MOOLARBEN COAL PROJECT

Stage 2

APPENDIX 4

Noise and Vibration Impact Assessment

Project No: 07289

Noise and Vibration Impact Assessment
Moolarben Coal Project – Stage 2
Ulan, NSW

Prepared for:

Wells Environmental Services
PO Box 205
East Maitland NSW 2323

Author:

.....
Neil Pennington
B.Sc., B. Math.(Hons), MAAS, MASA
Principal / Director

Review:

.....
Ross Hodge
B.Sc.(Hons)
Principal / Director

December 2008

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 The Proposal 1
1.2 Study Area 1
1.3 Proposed Operations 1
1.4 Surrounding Land Uses and Receivers 2

2.0 DESCRIPTION OF TERMS 5

2.1 General Terms 5
2.2 Noise Level Percentiles 7

3.0 THE EXISTING ENVIRONMENT 9

3.1 Meteorology 9
3.2 Ambient Noise Levels 10

4.0 CONSTRUCTION NOISE 10

5.0 OPERATIONAL NOISE 12

5.1 Operational Noise Criteria 12
5.2 Noise Impact Assessment Procedure 14
5.2.1 Noise Sources 14
5.2.2 Modelled Scenarios 16
5.3 Predicted Operational Noise Levels 18
5.3.1 Scenario 1: Year 2 18
5.3.2 Year 2 Recommendations 19
5.3.3 Scenario 2: Year 7 20
5.3.4 Year 7 Recommendations 21
Scenario 3: 22
5.3.5 Year 12 22
5.3.6 Year 12 Recommendations 23
5.3.7 Year 16 Operational Noise 23
5.3.8 Year 16 Recommendations 25
5.3.9 Scenario 5: Year 19 25
5.3.10 Year 19 Recommendations 27
5.3.11 Year 24 Operational Noise 27
5.3.12 Year 24 Recommendations 28
5.4 Sleep Disturbance 29
5.4.1 Year 2 Maximum Levels 29
5.4.2 Year 7 maximum levels 30
5.4.3 Year 12 Maximum Levels 30
5.5 Cumulative Mining Noise Levels 31
5.6 DECC Estate 32

6.0 OFF-SITE RAIL TRAFFIC 33

6.1 Train Noise Criteria 33
6.1.1 Train Noise Criteria – MCP 33
6.1.2 Train Noise Criteria – Cumulative 34
6.2 Train Noise Impact Assessment 34
6.2.1 Theoretical Method 34
6.2.2 Measurement Method 36
6.2.3 Train Vibration Assessment 39

7.0 OFF-SITE ROAD TRAFFIC 41

7.1 Traffic Noise Criteria 41
7.2 Predicted Traffic Noise Levels 41

8.0 BLAST OVERPRESSURE AND VIBRATION 43

8.1 Blasting Criteria 43
8.2 Blast Impact Assessment Procedure 43
8.2.1 Blast Overpressure 43
8.2.2 Blast Vibration 44
8.3 Blast Impact Predictions 44
8.3.1 Residential Receivers 44
8.3.2 Non-residential Locations 45

9.0 SUMMARY OF IMPACTS AND RECOMMENDATIONS 47

9.1 Impacted Receivers 47

10.0 CONCLUSION 49

APPENDIX A Ambient Noise Level Charts

APPENDIX B Noise Source Locations

APPENDIX C Noise Level Contours

EXECUTIVE SUMMARY

A Noise and Vibration Impact Assessment (NVIA) has been prepared for Stage 2 of the Moolarben Coal Project near Ulan, NSW. Stage 1 of the project received planning approval on 6 September 2007. The Stage 1 assessment and subsequent Construction Noise Management Plan (CNMP) (subject to approval) covered the initial 6 month construction period and the Noise Monitoring Program (also subject to approval) addressed noise monitoring for Stage 1 of the MCP. This assessment considers potential cumulative noise and vibration impacts from Year 2 of the overall MCP (Stage 1 and Stage 2) when mining in the proposed Open Cut 4 would commence. Cumulative Stage 1 and Stage 2 construction noise impacts have also been assessed.

