate pasquil stability classes) were acquired from the Coal & Allied Cheshunt automatic weather station (AWS) for the 2014 calendar year (the latest full year available at the time). A comparison of data from other neighbouring weather stations was undertaken and it is considered that this data are representative for the site and surrounds (Todoroski Air Sciences 2016).

The stability class frequency for the area, as determined from the hourly weather data, is indicated in Table 6.4. The last column indicates that atmospheric stability class F/G occurs for only 7.5 per cent of the winter nights in the area. This is well below the INP's 30 per cent threshold where temperature inversions are considered to be a 'feature' of an area and therefore does not need to be included in a noise impact assessment. Nonetheless, the prediction of noise impacts in this assessment includes consideration of the effects of a 4°C/100m temperature inversion consistent with the recommendations of the INP. This approach is appropriate given the well documented presence of temperature inversions in the broader Hunter Valley region.

Table 6.4 Atmospheric stability class frequency (Cheshunt weather station)

Stability Class	Percentage of occurrence (winter night)
A	0.1
B	0.05
C	0.3
D	79.9
E	12.0
F/G	7.5
Total	100

Notes: 1. This information is based on winter night analysis for 2014 as provided by Coal & Allied from the Cheshunt AWS.

6.5.2 Assessment of prevailing winds for the area

A detailed review of the vector components of the aforementioned hourly wind data (direction and speed) was undertaken in accordance with the INP. The wind directions determined to be a feature of the area in accordance with the INP are summarised in Table 6.5. The cumulative total values indicate wind speed occurrence above the INP 30 per cent threshold, which triggers the requirement for assessment (Section 5.3 of the INP). This is determined by a cumulative arithmetic addition of percentage occurrence values. EMM's wind calculator adopted for the proposal provides results consistent with the EPA's wind calculator (as found on the EPA's website) for defining feature wind directions.

It is demonstrated that the assessable winds occur during the evening and night time, and these specific winds are considered a 'feature' of the area according to the INP.

Table 6.5 Assessed INP meteorological conditions

Scenario	Wind direction	Wind speed (m/s)
Day periods		
1	Calm	0
Evening period		
1	Calm	0
2	E	2.4
3	ESE	2.5
4	SE	2.6
5	SSE	2.6
6	S	2.4
7	SSW	2
Night periods		
1	Calm	0
2	ESE	2.3
3	SE	2.6
4	SSE	2.7
6	S	2.4
7	Inversion	0

6.6 Predicted noise levels

The predicted noise level results reflect operational noise management commitments described in Section 3 and attenuation of trucks. The meteorological conditions in Table 6.5 were used to model mining noise levels. The predictions of mining noise during periods of 'prevailing meteorology' are presented in Appendix C. The results presented in Appendix C are derived from considering the effect of only INP-assessable meteorological conditions (Table 6.5) and not all possible wind conditions that may be experienced at site.

These results are also presented in the form of coloured markers for the four mine stages assessed (refer Figure 6.1 to Figure 6.4) which categorically represent predicted noise levels at assessment locations with respect to the project approval criteria. Assessment locations which meet or marginally exceed criteria are indicated with a black or green marker respectively for the indicative mining stage. Assessment locations with a blue or orange marker represent predicted entitlements to mitigation or acquisition criteria (respectively) for the respective mining stage. These data incorporate all 'prevailing' INP weather conditions (ie calm, INP winds and temperature inversions) for day, evening and night operations, as appropriate. Note that there is only one locality above acquisition noise limits, being the remaining private residence in Warkworth.

A summary of the noise results is provided in Table 6.6 based on the predicted noise levels at all assessment locations (refer to Table C.1 for a full list of noise levels for all assessment locations). The 'All Stages (worst case)' column provides the overall, or outer envelope impacts, which shows (also refer to Figure 6.5) the following with respect to the project approval conditions, which are consistent with the VLAMP. This includes noise emissions from construction plant and South Lemington Pit operations which are unlikely to occur in the medium term as described earlier:

- one property (location 77) entitled to acquisition (in Warkworth), which is currently entitled to mitigation according to the existing project approval and entitled to acquisition due to impacts from other mines;
- 25 properties entitled to mitigation:
 - 17 in Maison Dieu (13 of which are entitled to dwelling mitigation as per the current project approval); and
 - 8 for Jerrys Plains Road (to the east of the village).
- four properties marginally above operational noise criteria (two on Jerrys Plains Road , one in Jerrys Plains and one in Maison Dieu).

The cumulative assessment indicates that the eight Jerrys Plains Road residences to be afforded mitigation rights under the proposed modification are relatively more impacted by other mines (ie the approved Wambo Coal Mine). A review of the recently exhibited environmental assessment (EA) for United Wambo Open Cut Coal Mine Project (Umwelt 2016) was also completed. This shows that of the eight aforementioned Jerrys Plains properties six and two would be afforded acquisition and mitigation rights respectively under the proposed United and Wambo Open Cut Coal Mine Project, should it be approved.

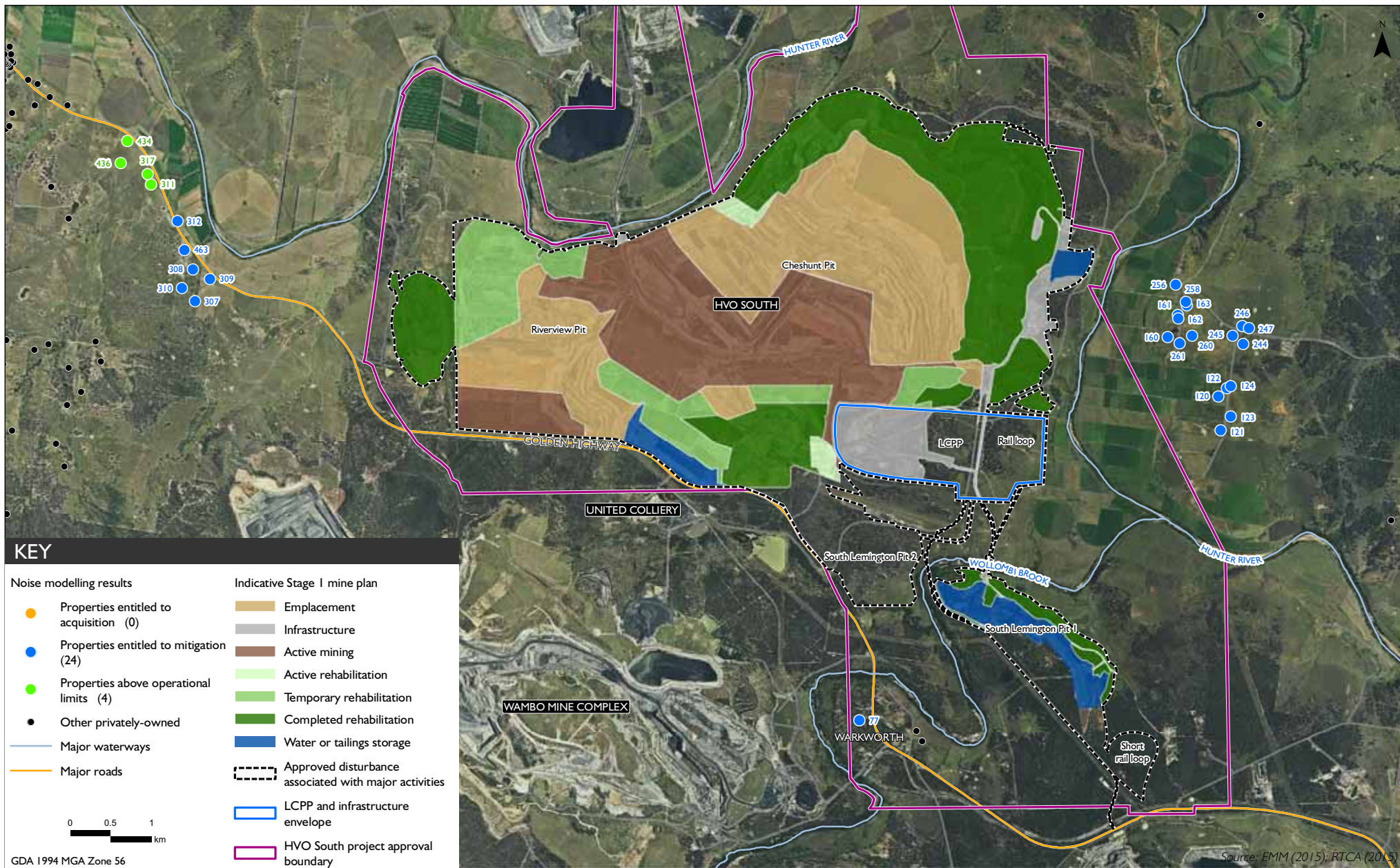
Table 6.6 Number of properties above PA noise conditions (with mitigation)

Description	Stage 1		Stage 2		Stage 3		Stage 4		All stages (worst case)	
	No. of properties	Locale	No. of properties	Locale	No. of properties	Locale	No. of properties	Locale	No. of properties ¹	Locale
Exceeds PSNL by ≤ 2 dB	4	Jerrys Plains Rd	10	Jerrys Plains Rd - 9 Maison Dieu - 1	7	Maison Dieu - 5 Jerrys Plains Rd - 2	4	Jerrys Plains Rd - 3 Jerrys Plains - 1	4	Jerrys Plains Rd - 2 Jerrys Plains - 1 Maison Dieu - 1
Exceeds PSNL by 3 - 5 dB (Entitled to mitigation)	24	Maison Dieu - 17 ³ Jerrys Plains Rd - 6 Warkworth - 1	17	Maison Dieu	21	Maison Dieu - 13 Jerrys Plains Rd - 8	7	Jerrys Plains Rd	25	Jerrys Plains Rd - 8 Maison Dieu - 17 ³
Exceeds PSNL by >5 dB (Entitled to acquisition ¹)	0	-	1	Warkworth	1	Warkworth	1	Warkworth	1 ²	Warkworth
Total	29	-	30		32		14		33	

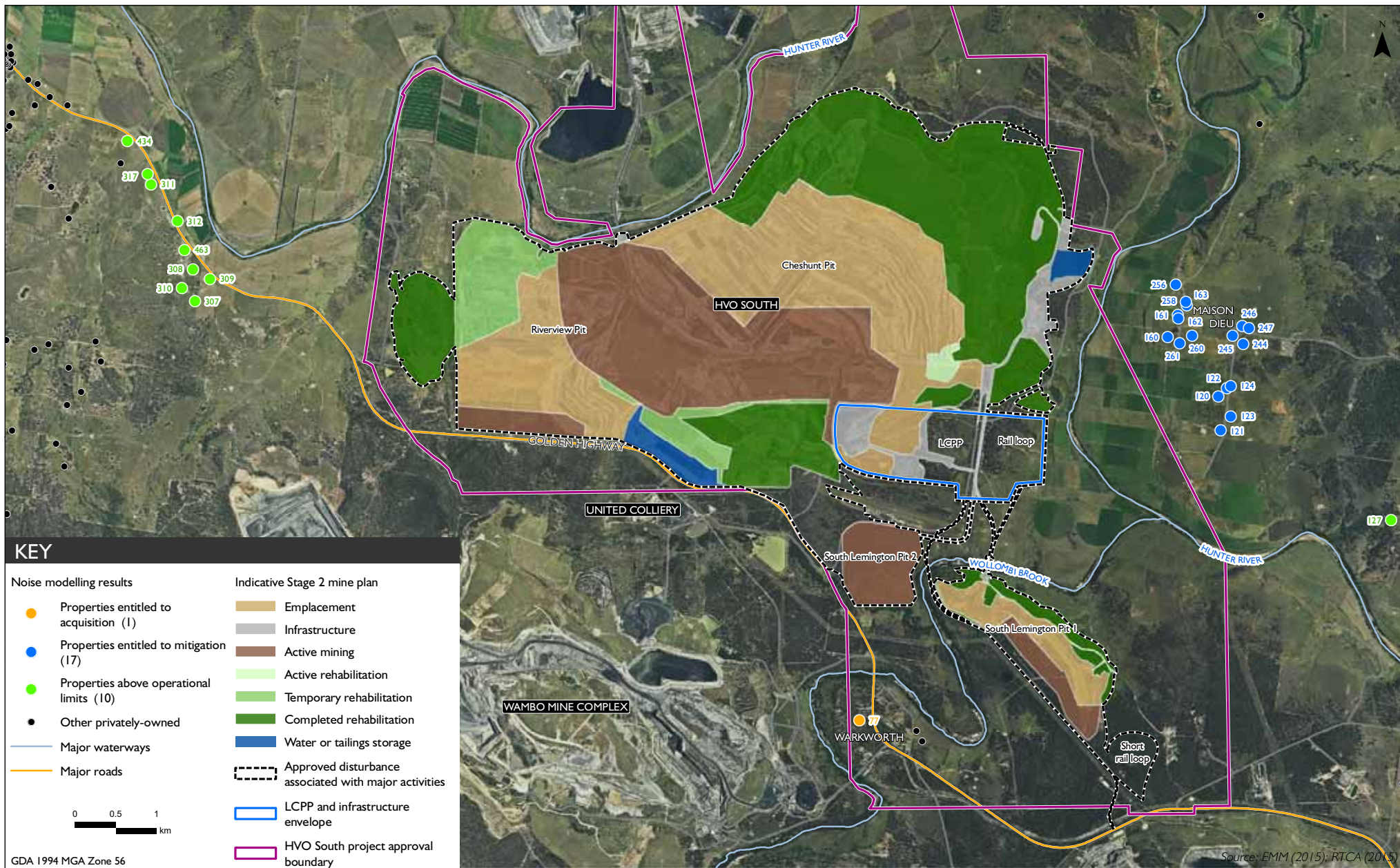
Notes: 1. The 'All stages (worst case)' result categorises properties into the highest impact level. Hence, total properties in the ' ≤ 2 dB' group is lower than that for individual stages (as many were categorised into the '3 - 5 dB' group as worst case).

2. This property (location 77) is entitled to mitigation according to the site's current approval and entitled to acquisition due to impacts from other mines.

3. 13 Maison Dieu properties identified are currently entitled to mitigation in accordance with the existing project approval conditions. An additional four properties (244, 245, 246 and 247) will be afforded mitigation under the proposed modification should it be approved.



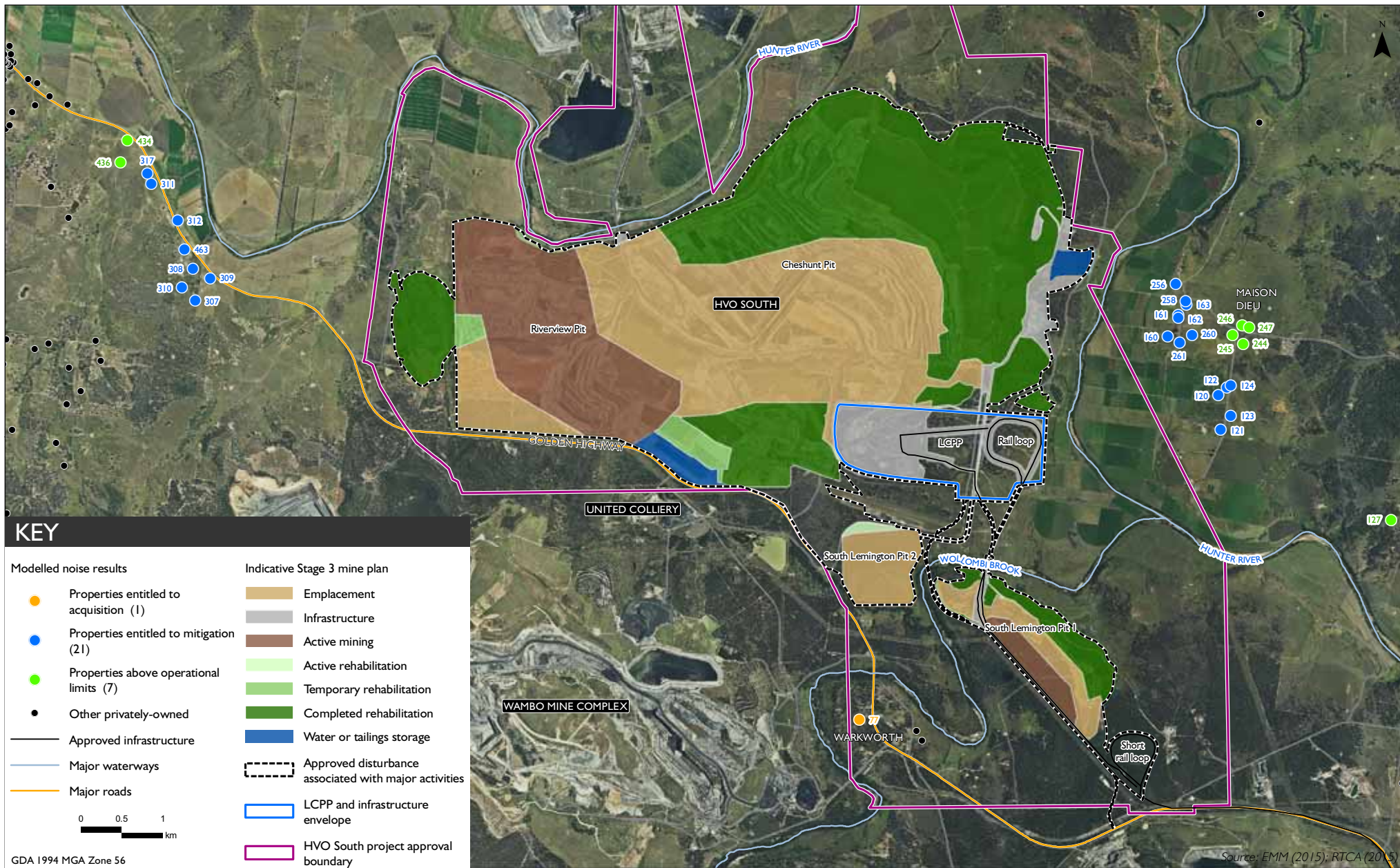
Stage I worst case day, evening and night time operational noise results – INP weather



Stage 2 worst case day, evening and night time operational noise results – INP weather

HVO South Modification 5
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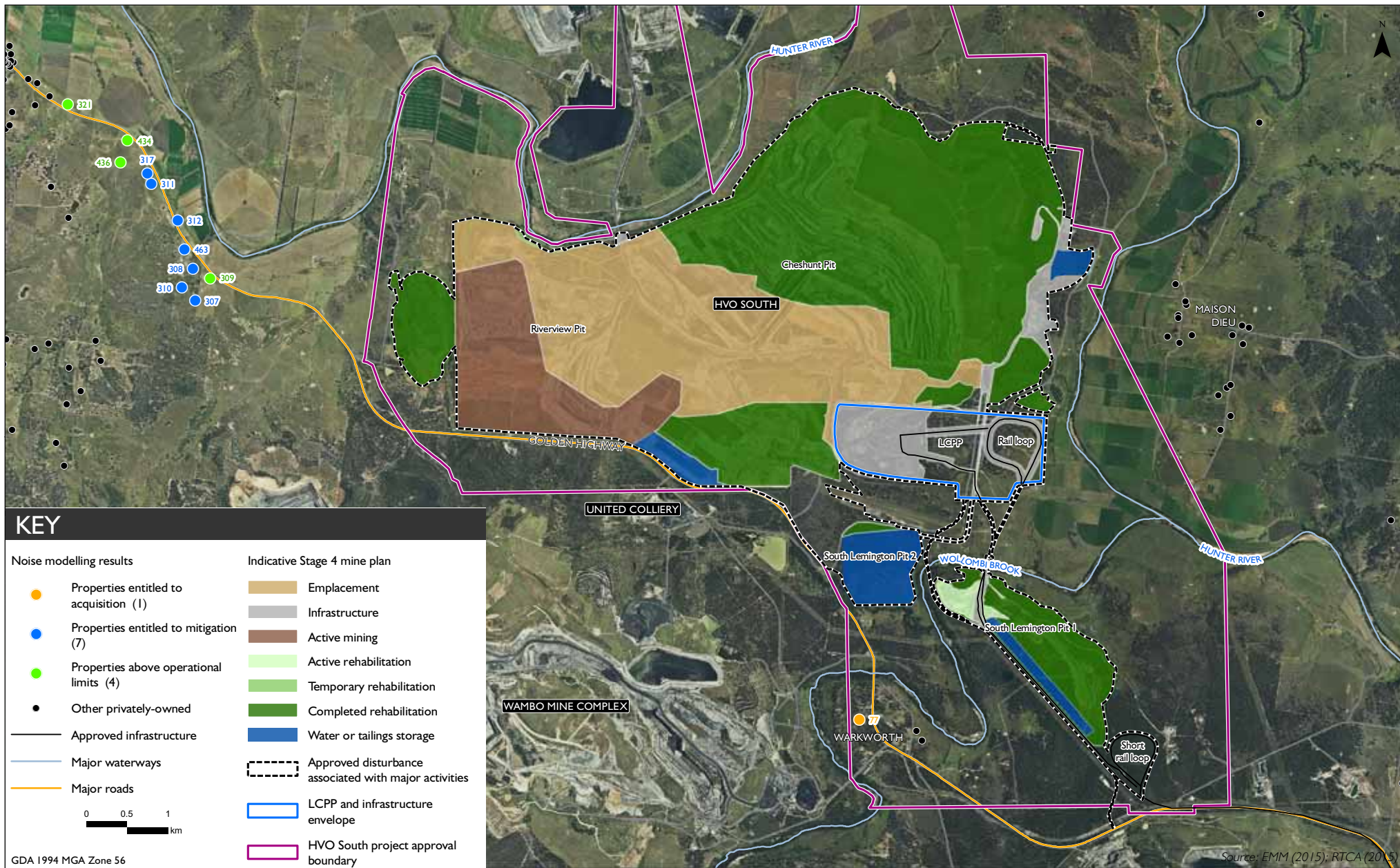
Figure 6.2



Stage 3 worst case day, evening and night time operational noise results – INP weather

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Figure 6.3

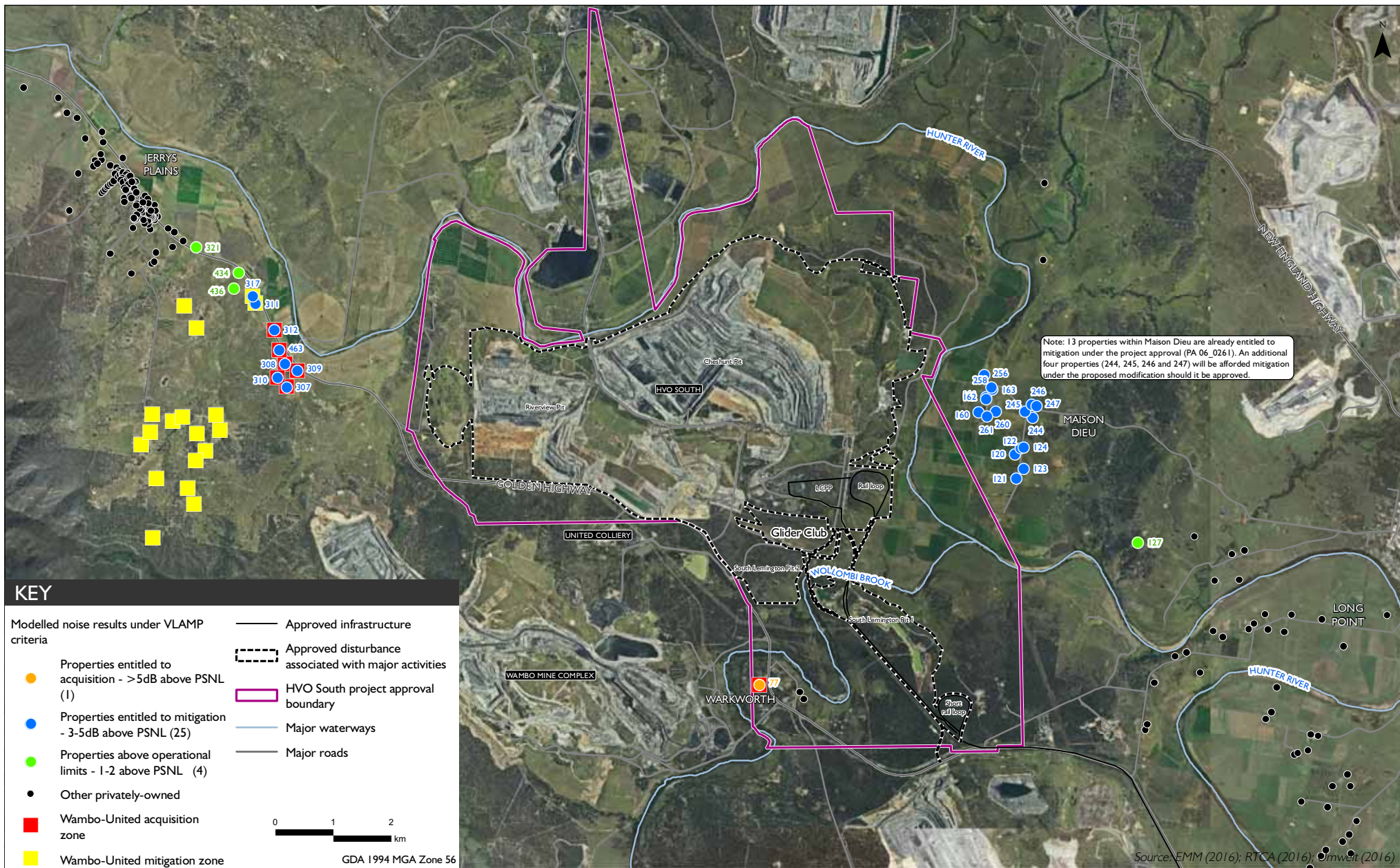


GDA 1994 MGA Zone 56

Source: EMM (2015); RTCA (2015)

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Stage 4 worst case day, evening and night time operational noise results – INP weather



All stages worst case day, evening and night time operational noise results – INP weather

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Figure 6.5

6.6.1 Existing versus proposed modification noise level comparison

To provide some illustration of the likely changes in noise levels due to the proposed modification, one east and one west assessment location were selected for comparison as shown in Table 6.7. The locations were selected to ensure a direct comparison could be made between available measured compliance data and modelled predictions (both from previous studies and the current study).

It should be noted that the tabulated measured compliance noise levels were obtained for various assessable weather conditions. The proposed modification's noise levels account for the mitigated operations as described herein. The 'existing' noise level is sourced from compliance monitoring reports commissioned by Coal & Allied which are conducted and submitted to regulators monthly in accordance with the requirements of the existing project approval.

Table 6.7 Comparison of existing operations and future noise levels, dB L_{Aeq,15minute}

Property		Existing operations noise levels		Proposed modification noise levels	PA Criteria
New ID (PA ID)	Location	Predicted (ERM 2008) ¹	Measured (2015 compliance)	Stage 1, 2, 3, 4	D/E/N
256 (47)	Maison Dieu	41	41 ²	40, 40, 39, 37	41
308 (31)	Jerrys Plains Rd	35	32	38, 37, 39, 38	35

Notes: 1. Predictions from the 2008 study shown are for the highest stage and option modelled.
2. Highest measurement for the year. Measured values are managed to this value and on rare occasion has marginally exceeded it during adverse weather.

The above demonstrates that Maison Dieu residences will be afforded lower noise contributions from the proposed modification, which reduces further as it progresses from Stage 1 to Stage 4 (ie westward and away from these properties). Conversely, noise to the west assessment locations (ie Jerrys Plains Road) is predicted to increase, however levels are not significantly different to current approved operations and will be mitigated (eg by operational management during adverse weather).

6.6.2 Model validation

The noise model adopted applies the same algorithm used for the HVO South Coal Project (ERM 2008), which included a comprehensive onsite validation process for adverse weather conditions. This is documented in the ERM (2008) noise technical report at Annex H (Appendix D).

In addition, predictions for adverse weather conditions from previous noise models developed for HVO South are generally consistent with measured levels (eg within 1 to 2 dB). This has been achieved frequently for compliance monitoring event samples by modelling GPS data provided for all plant at a given 15 minutes in time and the weather conditions during the sampling event.

6.7 Residual level of impact (INP Section 8.2.1)

Section 8.2.1 of the INP lists issues to be considered if predicted noise levels exceed the PSNLs after reasonable and feasible mitigation has been applied. Table 6.8 provides an assessment of residual noise impacts (presented in Table 6.6 and Table C.1) from the proposal.