The assessment is based on or refers to the following Standards, policies, guidelines and documents:

- DECC *NSW Industrial Noise Policy* (2000).
- DECC *Environmental Criteria for Road Traffic Noise* (1999).
- ANZECC *Technical basis for guidelines to minimise annoyance due to blast overpressure and ground vibration* (2000).
- DECC publication *Assessing Vibration: a technical guideline* (2006).
- Australian Rail Track Corporation (ARTC) Environmental pollution license EPL 3142.
- Wilpinjong Noise and Blasting Impact Assessment, Richard Heggie Associates (RTA, 2005).
- Traffic Impact Assessment (TIA) for the Moolarben Coal Project, Sinclair Knight Merz (SKM, 2006).
- US EPA document No. 550/9-74-004 "Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974".
- AS 2187.2-1993 *"Explosives – Storage, Transport and Use. Part 2: Use of Explosives"*

A brief summary of essential data, results and recommendations arising from this assessment is presented below.

Ambient Noise Levels

Ambient noise monitoring was conducted at three residential receivers surrounding the project site during the period 10 to 16 June 2008 (refer to Figure 1 on p3 for noise monitoring locations). Existing L_{Aeq} and L_{A90} (Rating Background levels, RBL) levels are summarised in **Table S1**.

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
R160 Ulan Public School	56	50	50	32	32	30
R26 Robinson	51	49	43	31	32	30
R36 Rayner	54	40	32	30	30	30

TABLE S1
Measured ambient noise levels (June 2008).
(L_{90} values below 30 dB(A) have been set to 30dB(A) per DECC guidelines.)

The purpose of the additional monitoring was to determine whether noise from the Wilpinjong Coal Mine had changed the acoustic environment at the monitoring locations as this would potentially change the amenity noise criteria for the MCP measured in 2005 for Stage 1. No discernible difference was measured and noise criteria at the monitoring locations have remained the same as specified in the Stage 1 Project Approval.

Operational Noise Criteria

This assessment is based on operational noise criteria as presented in the Project Approval for the Stage 1 of the MCP, and reproduced below:

Noise Impact Assessment Criteria

2. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 2 at any residence on privately-owned land, or on more than 25% of any privately-owned land.

Table 2: Noise impact assessment criteria dB(A)

Land Number	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
26, 49	38	38	38	45
22, 23, 41A, 63, 64, 170, 171, 172	38	38	37	45
169, 173	37	37	37	45
All other privately owned land (outside the village of Ulan)	35	35	35	45
Ulan Primary School	35 (internal) when in use and under all weather conditions			-
Ulan Anglican Church Ulan Catholic Church	35 (internal) when in use and under all weather conditions			-
Goulburn River National Park Munghorn Gap Nature Reserve	50			-

However, the Proponent may exceed the noise limits in Table 2 if it has:

(a) a written negotiated noise agreement with any landowner for higher noise limits, and a copy of this agreement has been forwarded to the Department and DECC; or

(b) an approved Construction Noise Management Plan (see condition 7 below) for the project, which sets higher noise limits for a specified period.

Notes:

- *To determine compliance with the $L_{Aeq(15\ minute)}$ noise limits, noise from the project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural situations) where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.*
- *To determine compliance with the $L_{A1(1\ minute)}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the DECC may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).*
- *The noise emission limits identified in the above table apply under meteorological conditions of:*
  - *wind speeds of up to 3 m/s at 10 metres above ground level ; or*
  - *temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.*

Land Acquisition Criteria

3. If the noise generated by the project exceeds the relevant criteria in Table 3 at any residence on privately-owned land or on more than 25% of any privately-owned land, the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 10-12 of Schedule 4.

Table 3: Land acquisition criteria dB(A)

Day/Evening/Night $L_{Aeq(15min)}$	Land Number
43 / 43 / 43	26, 49
43 / 43 / 42	22, 23, 41A, 63, 64, 170, 171, 172,
42 / 42 / 42	169, 173
40 / 40 / 40	All other private land owners not listed in Table 1

Note: Noise generated by the project is to be measured in accordance with the notes presented below Table 2.