Table 6.8 Residual level of impact

INP factors for consideration	Justification of the proposal
1. Characteristics of the area and receivers likely to be affected	<p>The majority of the local area surrounding the proposal is characterised by mining and associated infrastructure and agricultural land, mainly pasture, with moderate sized stands of native woodland retained along the steeper hillsides and ridgelines and in patches along creek lines.</p> <p>The proponent owns a substantial area of land surrounding the Site.</p> <p>The Site has been in operation since 1969 and the originally approved mine has been modified several times. Immediately to the south is Warkworth Mine, commissioned in 1981 which has been operating as an integrated complex with Mount Thorley Mine since 2004. The Bulga Coal Complex, which is adjacent to the south of Mount Thorley Warkworth (MTW), was commissioned in the 1980s. Wambo Mine Operations also to the south commenced in 1969.</p> <p>The noise and vibration study predicted noise levels at 163 privately owned assessment locations surrounding the mine. The predicted noise levels are during worst case INP prevailing meteorological conditions and for the majority of the time actual noise levels are likely to be less than those predicted.</p> <p>Of the 163 assessment locations, a total of 30 assessment locations are predicted with noise levels above PSNLs over the life of the mine. Of the 30 assessment locations, four are predicted with minor noise level exceedances (1-2 dB above PSNL), 25 are predicted with moderate noise level exceedances (3-5 dB above PSNL) and one is predicted with significant noise level exceedances (greater than 5 dB above PSNL). Note that 13 of 17 properties in Maison Dieu with predicted moderate noise level exceedances are currently entitled to mitigation in the existing project approval. An additional four properties (244, 245, 246 and 247) will be afforded mitigation under the proposed modification should it be approved. Further, the one assessment location (the only residence, ie location 77) predicted with a significant noise level exceedance has previously been identified in an acquisition zone of a neighbouring mine. This leaves a remaining eight residential assessment locations on Jerrys Plains Road with moderate noise level exceedances due to the proposed modification which accounts for less than 5 per cent of all assessment locations considered. It should be noted that six of these eight additional properties would be afforded acquisition rights and the remaining two would be afforded mitigation rights due to the United Wambo Project (refer to Section 3.2.5), should it be approved.</p> <p>The noise from the proposed modification is predicted to be similar to approved operations for assessment locations to the east (eg Maison Dieu) and marginally higher as the project progresses for western assessment locations. The proposed noise suppression and fleet management will mean the advancement westward will not result in a material increase to noise levels. A cumulative noise assessment in accordance with the INP and Mining SEPP demonstrates criteria will be satisfied for all assessment locations with the exception of location 77 (Warkworth), where current approved mining at Wambo dominates expected noise levels.</p> <p>There is a very large range of human reaction to noise, including those who are very sensitive to noise. This noise-sensitive sector of the population will react to intruding noises that are barely audible within the overall noise environment, or will have an expectation of very low environmental noise levels. On the other hand, there are those within the community who find living in noisy environments, such as near major industry, on main roads or under aircraft flight paths, an acceptable situation. The bulk of the population lies within these two spectrums, being unaffected by low levels of noise and being prepared to accept levels of noise commensurate with their surroundings.</p>

Table 6.8 Residual level of impact

INP factors for consideration	Justification of the proposal
2. Characteristics of the proposal and its noise or vibrations —	<p>The site is an existing and well established mine in the Hunter Valley. The application to modify PA 06_0261 is to allow:</p> <ul style="list-style-type: none"> • the progression of mining to the base of the deeper Bayswater seam from Cheshunt Pit into Riverview Pit and mining to the base of the Vaux seam below the Bowfield seam in South Lemington Pit 2; • a modification to the currently approved overburden emplacement strategy to enable an increase in height in some areas up to 240mAH and incorporation of micro-relief to provide a more natural final landform; • an increased rate of extraction from 16Mtpa to 20Mtpa ROM coal at peak production and an increased processing rate of coal extracted from HVO South from 16Mtpa to 20Mtpa of ROM coal across HVO CPPs; and • the update of the Statement of Commitments within PA 06_0261 with removal of commitments that are redundant or inconsistent with measures prescribed in approved management plans. This includes the transition from prescriptive blasting conditions and replacement with contemporary outcome based conditions. <p>HVO South currently invests significantly in the noise management on the mine and will continue to do so under the proposal. For example, attenuation of all major plant across HVO operations.</p> <p>The assessment has identified that noise levels predicted above PSNLs will occur during worst case prevailing metrological conditions. It has been demonstrated that with continued management of the mine, such as by limiting some plant and equipment operation during adverse meteorological conditions, and implementing equipment fleet with good practice noise suppression, that INP PSNLs can be met for the majority of assessment locations.</p> <p>The noise modelling adopts area specific validation and therefore provides added confidence in the accuracy of predictions. Extensive monitoring to measure compliance would be continued under the proposal.</p> <p>The existing socio-economic benefits of HVO South would continue under the proposed modification including:</p> <ul style="list-style-type: none"> • ongoing direct, indirect and induced employment; • continued community engagement and investment through the HVO CCC and programmes such as the Coal & Allied CDF (formerly known as the Community Trust), sponsorships, donations and the ACDF, with current community contributions commitments being approximately \$5 million for the period between January 2015 and December 2017; and • additional direct economic benefits and flow-on economic effects of HVO South with 21 per cent of revenue to be paid in the form of \$160 million taxes and \$243 million royalties. This proportion is consistent with the ERM (2008) EA. <p>In addition, as described in EA Section 15.3.3, a Near Neighbour Amenity Resource fund will be established and fund works and services to improve amenity for near neighbours. The scope of the programme will be developed in consultation with local stakeholders and will be in addition to the technical mitigation and management solutions outlined elsewhere in this EA.</p>

Table 6.8 Residual level of impact

INP factors for consideration	Justification of the proposal
<p>3. The feasibility of additional mitigation or management measures:</p> <ul style="list-style-type: none"> - Alternative sites or routes for the development - The technical and economic feasibility of alternative noise controls or management procedures 	<p>HVO South is an existing and well established mine in the Hunter Valley and relocation is not reasonable or feasible.</p> <p>The proponent has considered a range of noise management and mitigation measures for the proposal. Those that are considered reasonable and feasible have been included in this assessment. These include a significant investment in providing good practice noise suppression to their equipment fleet (see details in section 6.3.1) and limiting plant and equipment operation during worst case meteorological conditions.</p>
<p>4. Equity issues in relation to:</p> <ul style="list-style-type: none"> - The costs borne by a few for the benefit of others - The long-term cumulative increase in noise levels - The opportunity to compensate effectively those affected 	<p>The proponent will be investing significantly in noise management and mitigation over the life of the proposal which will be of significant benefit to the surrounding communities.</p> <p>The cumulative noise assessment in Section 11 demonstrates that with reasonable and feasible mitigation and management in place that the INP recommended acceptable Amenity noise limits can be achieved for the life of the mine, with the exception of location 77 (Warkworth), where current approved operations at a neighbouring mine operation leads to an exceedance.</p> <p>The proponent will appropriately compensate all assessment locations identified with moderate or significant noise level exceedance as negotiated with DP&E and the community.</p>

6.8 Assessment of potential sleep disturbance

Sleep within residences may be disturbed by intermittent noises such as shovel gates banging, bulldozer track plates and heavy vehicle reversing alarms. Typical noise levels from the loudest of these events are presented in Table 6.9.

Table 6.9 Maximum noise from intermittent sources

Noise source	Measured L_{Amax} noise level, dB
Haul truck pass-by at high revs or dumping load	125
Shovel gate banging	120
Bulldozer with reversing alarm	115

Table 6.9 indicates that the highest maximum noise levels expected at residences would likely result from haul trucks. The maximum sound power level of unmitigated haul trucks has previously been measured to be typically 125 dB L_{Amax} . Maximum noise levels at each residence were calculated under assessable worst case weather for the four indicative stages of operations.

Table 6.10 provides the maximum predicted L_{max} noise levels from the proposed modification under adverse meteorology at select representative assessment locations based on the typical equipment locations used for mining operations. Predictions were based on a single event, rather than the simultaneous operation of a number of plant items because of the low probability of more than one peak noise event occurring concurrently. The criteria used to assess sleep disturbance are based on the project approval criteria, which are consistent with the EPA's requirement for the maximum L_{max} level of 'background noise level plus 15 dB'.

Table 6.10 indicates that predicted noise levels under prevailing weather conditions are within the existing project approval sleep disturbance criterion at all representative assessment locations. It is expected that maximum noise levels at other assessment locations would be similar to or less than those presented, and also satisfying sleep disturbance criteria.

Table 6.10 Predicted maximum noise levels from site under prevailing meteorology

New ID	Location	External L_{Amax} noise level from on-site plant, dB				L_{Amax} criterion, dB
		Stage 1	Stage 2	Stage 3	Stage 4	
307	Jerrys Plains Rd	39	37	39	38	45
321	Jerrys Plains	35	35	35	36	45
160	Maison Dieu	41	41	40	38	45
261	Maison Dieu	41	41	40	38	45
77	Warkworth	40	44	41	44	45

Notes: 1. The L_{eq} operational noise level prediction from Appendix C has been adopted where it is higher than the predicted L_{max} noise level. This is because it is theoretically impossible to measure an L_{eq} greater than the L_{max} . This was the case in most instances. However, the prediction method adopts the maximum noise level from a single source which can result in an L_{max} prediction less than the overall L_{eq} result, which includes all noise sources.

6.9 Other activities

6.9.1 Construction

Construction activities planned for the proposed modification include the Lemington coal preparation plant, rail loop and rail spur. These activities would be undertaken concurrently with mining and most likely during daytime hours only. Noise from these construction activities would be less than that from mining operations and would therefore generally not contribute to the total overall received noise at surrounding residences. Nonetheless, construction activity was modelled together with indicative Stage 2 and Stage 3 mining to represent a worst-case noise scenario during these stages.

6.9.2 Rail traffic

The proposed modification will not result in any net increase in rail traffic above currently approved rail activities servicing HVO. Coal production rate increases are managed as part of the integrated HVO operation. This will essentially result in a balance of coal rail traffic operations, with no net change anticipated.

While noise from rail movements on the rail loop and loading of the wagons has been included and assessed with the industrial noise from the site, noise emissions from the proposed rail spur options were considered separately as required by the Rail Infrastructure Noise Guideline (RING). The RING includes recommended noise levels for non-network rail lines on or exclusively servicing industrial sites within Appendix 3 Table 6. For rural residences the RING recommends acceptable levels of 50dB $L_{Aeq,day}$, 45 dB $L_{Aeq,evening}$ and 40 dB $L_{Aeq,night}$. Recommended maximum levels of 5dB higher than these are also provided.

The proposed modification includes up to two trains (four movements) on the proposed Lemington spur in any 24 hour period, and predictions have assumed a worst case of four movements in any night period. The calculations of $L_{Aeq,night}$ at the closest most exposed residences of Maison Dieu and Warkworth range between 1 dB to 10 dB under adverse weather. This is well below and satisfies the RING acceptable recommended noise level of 40 dB $L_{Aeq,night}$.

The relatively low predictions are due to the averaging period of nine hours for the night assessment period and having only four movements, each likely to take approximately 15 minutes to pass through the spur (ie total of 60 minutes) with the remaining eight hours of the night having no noise contributions.

Other off-site transportation will remain consistent with current operations (eg road traffic).

7 Cumulative noise

This section provides an assessment of cumulative noise from all major industrial sites, so the area's amenity can be assessed against the Mining SEPP's non-discretionary standards, which adopt the INP's acceptable noise levels (ANLs). The amenity criteria provide the over-arching goal, that is, if criteria are achieved, a residence's amenity is not compromised.

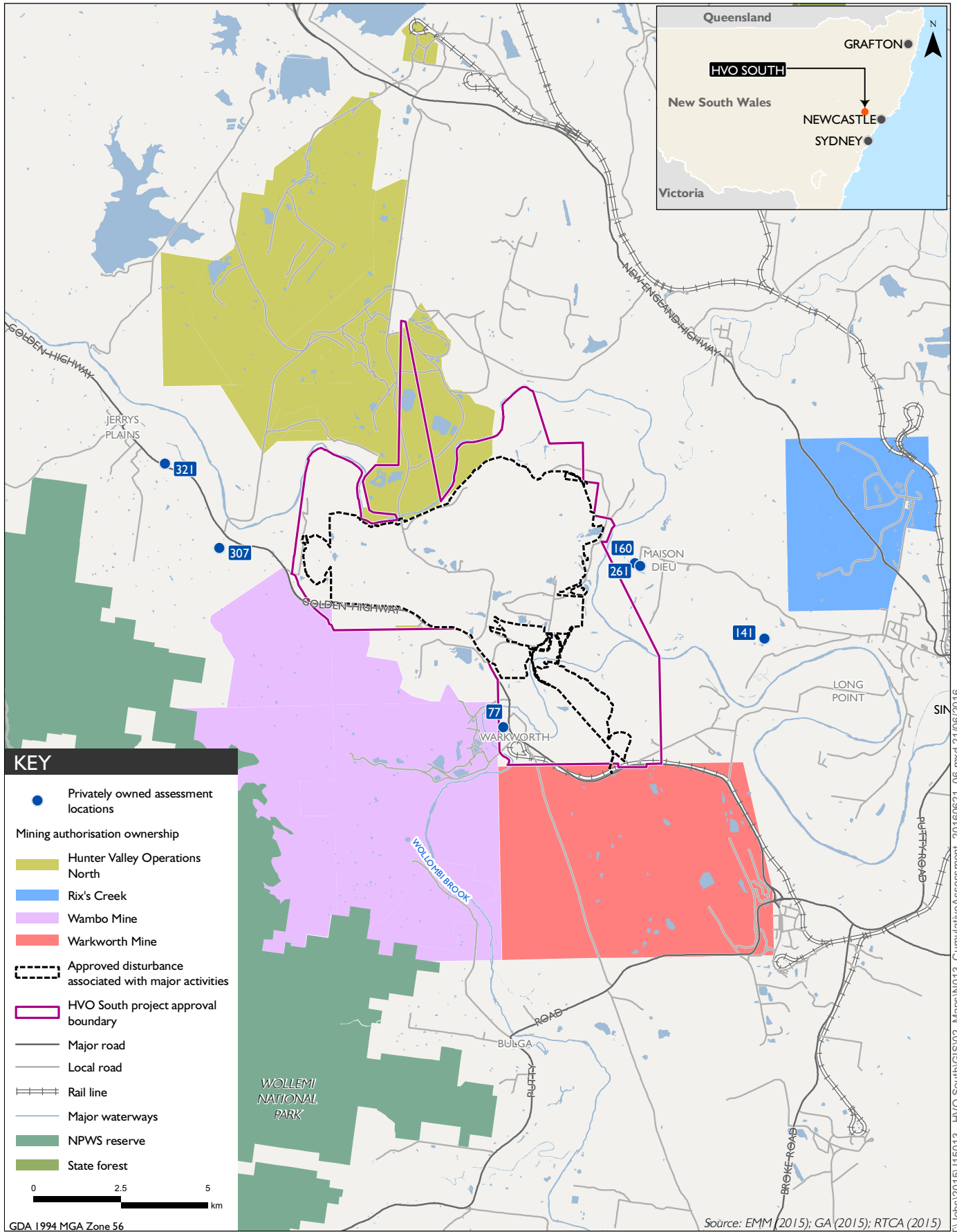
7.1 Cumulative noise assessment approach

The ambient noise at assessment locations in the vicinity of the proposed modification is also influenced by nearby industrial premises, for example, Wambo Mine, United Mine, HVO North, Warkworth Mine and Rix's Creek Mine. Refer to Figure 7.1.

The level of noise at residences from each of these surrounding industries was referenced from the following documents:

- an EIS for the expansion of Wambo Mine (Resource Strategies 2003);
- HVO North - Fine reject emplacement modifications Environmental Assessment (EMM 2013);
- Warkworth Continuation 2014 Environmental Impact Statement (EMM 2014); and
- Rix's Creek Mine - continuation of mining project (AECOM 2015).

Note that a review of the recently exhibited environmental impact statement (EIS) for United and Wambo Open Cut Coal Mine Project (Umwelt 2016) was also completed as discussed earlier.



Surrounding surface operations included in the cumulative noise assessment
 HVO South Modification 5
 Noise Impact Assessment
 Figure 7.1

7.2 Cumulative noise results

The published assessments predict noise levels at residences under both calm and adverse weather conditions. To assess cumulative impacts, the L_{eq} noise levels predicted by this assessment were combined with the L_{eq} noise levels from relevant mining stages of each of the aforementioned assessments.

The cumulative impacts can be predicted for any given mining year, using the conservative approach of combining worst case adverse weather condition noise predictions from each of the operations. In some cases, this is a conservative approach for at least the scenario that for some assessment locations, meteorological conditions required to produce worst case noise levels from one mine will generally be different and are, in some cases, in opposition. For example, while north-westerly winds will serve to increase noise to residences in Warkworth from HVO South and Wambo mine, such winds serve to decrease noise from the Warkworth Mine to these residences.

In light of this, the assessment of cumulative noise impacts was undertaken on the basis of considering the published calm weather results as well as adverse weather. For adverse weather the predictions are based on temperature inversion influences at night. The effects of temperature inversions is to enhance noise from a source in all directions and provides a representative an equitable share in contributions from all sites at a given assessment location. Where temperature inversion data was not specifically published, the published adverse wind scenario is adopted and expected to conservatively represent enhancement due to temperature inversions.

Table 7.1 summarises the cumulative noise levels at residences surrounding HVO South. A subset of representative assessment locations has been used to assess cumulative noise impacts and includes assessment locations potentially most affected by the proposed modification. The results are presented in accordance with the approach described above. To that end, where published assessments do not provide predictions to 2028, the last year of mining that is published was adopted, which assumes operations will continue beyond consented or published years of operation via a modification, for example.

Also presented (in parentheses) within Table 7.1 is the respective percentage contribution to the total cumulative noise level from the site. To estimate $L_{eq,period}$ noise levels from each site, the published $L_{eq,15min}$ predictions were adjusted by subtracting 4 dB to account for changes in operations and weather conditions between a 'prevailing' worst case 15-minute and an average nine hour night period. This adjustment is conservative based on our experience in the field for this and other sites.

The results show that the INP's (and non-discretionary Mining SEPP) acceptable night time criterion (ie 40 dB $L_{Aeq,9hour}$) is satisfied at most locations. The exception is location 77 (Warkworth), where current approved mining at Wambo mine dominates expected noise levels, with relatively insignificant contributions from the proposal (eg 1 to 4 per cent as shown in Table 7.1).

Table 7.1 Cumulative noise at properties, dB L_{Aeq,night}

Assessment location		HVO South mine indicative operating years								INP night time Acceptable Amenity Noise Level (ANL)
		Stage 1 (~2019)		Stage 2 (~2022)		Stage 3 (~2026)		Stage 4 (~2028)		
New ID	Locale	Calm	Adverse	Calm	Adverse	Calm	Adverse	Calm	Adverse	
77	Warkworth	49 (1%)	53 (2%)	49 (1%)	53 (4%)	49 (1%)	53 (2%)	49 (1%)	53 (2%)	45 ²
141	Maison Dieu	32 (2%)	36 (10%)	32 (2%)	35 (19%)	32 (2%)	35 (13%)	32 (1%)	35 (7%)	40
160	Maison Dieu	34 (40%)	39 (73%)	33 (23%)	38 (73%)	34 (37%)	38 (70%)	32 (14%)	36 (59%)	40
261	Maison Dieu	34 (37%)	38 (71%)	33 (21%)	38 (71%)	34 (41%)	38 (71%)	32 (15%)	36 (57%)	40
307	Jerrys Plains Rd	29 (21%)	40 (29%)	28 (11%)	40 (20%)	29 (19%)	40 (29%)	28 (9%)	40 (24%)	40
321	Jerrys Plains	21 (43%)	37 (21%)	20 (29%)	37 (21%)	20 (32%)	37 (23%)	20 (22%)	37 (26%)	40

Notes: 1. Numbers in bold indicates levels above EPA's night Amenity Criterion.
 2. The industrial interface ANL has been adopted for these locations.

7.3 VLAMP assessment of privately owned land

As described in Section 5.3.2, the VLAMP assigns acquisition rights if the noise generated by a development contributes to an exceedance of the recommended maximum noise levels in Table 2.1 of the INP on more than 25 per cent of any privately owned land, where a dwelling could be built on the land under existing planning controls.

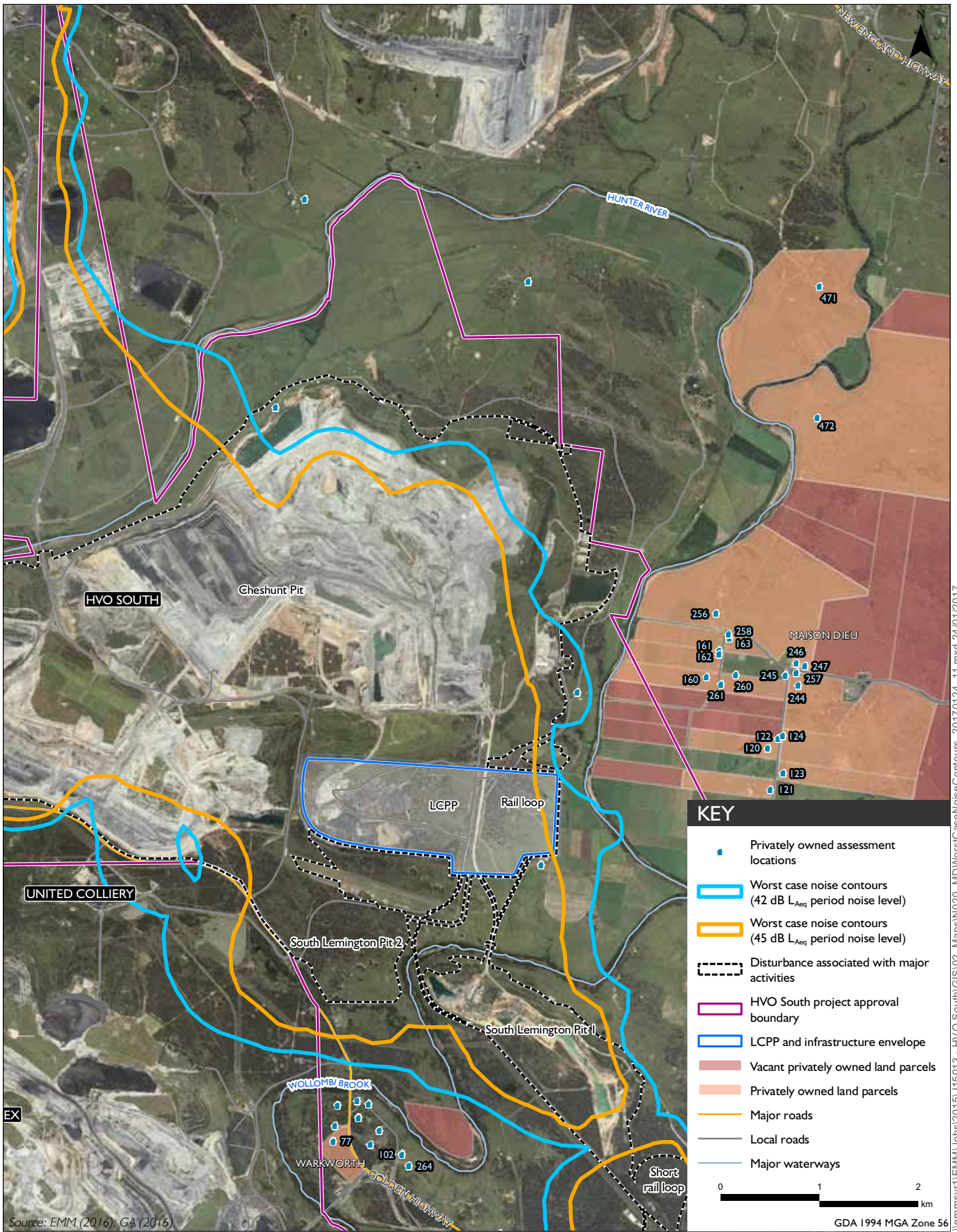
The lateral distribution of mine noise levels has been assessed over vacant and occupied privately owned land parcels presented in Figure 7.2 and Figure 7.3 for areas to the east and west of the site respectively.

The assessment considered predicted noise levels from the modification along with potential cumulative noise levels from other mine operations as described in Section 7.1 and 7.2, as required by VLAMP. The strictest criterion applicable is the night time target of 45 dB $L_{Aeq,9hour}$ from all industrial noise contributors (ie sites). A minus 4 dB adjustment to all predicted worst case $L_{Aeq,15minute}$ noise levels has been applied to represent the $L_{Aeq,period}$ level and to maintain consistency with the cumulative noise assessment.

The assessment adopted a conservative screening method approach. The worst case noise levels in the vicinity of privately owned land parcels was initially determined by reviewing single point noise predictions in Table C.1 and the potential percentage noise level contribution from other surrounding mining operations depicted in Table 7.1. Where a noise level could not be reasonably inferred using a nearby single point prediction (eg vacant parcels in Maison Dieu closer to the modification, refer Figure 7.2), or a potential cumulative noise level approaching VLAMP criteria was identified, the noise level contribution from HVOS operations was calculated by using a high resolution noise prediction grid over the land parcel before combining with noise from other mines. This HVOS (singular) contribution ($L_{Aeq,9hour}$) noise level is contoured as shown in Figure 7.2 and Figure 7.3.

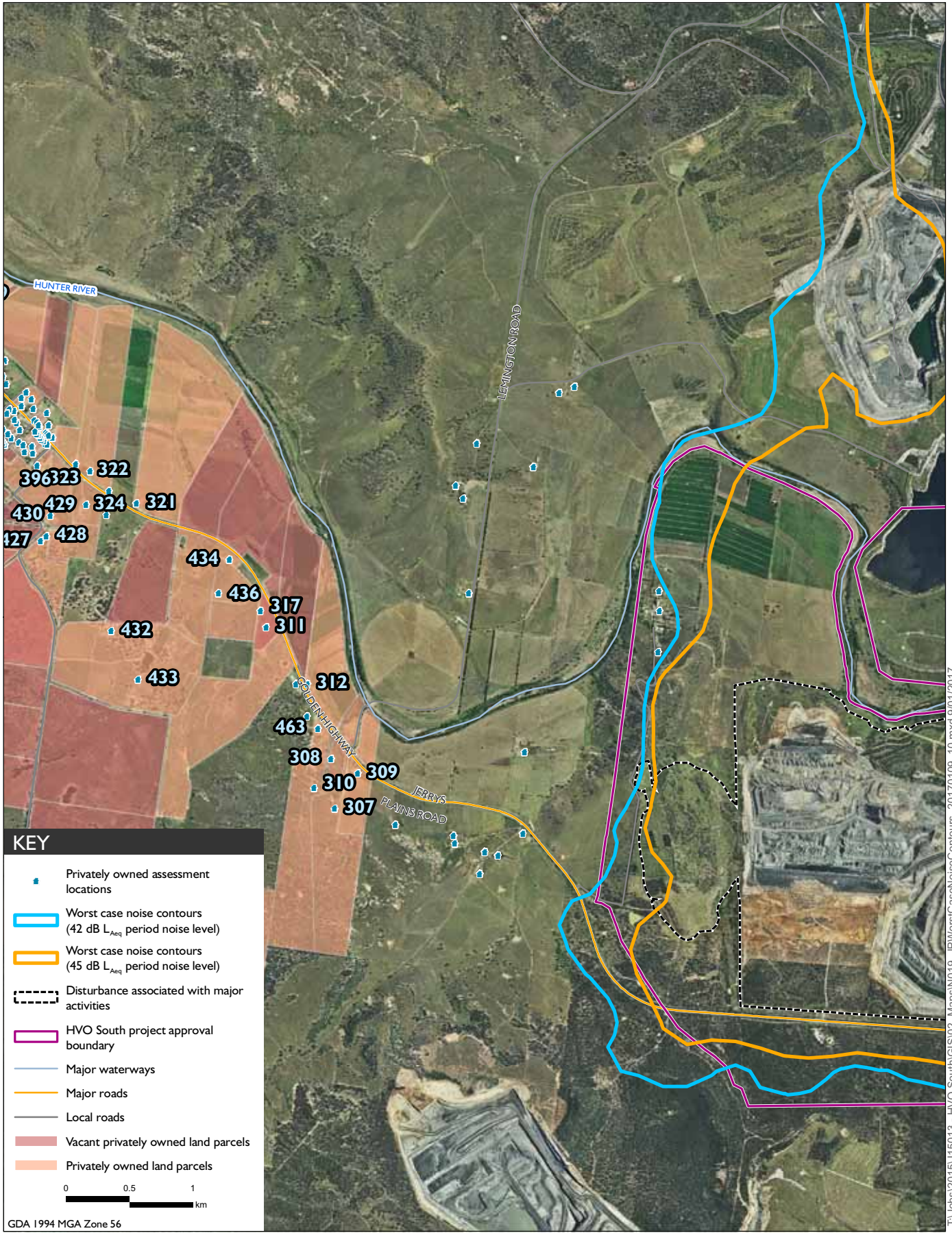
In summary, the assessment found that predicted $L_{Aeq,period}$ noise levels satisfy the VLAMP 25 per cent exceedance criteria on all vacant and occupied privately owned land parcels for day, evening and night periods during calm and worst case prevailing meteorological conditions. This is comparable with the outcomes of the cumulative noise assessment predictions presented in Table 7.1, where predicted noise levels during the night period are 40 dB, $L_{Aeq,period}$ or less (with the exception of assessment location 77 where noise levels are dominated by Wambo mine). Comparing this outcome with the VLAMP privately owned land assessment criteria of 45 dB $L_{Aeq,period}$, and given the location of all privately owned land parcels relative to the mine and single point assessment locations, the 45dB $L_{Aeq,period}$ VLAMP 25 per cent of land area criterion is considered satisfied.