Cumulative Noise Criteria

4. The Proponent shall take all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by other mines does not exceed the following amenity criteria at any residence on privately owned land, or on more than 25% of any privately owned land, excluding the land listed in Table 1, to the satisfaction of the Director-General:
   - $L_{Aeq(11\ hour)}$ *50 dB(A) - Day;*
   - $L_{Aeq(4\ hour)}$ *45 dB(A) - Evening;*
   - $L_{Aeq(9\ hour)}$ *40 dB(A) – Night.*

5. If the cumulative noise generated by the project combined with the noise generated by other mines exceeds the following amenity criteria at any residence on privately owned land, or on more than 25% of privately owned land, excluding the land listed in Table 1, then upon receiving a written request from the landowner, the Proponent shall take all reasonable and feasible measures to acquire the land on as equitable basis as possible with the relevant mines, in accordance with the procedures in conditions 10-12 of schedule 4, to the satisfaction of the Director-General:
   - $L_{Aeq(11\ hour)}$ *53 dB(A) - Day;*
   - $L_{Aeq(4\ hour)}$ *48 dB(A) - Evening;*
   - $L_{Aeq(9\ hour)}$ *43 dB(A) – Night.*

Notes:
- *For the purpose of this condition, the expression "Proponent" in conditions 10-12 of schedule 4 should be interpreted as the Proponent and any other relevant mine owners.*
- *The cumulative noise generated by the project combined with the noise generated by other mines is to be measured in accordance with the relevant procedures in the NSW Industrial Noise Policy.*

Traffic Noise Impact Assessment Criteria

6. The Proponent shall take all reasonable and feasible measures to ensure that the traffic noise generated by the project combined with the traffic noise generated by other mines does not exceed the traffic noise impact assessment criteria in Table 4.

Table 4: Traffic noise criteria dB(A)

Road	Day/Evening $L_{Aeq(1\ hour)}$	Night $L_{Aeq(1\ hour)}$
Ulan Road	60	55

Note: Traffic noise generated by the project is to be measured in accordance with the relevant procedures in the DECC's Environmental Criteria for Road Traffic Noise.

Summary of Affected Receivers

Noise levels above the project specific criteria have been predicted at seven Ulan or Wilpinjong Mine owned properties as summarised below.

Receiver	Owner	Criterion	Predicted	Year of impact	Source
46B	Ulan	35	>45	7	OC4
46C	Ulan	35	47	2	OC4 haulage
46G	Ulan	35	36 to >45	After Year 7	OC4
65B	Wilpinjong	35	up to 38	After Year 19	OC4
65C	Wilpinjong	35	up to 38	After Year 19	OC4
65D	Wilpinjong	35	up to 38	After Year 19	OC4
141	Wilpinjong	35	up to 38	After Year 19	OC4

Receivers R46C/G lie within the footprint of OC4 and will fall into MCM ownership. Recommendations have been made to assess cumulative noise levels and the residential status of the remaining mine-owned receivers at some time prior to when the excessive noise levels are predicted to occur.

The assessment has found that no additional receivers west or south of the site would be included in an acquisition zone as a result of Stage 2 components of the project. Receivers R27 (Helm) and R44 (Power) would be included in the OC4 acquisition zone and have recently been acquired by MCM.

Some receivers are predicted to have received noise levels close to the noise criteria and up to a 3 dB exceedance under adverse weather conditions. These receivers should be included as attended noise monitoring locations and include the following:

Open Cut 1 – commences Year 2

Receiver	Exceedance (dB)
R26 (Robinson)	N/A[1]
R169 (Tinker)	N/A
R22 (Aiton)	N/A

Open Cut 2 – commences Year 7

Receiver	Exceedance (dB)
R22 (Aiton)[2]	up to 3
R23 (Woodhead)	up to 2
R41A (Libertis)	1
R63 (Whiticker)	N/A
R64 (Goninan & Boland)	N/A
R70 (Coventry)	N/A
R172 (Kimber)	N/A

[1] Signifies a predicted level equal to or less than the criterion.

[2] Monitoring at R22 would be representative of R23, R41A, R63 and R64.

Open Cut 3 – commences Year 12

Receiver	Exceedance (dB)
R30 (Cox)	1
R35 (Johnson)	N/A
R47 (Andrews)	N/A

The four receivers with predicted exceedances up to 3 dB will be incorporated in a Noise Management Plan requiring attended and/or real-time noise monitoring to be conducted for at least a year prior to commencement of the MCP component responsible for the noise exceedance. Based on this noise monitoring, and noise model validation studies, noise management/mitigation options will be investigated with the intent of achieving compliance with the relevant noise criteria. Where this is not reasonably or feasibly possible, it may be necessary to enter into negotiated agreements with the affected receivers.

Train Noise Predictions

It is understood that train noise on the Gulgong – Sandy Hollow Rail Line is the responsibility of the Australian Rail Track Corporation (ARTC) with noise goals and Pollution Reduction Program guidelines contained in their Environmental Protection Licence (EPL 3124). The set-back distance for achieving the ARTC noise goals at locations between the project site and Muswellbrook is approximately 70 m and is governed by predicted night time noise levels.