It should be noted that the parcel of vacant land already afforded voluntary acquisition rights upon request within the project approval (PA 06_0261) does not meet the vacant land criteria specified within VLAMP as construction of a dwelling is not permissible under existing planning controls. The VLAMP is unclear on its application to vacant land parcels with existing voluntary acquisition rights where construction of a dwelling is not permissible under existing planning controls and the extinguishment of those voluntary acquisition rights based on the most recent technical assessments and government policy.



Source: EMM (2016), GA (2016)

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Privately owned land assessment locations and worst case (HVO South only) noise contours (west)

8 Blasting noise and vibration assessment

The proposed modification does not increase the approved disturbance area. Hence, impacts will not be materially different when considering off-site noise and vibration from blasting. Nonetheless, potential blasting impacts have been considered for the extremities of disturbance areas.

8.1 Blast locations

The proposed approximate blast locations for the proposed mining stages are shown in Figure 8.1.

8.2 General blast impacts

The blast design is actively managed by the operation, and hence corresponding airblast overpressure and ground vibration will be minimised. HVO's existing blast management procedures will continue to be used to ensure appropriate charge masses are used for blasting. Other mitigation options include reducing bench heights and the use of electronic detonators to provide more accurate timing of blasts. Typically, blasting occurs once per day, however it is not uncommon for two blasts to be undertaken in one day at larger mines. Blasts can occur regularly on consecutive days throughout the majority of the year.

The charge masses (or maximum instantaneous charge MIC) needed to achieve human annoyance based criteria are presented in Table 8.1. This provides a guide to assist blast designers with their assessment of potential impacts at the specified distances from assessment locations. The predictions were derived from formulae in the Blastronics Pty Limited publication for monitoring data collected at similar mines. The formulae used are:

- Blast overpressure (95 per cent) in dBL = $172.8 - 23.7 * \text{LOG}(D / (\text{MIC}^{1/3}))$ (1)
- Blast vibration (95 per cent) in mm/s = $1667 * (D / (\text{SQRT}(\text{MIC}))^{-1.45})$ (2)

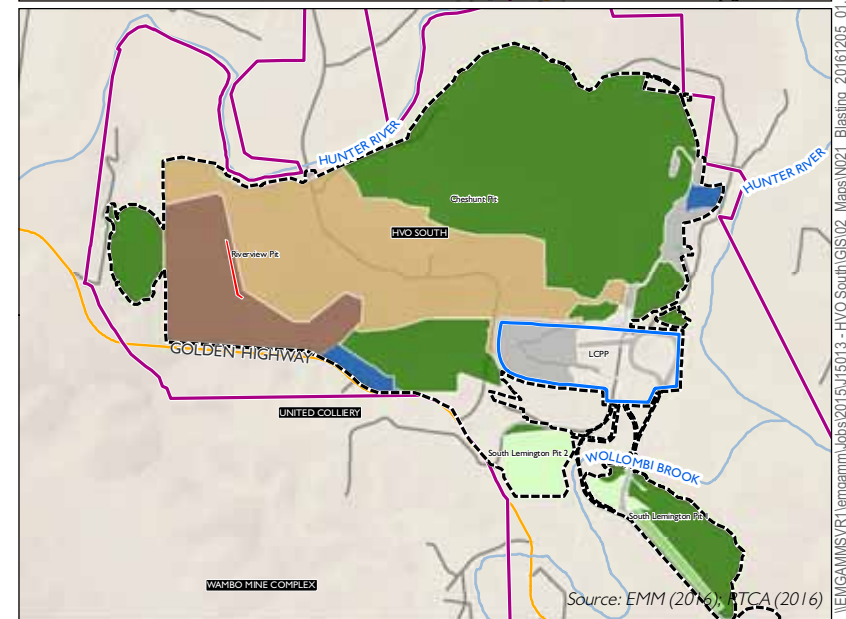
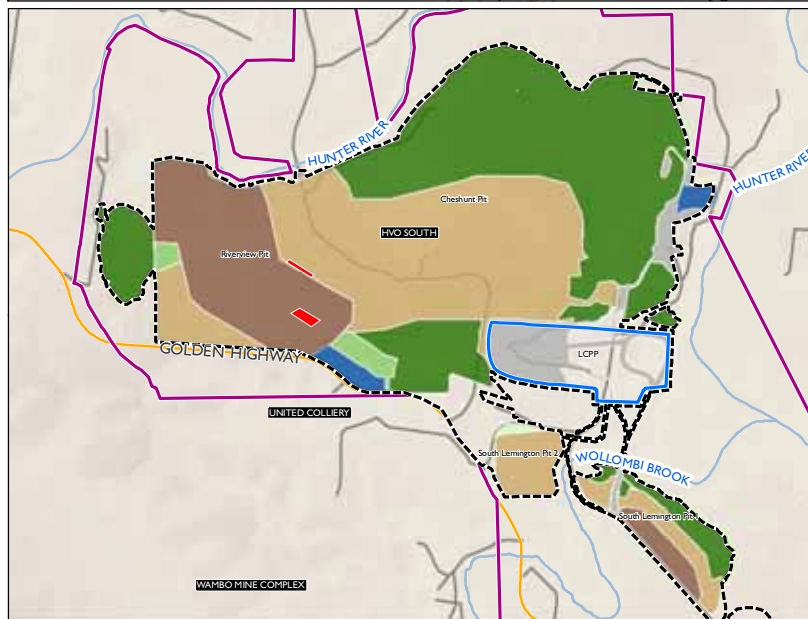
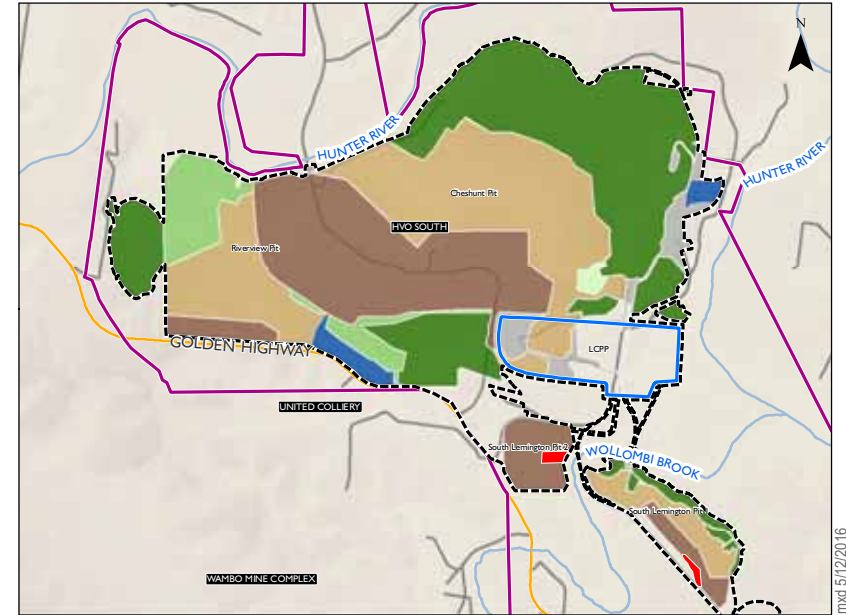
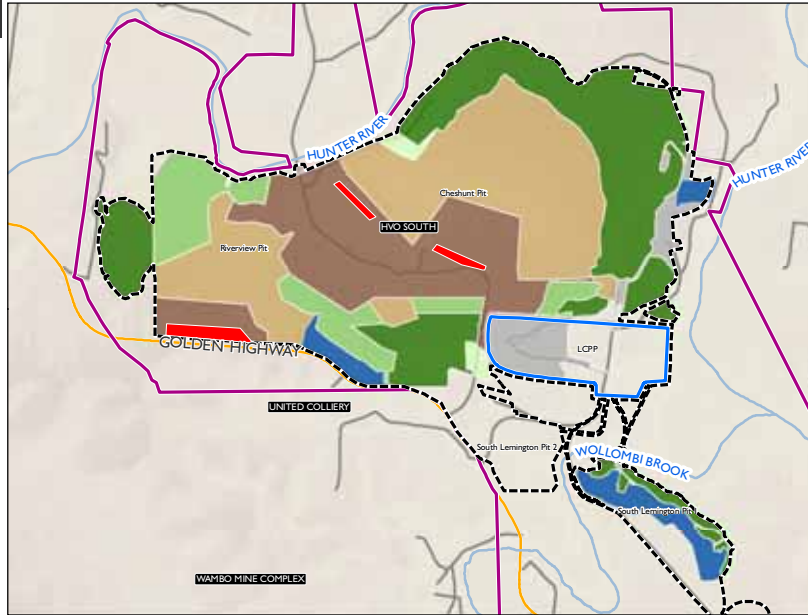
Where D is the blast to assessment location separation distance in metres and MIC is the maximum instantaneous charge in kg.

Adopting the mass charges in Table 8.1 for corresponding separation distances to residences will ensure current blast consent limits will be achieved.

The typical MIC proposed for blasting over the four stages of mining ranges approximately between 400 kg to 1,900 kg. This is consistent with or less than mass charges currently adopted at site for approved operations, which could be as high as 3000 kg for overburden blasts for example. Table 8.1 demonstrates that ground vibration limits will be achieved during all types of blasts for separation distances of over 3 km. Within 3 km, blasts will be designed to achieve the appropriate limits and in all cases will be monitored. Appropriate management of blasts will be needed to ensure blast noise overpressure limits are satisfied.

KEY

- █ Blasting location
- Approved disturbance associated with major activities
- LCPP and infrastructure envelope
- HVO South project approval boundary
- Indicative mine plan
 - Emplacement
 - Infrastructure
 - Active mining
 - Active rehabilitation
 - Temporary rehabilitation
 - Completed rehabilitation
 - Water or tailings storage
 - Major waterways
 - Major roads



GDA 1994 MGA Zone 56



Source: EMM (2016); ATCA (2016)

Blast locations
 HVO South Modification 5
 Noise Impact Assessment

Figure 8.1

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Table 8.1 **Blasting assessment**

Distance to property, m	MIC_{8ms} to satisfy ANZECC 95 % overpressure limit of 115dB(Lin), kg	MIC_{8ms} to satisfy ANZECC 95% Ground vibration limit of 5 mm/s (ppv), kg
900	NA	268
1,500	163	745
2,000	386	1,324
2,500	753	2,069
3,000	1,302	2,980

8.3 Sensitive structures

The potential impact of blasting on structures is another area that was considered in the assessment. The focus of this assessment was on St Phillip’s Church in Warkworth village and outbuildings at Archerfield, north east of the site.

Blasting will be at its closest to St Phillip’s Church during proposed Stage 2 at South Lemington. An estimated separation distance of at least 1,600 m is expected based on Figure 8.1 and the location of the church (assessment location 264).

The blasting operations have and will continue to move away from the outbuildings at Archerfield to the north-east and hence future blasts will not impact these structures any more than historic blasts. Hence impacts have not been specifically quantified for these structures.

Based on Bill & Jordon 2009 a conservative limit of 10 mm/s peak particle component vibration velocity would be conservative for heritage type structures. Adopting this limit for the church is therefore considered conservative.

To achieve this limit at the church from blasting located 1,600 m away, Blastronics formulae suggest a MIC of up to 2,200 kg can be used. This should be used as a guide to blast designers, and be confirmed through monitoring. The anticipated MIC proposed to be used at this location is lower than 2,200 kg and, therefore, resulting ground vibration at the church is expected to achieve criteria.

Hence, impacts on these structures are considered highly unlikely and would allow for normal blasting practices to continue.

8.4 Effects on animals

Very little evidence is available in literature on the direct impacts that blast noise has on livestock or animals in general. Blast noise is not a new or newly introduced source for the area and, therefore, it is expected that livestock and other animals are accustomed to such sources of noise. For the proposed modification, it is clear that the current level of noise from blasting is not going to increase significantly at locations assessed. A similar level of minimal change is therefore expected for locations where livestock or animals inhabit. These include surrounding grazing land. Impacts on animals are therefore expected to be minimal.

9 Conclusion

EMM has assessed the noise and vibration from the proposed modification, which will not change the approved footprint of disturbance, mining method, employee numbers, integrated tailings and water management across HVO or extend the project approval period. The objective of the modified project in noise terms is to achieve the existing criteria as shown in Schedule 3 of the project approval (PA 06_0261) and otherwise to comply with the requirements of the INP.

This study considers the potential for noise impacts to residences from the proposed modification, including:

- optimisation of mine plans and operations;
- detailed three-dimensional noise modelling and predictions;
- assessment against the existing project approval, INP and VLAMP;
- assessment of potential sleep disturbance;
- assessment of blasting;
- assessment of rail traffic noise;
- a review of noise mitigation including sound suppression on all trucks;
- operational controls to manage off site noise to within criteria during adverse weather; and
- description of comprehensive management procedures adopted by the site.

The assessment of the potential for noise impacts on 163 assessment locations (161 identified as residences) over the life of the proposed modification includes predictions of emissions based on an equipment fleet with sound suppression on all trucks. Further, Coal & Allied has invested in new technology with respect to real time noise monitoring at Jerrys Plains, adopting the latest directional monitoring hardware, the 'Noise Compass'. Together with monthly monitoring, this constitutes all feasible and reasonable mitigation at this time, which will be reviewed on an ongoing basis to ensure leading available practices are adopted as part of the proposed modification.

Operational noise at residences was predicted under varying meteorological conditions prevalent at the site including calm, winds and temperature gradient conditions. Modelling has been validated in the past and during this study against compliance monitoring data with strong correlations found.

The assessment concluded that operational noise would comply with the existing project approval conditions, which are based on the INP, for all assessment locations during 'calm' weather conditions for day, evening and night periods.

Predictions during adverse weather indicate that operational noise levels from the proposal would likely present significant noise level exceedances at one assessment location, located in Warkworth Village, south of HVO South. This location (location 77) has previously been identified within a zone of mitigation for HVO South and within acquisition of neighbouring mines (Wambo and Warkworth).

The noise predictions during adverse weather have also been used to indicate which properties are entitled to mitigation based on the project approval. Twelve additional properties not previously entitled to mitigation have been identified when assessed against the existing project approval (eight on Jerrys Plains Road and four in Maison Dieu). The cumulative assessment indicates that the Jerrys Plains Road residences are relatively more impacted by operations at the approved Wambo Coal Mine. A review of the recently exhibited EIS for United Wambo Open Cut Coal Mine Project shows that six and two of the eight aforementioned Jerrys Plains properties would be afforded acquisition and mitigation rights respectively under the proposed United Wambo Open Cut Coal Mine Project, should it be approved.

The noise from the proposed modification is predicted to be similar to approved operations for assessment locations to the east (eg Maison Dieu) and marginally higher as the project progresses for western assessment locations. The proposed noise suppression and fleet management will mean the advancement westward will not result in a material increase to noise levels.

The cumulative noise assessment demonstrates adherence to the INP's amenity criteria and the non-discretionary Mining SEPP at all properties with the exception of those previously identified as impacted by other mining operations (ie locations in Warkworth village).

It is demonstrated that the non-discretionary Mining SEPP is satisfied for all other residences (eg in Maison Dieu and Jerrys Plains). This means these area's amenity is not compromised as it meets the INP's acceptable noise level. This means that while some assessment locations will be above PSNLs, for example, these assessment locations can remain habitable whilst still being subject to a noise level commensurate with a rural amenity residential area as defined in the INP.

The assessment found that predicted $L_{Aeq,period}$ noise levels satisfy the VLAMP 25 per cent exceedance criterion on all vacant and occupied privately owned land parcels for day, evening and night periods during calm and worst case prevailing meteorological conditions.

This assessment also concludes that noise impacts can be managed within appropriate criteria for operational blasting activities, and rail operations on the approved spur.

References

Australian and New Zealand Environment and Conservation Council (ANZECC) (1990); Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration

Bill Jordan & Associates (2009), Edinglassie Homestead & Rous Lench – Blast Vibration Vulnerability

British Standard 7385-2 and US Bureau of Mines Standard RI 8507 (2006)

International Organisation for Standardisation (1999); DIN 4150 Part 3 – Structural Vibration: Effects of Vibration Structures

Deutsche Norm (1999); DIN 4150 Structural Vibration Part 3: Effects of Vibration on Structures

Blastronics Pty Limited (1994); Drill & Blast Study, Mount Pleasant, prepared for Coal & Allied

Environment Protection Authority (2013); Rail Infrastructure Noise Guideline

Environment Protection Authority (2011); Road Noise Policy

Environment Protection Authority (2000); NSW Industrial Noise Policy

NSW Government *Integrated Mining Policy, Voluntary Land Acquisition and Mitigation Policy* (2014)

State Environmental Planning Policy (2007); Mining, Petroleum Production and Extractive Industries (Mining SEPP)

The Australian Standard, AS2187.2 (2006); Explosives - Storage and Use Part 2 Use of Explosives (Appendix J)

Umwelt (2016); *United Wambo Open Cut Coal Mine Project*, Environmental Impact Statement

Appendix A

Assessment locations

Table A.1 Properties included in the noise assessment

Locality	PA reference (where applicable)	Assessment location New ID	MGA coordinates	
			Eastings	Northing
Warkworth	All other privately owned land	77	314103.2	6394482
Warkworth	All other privately owned land	102	314800.3	6394348
Maison Dieu	Within 1 km of Shearers lane	120	318503.9	6398457
Maison Dieu	Within 1 km of Shearers lane	121	318529.6	6398039
Maison Dieu	Within 1 km of Shearers lane	122	318607.9	6398554
Maison Dieu	Within 1 km of Shearers lane	123	318658.3	6398205
Maison Dieu	Within 1 km of Shearers lane	124	318654.6	6398582
Long Point/Gouldsville	Other Maison Dieu residences	126	320763.7	6393699
Long Point/Gouldsville	Other Maison Dieu residences	127	320623.6	6396932
Long Point/Gouldsville	Other Maison Dieu residences	128	320915.8	6394511
Long Point/Gouldsville	Other Maison Dieu residences	130	321271.1	6394970
Long Point/Gouldsville	Other Maison Dieu residences	134	321471.9	6395034
Long Point/Gouldsville	Other Maison Dieu residences	139	321706.8	6394686
Long Point/Gouldsville	Other Maison Dieu residences	141	321604.5	6397030
Shearers Lane Maison Dieu	Shearers Lane	160	317882.6	6399178
Shearers Lane Maison Dieu	Shearers Lane	161	318010.1	6399448
Shearers Lane Maison Dieu	Shearers Lane	162	318011.3	6399407
Shearers Lane Maison Dieu	Shearers Lane	163	318114.1	6399572
Long Point/Gouldsville	Other Maison Dieu residences	169	321958.9	6396271
Long Point/Gouldsville	Other Maison Dieu residences	172	321924.9	6395400
Maison Dieu	Within 1 km of Shearers lane	244	318808.5	6399092
Maison Dieu	Within 1 km of Shearers lane	245	318679	6399194
Maison Dieu	Within 1 km of Shearers lane	246	318794.9	6399314
Maison Dieu	Within 1 km of Shearers lane	247	318879.5	6399292
Shearers Lane Maison Dieu	Shearers Lane	256	317979	6399821
Shearers Lane Maison Dieu	Shearers Lane	258	318103.9	6399611
Shearers Lane Maison Dieu	Shearers Lane	260	318180.1	6399198
Shearers Lane Maison Dieu	Shearers Lane	261	318029.5	6399106
Long Point/Gouldsville	Other Maison Dieu residences	262	320794.4	6393794
Warkworth	All other privately owned land	264	314869.9	6394227
Jerrys Plains Road		307	305954.9	6399617
Jerrys Plains Road		308	305925.7	6400011
Jerrys Plains residence	Smith	309	306139	6399895
Jerrys Plains Road		310	305791.2	6399780
Jerrys Plains Road		311	305416	6401053
Jerrys Plains Road		312	305739.4	6400603
Jerrys Plains Road		317	305369.7	6401180
Jerrys Plains residence		321	304390.1	6402028
Jerrys Plains residence		322	304021	6402284

Table A.1 Properties included in the noise assessment

Locality	PA reference (where applicable)	Assessment location New ID	MGA coordinates	
			Easting	Northing
Jerrys Plains residence		323	303907.9	6402342
Jerrys Plains residence		324	304172.1	6402127
Jerrys Plains residence		325	302366.6	6403296
Jerrys Plains residence		326	302342.8	6404253
Jerrys Plains residence		327	302162.7	6404340
Jerrys Plains residence		328	302772.9	6404013
Jerrys Plains residence		329	303132.4	6403565
Jerrys Plains residence		330	302487.9	6403896
Jerrys Plains residence		331	302790.8	6403833
Jerrys Plains residence		332	302771.4	6403528
Jerrys Plains residence		333	302650.5	6403521
Jerrys Plains residence		334	302624.1	6403419
Jerrys Plains residence		335	302690.7	6403468
Jerrys Plains residence		336	302755.8	6403623
Jerrys Plains residence		337	302914	6403433
Jerrys Plains residence		338	303027.1	6403399
Jerrys Plains residence		339	302768.5	6402966
Jerrys Plains residence		340	302798.6	6402990
Jerrys Plains residence		341	302829.5	6403026
Jerrys Plains residence		342	302863	6403055
Jerrys Plains residence		343	302878.6	6403079
Jerrys Plains residence		344	302914	6403113
Jerrys Plains residence		345	302943.7	6403132
Jerrys Plains residence		346	302974.6	6403164
Jerrys Plains residence		347	303057.6	6403344
Jerrys Plains residence		348	303034.5	6403315
Jerrys Plains residence		349	302999.9	6403289
Jerrys Plains residence		350	303049	6403237
Jerrys Plains residence		351	303081.8	6403277
Jerrys Plains residence		352	303116	6403299
Jerrys Plains residence		353	303137.2	6403310
Jerrys Plains residence		354	303207.2	6403301
Jerrys Plains residence		355	303186.7	6403276
Jerrys Plains residence		356	303130.2	6403214
Jerrys Plains residence		357	303096.3	6403185
Jerrys Plains residence		358	303137.6	6403141
Jerrys Plains residence		359	303207.2	6403190
Jerrys Plains residence		360	303231	6403235
Jerrys Plains residence		361	303252.6	6403253
Jerrys Plains residence		362	303347.7	6403156

Table A.1 Properties included in the noise assessment

Locality	PA reference (where applicable)	Assessment location New ID	MGA coordinates	
			Easting	Northing
Jerrys Plains residence		363	303316.8	6403133
Jerrys Plains residence		364	303257.2	6403134
Jerrys Plains residence		365	303279.9	6403102
Jerrys Plains residence		366	303268	6403081
Jerrys Plains residence		367	303212.2	6403085
Jerrys Plains residence		368	303224.5	6403105
Jerrys Plains residence		369	303332	6403032
Jerrys Plains residence		370	303155.3	6403045
Jerrys Plains residence		371	303239	6402933
Jerrys Plains residence		372	303153.4	6402874
Jerrys Plains residence		373	303257.2	6402924
Jerrys Plains residence		374	303261	6402901
Jerrys Plains residence		375	303276.6	6402867
Jerrys Plains residence		376	303481.2	6402864
Jerrys Plains residence		377	303359.2	6402968
Jerrys Plains residence		378	303516.6	6402907
Jerrys Plains residence		379	303559	6402853
Jerrys Plains residence		380	303465.6	6402611
Jerrys Plains residence		381	303443.3	6402666
Jerrys Plains residence		382	303422.8	6402691
Jerrys Plains residence		383	303422.1	6402758
Jerrys Plains residence		384	303381.1	6402774
Jerrys Plains residence		385	303366.3	6402742
Jerrys Plains residence		387	303680.7	6402746
Jerrys Plains residence		388	303580.6	6402686
Jerrys Plains residence		389	303599.2	6402669
Jerrys Plains residence		390	303620.8	6402636
Jerrys Plains residence		391	303671.8	6402589
Jerrys Plains residence		392	303683.3	6402575
Jerrys Plains residence		393	303726.5	6402547
Jerrys Plains residence		394	303694.5	6402565
Jerrys Plains residence		395	303695.4	6402648
Jerrys Plains residence		396	303605.2	6402326
Jerrys Plains residence		397	303667.3	6402504
Jerrys Plains residence		398	303568.3	6402424
Jerrys Plains residence		399	303684.8	6402492
Jerrys Plains residence		400	303657.2	6402525
Jerrys Plains residence		401	303638.6	6402533
Jerrys Plains residence		402	303627.9	6402548
Jerrys Plains residence		403	303613	6402568

Table A.1 Properties included in the noise assessment

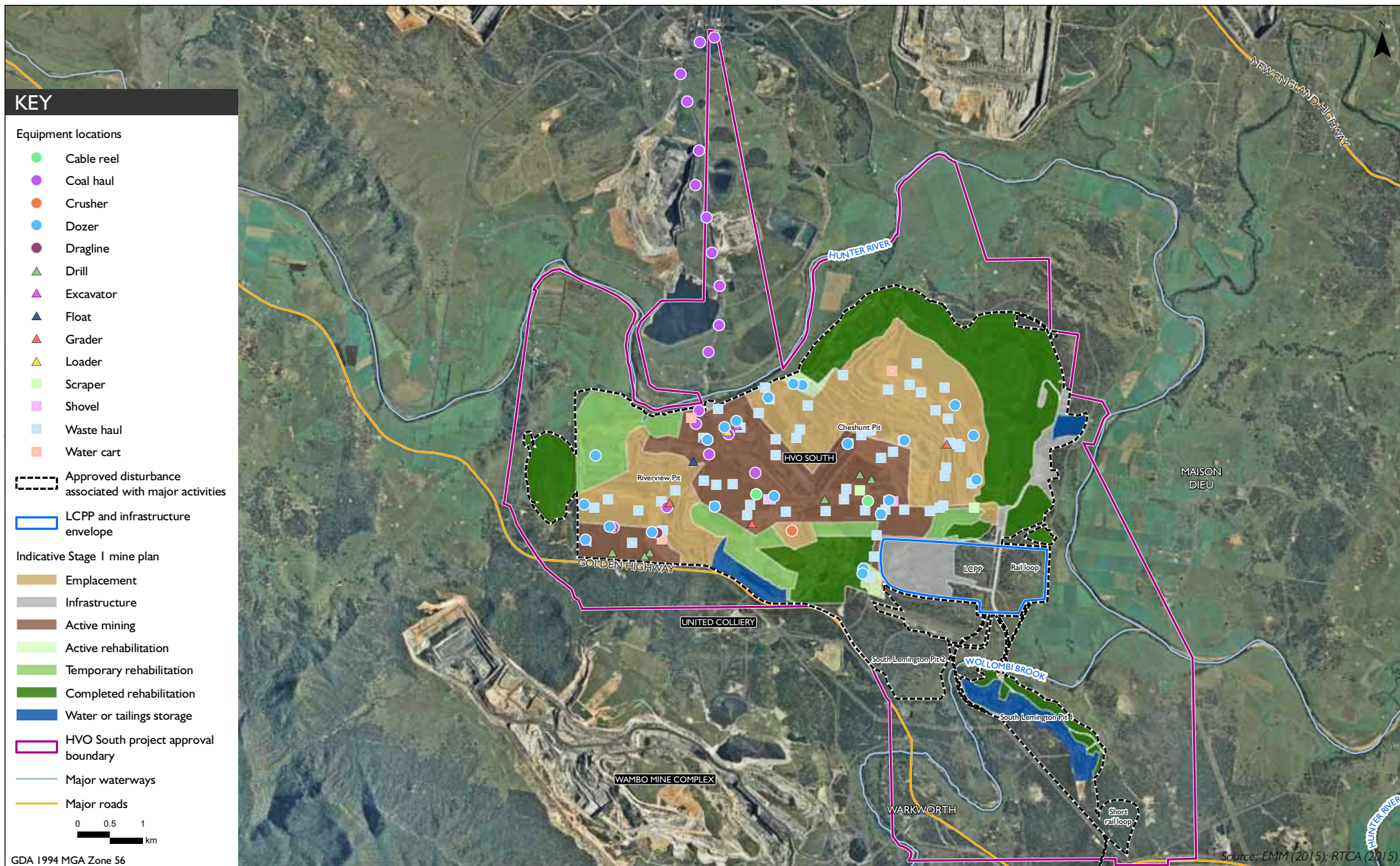
Locality	PA reference (where applicable)	Assessment location New ID	MGA coordinates	
			Easting	Northing
Jerrys Plains residence		404	303562.7	6402478
Jerrys Plains residence		405	303599.6	6402580
Jerrys Plains residence		406	303585.4	6402596
Jerrys Plains residence		407	303459.7	6402510
Jerrys Plains residence		408	303505.4	6402438
Jerrys Plains residence		409	303400.1	6402544
Jerrys Plains residence		411	303373	6402579
Jerrys Plains residence		413	303346.9	6402494
Jerrys Plains residence		414	303335.4	6402510
Jerrys Plains residence		415	303325.3	6402527
Jerrys Plains residence		417	303180.6	6403016
Jerrys Plains residence		418	303159	6402798
Jerrys Plains residence		419	303308.6	6402354
Jerrys Plains residence		420	303492.4	6402491
Jerrys Plains residence		421	303574.6	6402776
Jerrys Plains residence		422	303480.9	6402796
Jerrys Plains residence		423	303613.3	6402648
Jerrys Plains residence		424	303288.9	6403151
Jerrys Plains residence		425	302915.3	6401913
Jerrys Plains residence		426	303276.2	6401566
Jerrys Plains residence		427	303632.7	6401732
Jerrys Plains residence		428	303676.6	6401772
Jerrys Plains residence		429	303990.3	6402021
Jerrys Plains residence		430	303709	6401932
Jerrys Plains Road		432	304188.2	6401020
Jerrys Plains Road		433	304402.6	6400637
Jerrys Plains Road		434	305123.7	6401584
Jerrys Plains Road		436	305040.4	6401316
Jerrys Plains residence		437	302021.1	6404598
Jerrys Plains residence		438	301416.8	6404773
Jerrys Plains residence		451	304799.9	6398880
Jerrys Plains residence		452	304734.3	6399131
Jerrys Plains Road		453	304404.1	6398805
Jerrys Plains Road		454	304553.3	6398507
Jerrys Plains Road		455	304380.8	6398349
Jerrys Plains Road		456	304246.4	6397874
Jerrys Plains Road		457	304350.1	6397594
Jerrys Plains Road		458	303443.7	6398622
Jerrys Plains Road		459	303985.5	6399027

Table A.1 Properties included in the noise assessment

Locality	PA reference (where applicable)	Assessment location New ID	MGA coordinates	
			Easting	Northing
Jerrys Plains Road		460	303638.4	6399147
Jerrys Plains Road		462	303598.2	6398842
Jerrys Plains Road		463	305825	6400249
South-west Camberwell		471	319025	6403131
South-west Camberwell		472	319005	6401802

Appendix B

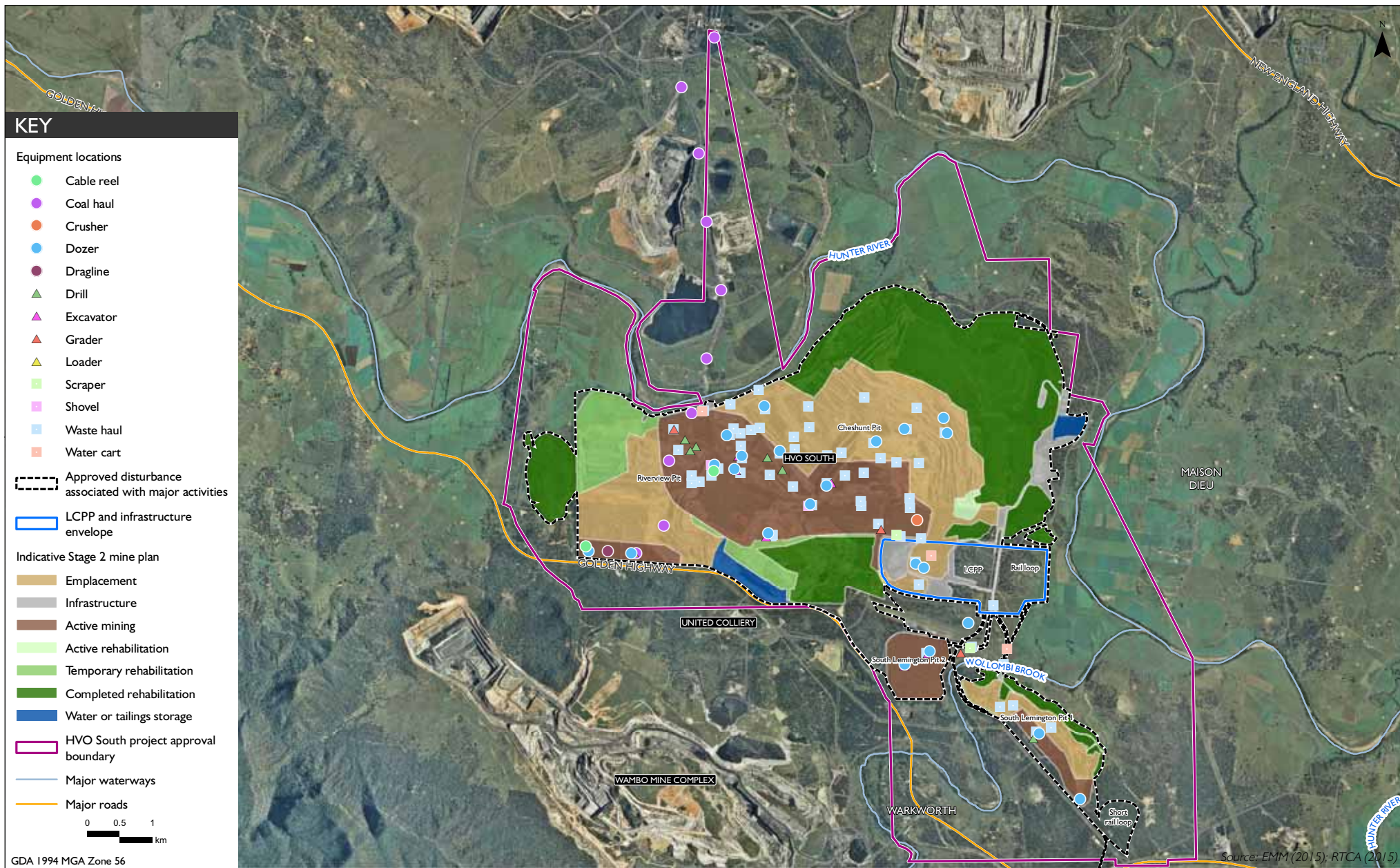
Mine plans and modelled equipment locations



Stage I mine plan and modelled equipment locations

HVO South Modification 5
Noise Impact Assessment

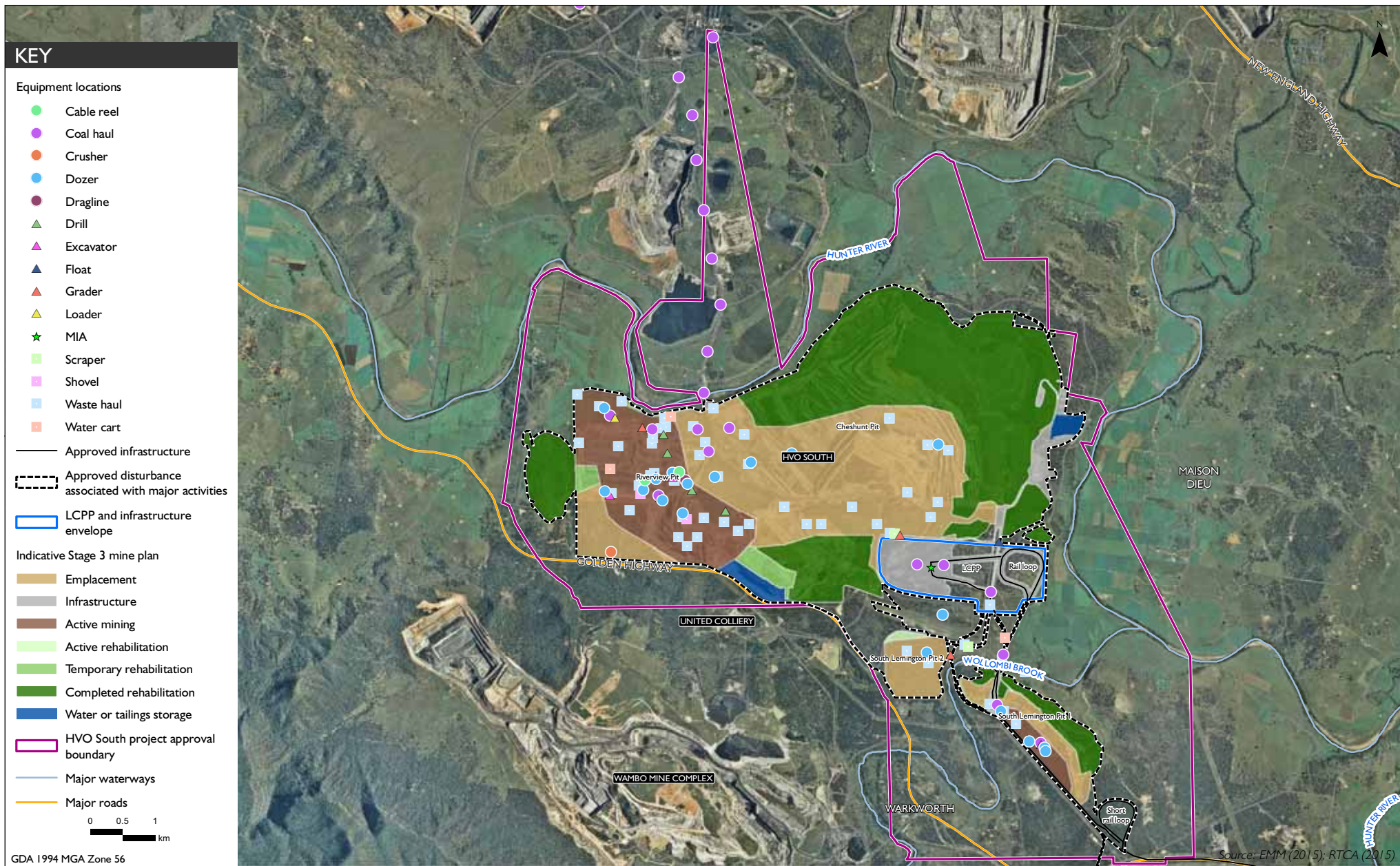
Figure B.1



Stage 2 mine plan and modelled equipment locations

HVO South Modification 5
Noise Impact Assessment

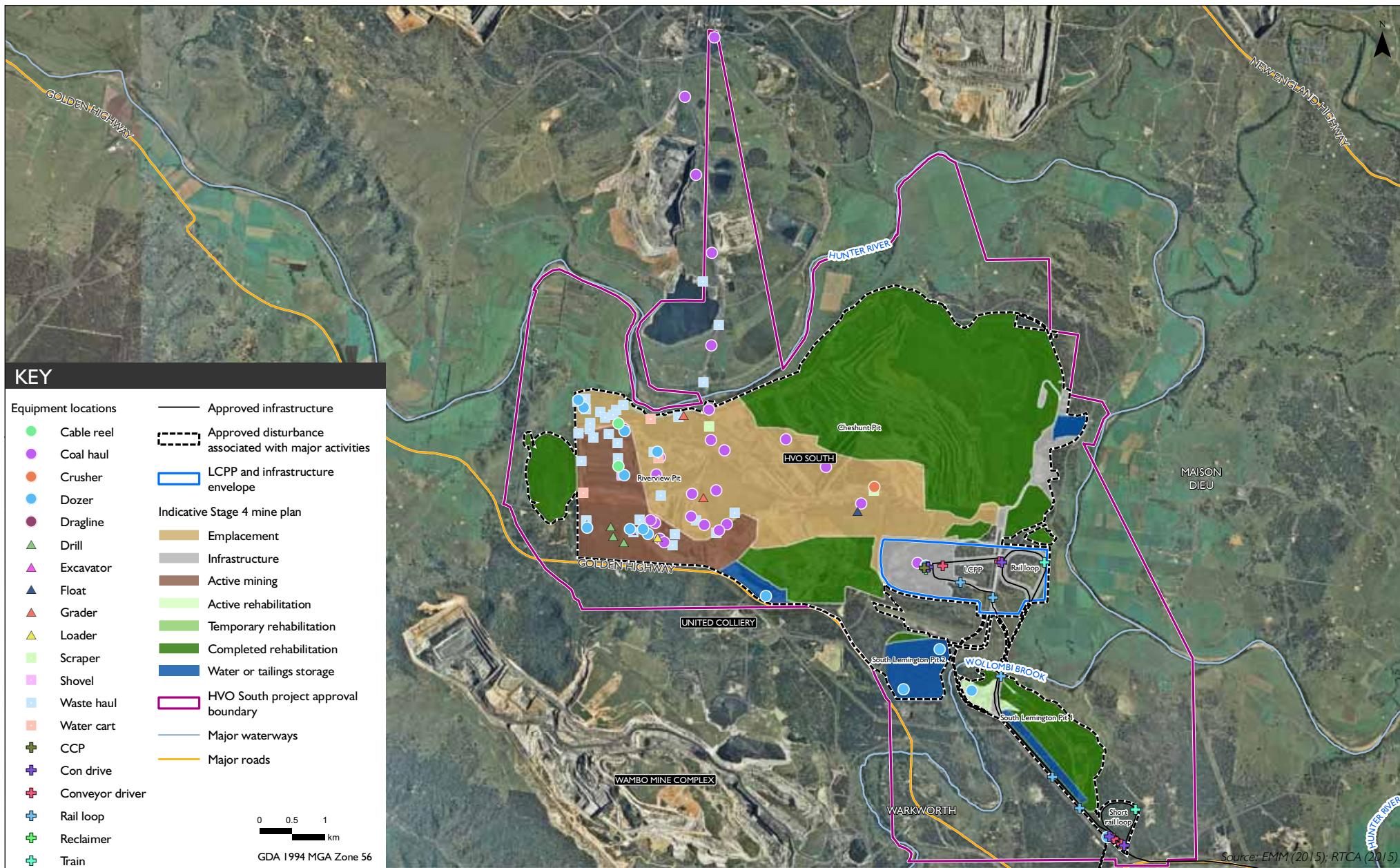
Figure B.2



Stage 3 mine plan and modelled equipment locations

HVO South Modification 5
 Noise Impact Assessment

Figure B.3



Stage 4 mine plan and modelled equipment locations

HVO South Modification 5
Noise Impact Assessment

Figure B.4

Appendix C

Predicted noise levels

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits									
			Worst case mets	Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
				Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
				(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening
Warkworth	77 (45)	36	35	36	40	38	39	44	36	37	41	35	37	41	43	43	43	38	38	38	40	40	40	
Warkworth Hall ⁴	102	32*	31	32	35	35	36	39	33	33	37	32	34	37	65	65	65	-	-	-	-	-	-	
Maison Dieu within 1km of Shearers lane	120	40*	36	37	40	33	34	39	33	34	39	32	33	37	39	39	39	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	121 (34)	40*	36	37	40	34	35	40	36	37	40	32	33	37	40	40	40	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	122 (56)	40*	36	37	40	33	34	39	32	33	39	31	32	37	39	39	39	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	123 (50)	40*	35	36	39	34	35	39	34	35	39	31	33	37	40	40	40	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	124 (24)	40*	36	37	40	34	35	39	32	33	39	31	32	36	39	39	39	39	39	39	43	41	41	
Long Point/Gouldsville (other Maison Dieu residences)	126		26	26	26	27	28	28	26	26	27	26	27	31	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	127		30	31	35	31	31	37	30	30	36	28	28	33	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	128		27	27	33	28	29	35	28	27	35	27	28	33	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	130		28	28	33	28	29	35	28	28	33	26	26	30	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	134		28	29	33	28	28	34	27	27	31	25	25	30	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	139		25	25	26	25	25	27	24	23	26	23	23	25	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	141		25	25	30	25	25	31	23	23	30	21	21	27	35	35	35	38	38	38	40	40	40	
Shearers Lane Maison Dieu	160 (5)	41*	37	39	41	34	35	41	36	38	40	31	33	38	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	161 (61)	41*	37	38	41	33	34	40	38	39	40	30	31	37	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	162	41*	37	38	41	34	35	40	38	39	40	30	32	37	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	163	41*	36	38	40	33	34	40	36	38	40	30	31	37	41	41	41	39	39	39	43	41	41	
Long Point/Gouldsville (other Maison Dieu residences)	169		27	27	30	28	28	32	26	26	30	24	24	29	35	35	35	38	38	38	40	40	40	
Long Point/Gouldsville (other Maison Dieu residences)	172		27	28	33	27	27	34	26	26	31	24	25	30	35	35	35	38	38	38	40	40	40	

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits									
			Worst case mets (PA ID)	Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
				Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
				(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening
Maison Dieu within 1km of Shearers lane	244	40*	35	36	39	33	34	39	33	33	38	30	31	36	37	37	37	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	245	40*	35	36	39	33	34	39	33	34	38	30	31	36	37	37	37	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	246	40*	35	36	39	32	33	39	34	36	38	30	31	36	37	37	37	39	39	39	43	41	41	
Maison Dieu within 1km of Shearers lane	247	40*	35	36	39	34	35	39	35	36	38	30	31	35	37	37	37	39	39	39	43	41	41	
Shearers Lane Maison Dieu	256 (47)	41*	37	38	40	33	33	40	34	34	39	29	30	37	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	258	41*	36	38	40	33	34	40	36	37	40	29	31	37	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	260	41*	37	38	40	33	34	40	37	38	40	32	33	37	41	41	41	39	39	39	43	41	41	
Shearers Lane Maison Dieu	261	41*	37	38	41	34	35	41	37	39	40	32	33	38	41	41	41	39	39	39	43	41	41	
Long Point/Gouldsville (other Maison Dieu residences)	262		26	27	30	28	28	33	26	26	31	26	27	31	35	35	35	38	38	38	40	40	40	
Warkworth (St Phillips Church) ⁴	264	32*	31	32	35	35	36	39	32	33	37	32	34	37	50	50	50	-	-	-	-	-	-	
Jerrys Plains Road	307 (4)	37*	31	31	39	28	28	37	31	31	39	27	27	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Road	308 (31)	37*	30	30	38	28	28	37	31	31	39	27	27	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Receiver - SMITH	309 (36)		29	29	39	26	26	37	30	30	40	26	26	38	36	36	36	39	39	39	43	41	41	
Jerrys Plains Road	310	37*	32	33	39	29	29	37	32	32	39	28	28	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Road	311 (3)	37*	28	28	37	25	25	36	28	28	38	24	24	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Road	312	37*	28	29	38	25	26	36	29	29	39	25	26	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Road	317	37*	28	28	37	25	25	36	27	27	38	23	24	38	35	35	35	38	38	38	43	40	40	
Jerrys Plains Receivers	321	33*	26	26	35	24	24	35	25	24	35	22	22	36	35	35	35	38	38	38	40	40	40	
Jerrys Plains Receivers	322	33*	25	25	34	23	23	34	24	24	35	22	22	35	35	35	35	38	38	38	40	40	40	
Jerrys Plains Receivers	323	33*	25	25	34	23	23	34	24	24	35	21	22	35	35	35	35	38	38	38	40	40	40	

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits								
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
			Worst case mets			Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	324	33*	26	26	35	24	24	35	25	24	35	22	22	35	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	325	28*	24	24	31	22	22	31	24	24	32	21	21	31	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	326	28*	22	22	30	20	20	31	23	22	31	17	17	31	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	327	28*	22	22	30	21	20	31	23	22	31	17	17	30	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	328	28*	22	22	31	21	21	31	23	22	32	18	18	31	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	329	28*	23	23	31	21	21	32	23	23	32	19	19	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	330	28*	23	23	31	21	21	31	23	22	31	19	19	31	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	331	28*	23	23	31	21	21	31	23	23	32	18	18	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	332	28*	23	23	31	21	21	32	23	22	32	19	19	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	333	28*	23	23	31	22	22	32	23	23	32	20	20	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	334	28*	24	24	32	22	22	32	24	23	32	20	20	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	335	28*	23	23	32	22	22	32	23	23	32	20	20	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	336	28*	23	23	31	21	21	31	23	22	32	19	19	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	337	28*	23	23	32	22	21	32	23	22	32	19	19	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	338	35*	23	23	32	21	21	32	23	22	32	20	20	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	339	35*	25	25	32	23	23	32	24	24	33	21	21	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	340	35*	25	25	32	23	23	32	24	24	33	21	21	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	341	35*	24	24	32	23	23	32	24	24	33	21	21	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	342	35*	24	24	32	23	23	32	24	24	33	21	21	32	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	343	35*	24	24	32	23	23	32	24	24	33	21	21	32	35	35	35	38	38	38	40	40	40

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits											
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³					
			Worst case mets			Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	344	35*	24	24	32	23	22	32	24	23	33	21	21	32	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	345	35*	24	24	32	22	22	32	24	23	33	20	20	32	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	346	35*	24	24	32	22	22	32	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	347	35*	23	23	32	22	21	32	23	23	33	20	20	32	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	348	35*	23	23	32	22	22	32	23	23	33	20	20	32	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	349	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	350	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	351	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	352	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	353	35*	23	23	32	22	21	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	354	35*	23	23	32	22	21	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	355	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	356	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	357	35*	24	24	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	358	35*	24	24	32	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	359	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	360	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	361	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	362	35*	23	23	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	363	35*	24	24	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits											
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³					
			Worst case mets			Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	364	35*	24	24	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	365	35*	24	24	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	366	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	367	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	368	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	369	35*	24	24	32	22	22	32	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	370	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	371	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	372	35*	24	24	33	22	22	33	24	23	33	21	21	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	373	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	374	35*	24	24	33	22	22	33	24	23	33	21	21	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	375	35*	24	24	33	22	22	33	24	23	33	21	21	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	376	35*	24	24	33	23	22	33	24	23	33	20	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	377	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	378	35*	24	24	33	22	22	33	24	23	33	20	20	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	379 (13)	35*	24	24	33	23	23	33	24	23	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	380	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	381	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	382	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	383	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits											
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³					
			Worst case mets			Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	384	35*	25	24	33	23	22	33	24	24	33	21	21	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	385	35*	25	25	33	23	23	33	24	24	33	21	21	33	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	387	35*	24	24	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	388	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	389	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	390	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	391	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	392	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	393	35	25	25	34	23	23	34	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	394	35	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	395	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	396	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	397	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	398	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	399	35*	25	25	34	23	23	34	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	400	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	401	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	402	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	403	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			
Jerrys Plains Receivers	404	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40			

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits								
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
			Worst case mets			Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Calm	Prevailing		Day	Evening	Night	Day	Evening	Night
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	405	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	406	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	407	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	408	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	409	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	411	35*	25	25	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	413	35*	26	26	33	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	414	35*	25	26	33	23	23	33	25	24	34	21	21	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	415	35*	25	25	33	23	23	33	24	24	34	21	21	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	417	35*	24	24	33	22	22	33	24	23	33	20	20	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	418	35*	25	25	33	23	23	33	24	23	33	21	21	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	419	35*	26	26	33	24	23	33	24	24	34	22	22	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	420	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	421	35*	24	24	33	23	22	33	24	23	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	422	35*	24	24	33	23	22	33	24	23	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	423	35*	25	25	34	23	23	33	24	24	34	21	21	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	424	35*	24	24	32	22	22	32	23	23	33	20	20	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	425	35*	26	26	33	24	24	33	26	26	33	21	22	33	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	426	35*	27	27	34	24	24	33	27	26	34	22	22	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	427	35*	27	27	34	25	25	34	27	26	35	22	23	34	35	35	35	38	38	38	40	40	40

Table C.1 Predicted operational $L_{Aeq,15minute}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15minute}$, dB												PA noise limits								
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
			Worst case mets	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Operational	Mitigation ²	Acquisition ³	Operational	Mitigation ²	Acquisition ³	Operational	Mitigation ²	Acquisition ³	
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Receivers	428	35*	27	27	34	25	25	34	27	26	35	22	22	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	429	35*	26	27	34	24	24	34	25	25	35	22	22	35	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	430	35*	27	27	34	25	25	34	26	25	35	22	22	34	35	35	35	38	38	38	40	40	40
Jerrys Plains Road	432	37*	27	28	35	26	26	34	28	28	35	24	24	34	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	433	37*	27	27	33	25	25	31	27	26	33	24	24	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	434	37*	27	28	36	25	25	36	26	26	37	23	23	37	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	436	37*	27	28	36	25	25	35	27	26	37	23	23	37	35	35	35	38	38	38	43	40	40
Jerrys Plains Receivers	437	35*	21	21	30	21	20	30	22	22	31	17	17	30	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	438	35*	20	20	29	19	19	29	22	21	29	16	16	28	35	35	35	38	38	38	40	40	40
Jerrys Plains Receivers	451	35*	28	28	35	25	25	33	28	28	34	24	24	31	35	35	35	38	38	38	40	40	40
Jerrys Plains Road	452	37*	28	28	35	24	24	32	27	27	34	23	23	31	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	453	37*	27	27	33	23	23	32	27	26	34	23	23	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	454	37*	25	25	33	22	22	31	24	24	33	22	22	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	455	37*	24	24	33	22	22	32	23	23	33	21	21	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	456	37*	25	25	33	23	23	32	24	24	32	22	22	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	457	37*	27	27	32	24	24	32	28	27	33	22	22	29	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	458	37*	26	27	32	23	23	32	27	26	33	22	22	30	35	35	35	38	38	38	43	40	40

Table C.1 Predicted operational $L_{Aeq,15\text{minute}}$ Noise levels, dB

Locality	Assessment location New ID	Approved operations	Predicted noise levels, $L_{Aeq,15\text{minute}}$, dB												PA noise limits								
			Stage 1			Stage 2			Stage 3			Stage 4			Operational			Mitigation ²			Acquisition ³		
			Worst case	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Calm	Prevailing	Operational	Mitigation ²	Acquisition ³							
(PA ID)	(ERM, 2008)	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening/Night	Evening/Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	
Jerrys Plains Road	459	37*	27	27	33	24	24	32	27	26	33	22	22	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	460	37*	27	27	33	25	25	32	28	27	33	23	23	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	462	37*	27	27	33	24	24	32	27	27	33	22	23	30	35	35	35	38	38	38	43	40	40
Jerrys Plains Road	463	37*	29	30	38	27	27	36	30	30	39	26	27	38	35	35	35	38	38	38	43	40	40
South-west Camberwell	471		23	31	31	21	31	30	21	30	30	19	27	27	37 ⁵	37 ⁵	37 ⁵	38	38	38	43	40	40
South-west Camberwell	472		24	32	32	21	28	29	21	28	29	19	26	27	37 ⁵	37 ⁵	37 ⁵	38	38	38	43	40	40

- Note:
1. Predicted values marked with an * are the value of the nearest predicted receiver in the ERM report (2008).
 2. Mitigation applies if noise level contribution from site alone equals or exceeds this value (as per PA).
 3. Acquisition applies if noise level contribution from site alone exceeds this value (as per PA).
 4. Predictions for these properties are $L_{Aeq,period}$ since these are non-residences. For location 264 (St Philips Church), the 40 dB $L_{Aeq,period}$ internal criteria is conservatively 50 dB externally based on partially open windows/doors.
 5. The PSNLs are based on RBL data published in the HVO AEMR 2007 collected at the property Moxey in Maison Dieu, and are otherwise consistent with limits at other Maison Dieu properties located nearby.

Key:

- Entitled to acquisition as per consent limits
- Entitled to mitigation as per consent limits
- Exceeds operational criteria consent limits



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