Twenty-two residences were identified as being within 70 m of the rail line between the site and Muswellbrook during a helicopter survey of the rail line in April 2006. Most of these residences are in the town of Denman with the remaining residences being in rural areas. The rail line was in deep cut near several of the identified residences and two residences appeared to have acoustic bunds between the rail line and residence. Any future assessment of rail noise impacts would therefore need to be specific for each receiver and not reliant upon the predictions in this report.

Vibration levels from all coal trains associated with Ulan, Wilpinjong and Moolarben mines are predicted to be equal to or less than the DECC recommended vibration dose levels at a receiver 20m from the train line. The addition of freight trains would increase the vibration doses, however, and any future assessment of train noise at individual receivers would need to include a vibration assessment.

Road Traffic Noise

An assessment of the peak traffic noise levels at shift change has found that no adverse noise impact is expected at any receiver, especially since all residences along the Ulan-Gulgong Road in Ulan are now mine-owned.

One receiver west of Ulan has been nominated as a traffic noise monitoring location.

Sleep Disturbance

An assessment of potential sleep disturbance under a worst case operating scenario has predicted levels that are not likely to disturb the sleep of any receiver. Worst case impact levels from dozer tracks at high level on the OC1 out of pit emplacement may exceed the DECC sleep disturbance 'screening criterion' of 45 dB(A) by

2 dB at R26 (Olive Lea) and R49 (Robinson). Should these levels eventuate and be intrusive, management procedures may be introduced to reduce dozer track noise. This may involve restricting dozers to reverse at low speed or to be moved to a lower level working area until the adverse conditions abate.

Mobile plant items will be fitted with broadband reverse alarms which have proven very effective in mitigating the noise impact from this source. Examples previously tested by Spectrum Acoustics are 10 dB quieter (perceived as half as loud) in the tonal frequency bands of standard alarms. The total noise is spread over many frequency bands so the sound is not tonal, it is more of a “static hiss” that dissipates rapidly with distance.

Blasting

No privately owned residential receivers (excluding those in the Stage 1 Project Approval acquisition zone) are predicted to be impacted above the Stage 1 Project Approval acquisition criteria by blasting within Stage 2 of the project.

No adverse blasting impacts have been predicted at any non-residential locations when assessed against blasting criteria contained in the Stage 1 project approval.

In summary, it has been found that the Moolarben Coal Project can operate within the applicable noise and vibration guidelines.

1.0 INTRODUCTION

1.1 The Proposal

Moolarben Coal Mines Pty Limited (MCM) is seeking to gain approval for Stage 2 of the Moolarben Coal Project (MCP) in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong. Planning approval for Stage 1 of the MCP consisting of three open cuts and an underground mine with supporting infrastructure was granted by the Minister for Planning on 6 September 2007.

Stage 2 consists of Open Cut 4 (OC4), Underground Mines (UG1 and UG2) and supporting infrastructure that will integrate with the approved Stage 1 infrastructure.

If approved, Stage 2 will operate in conjunction with Stage 1 to constitute the MCP which will operate as a single integrated mining complex comprising three underground and four open cut coal mines with surface facilities comprising coal handling, preparation, Run of Mine (ROM), raw and product coal stock piling and loading at the currently approved facilities.

1.2 Study Area

The MCP site lies south and east of the existing Ulan Mine and immediately west of the approved Wilpinjong Mine. The project area is characterised by substantial topographic relief, with land elevation ranging from about 400m reduced level (RL) in valleys to over 600m RL on adjacent ridges. The approved Open Cuts 1, 2 and 3 lie adjacent to the western escarpments of the Munghorn Gap Nature Reserve and adjacent ridgelines. The proposed Stage 2 lies in the Murragamba Valley and extends from the ridgeline east of Open Cuts 1 and 2 to the western boundary of the Wilpinjong Mine.

1.3 Proposed Operations

The approved Stage 1 comprises mining in Underground (UG) No 4 and Open Cuts (OC) No 1, 2 and 3, as well as the use of the surface facilities, with a production of 10 Mtpa of product coal from a maximum of 12 Million tonnes per annum (Mtpa) ROM. The Stage 2 approval is sought to approve mining in OC4 UG1 and UG2 and to upgrade the surface facilities to achieve a total of 13 Mtpa of product coal from a maximum of 17 Mtpa ROM.

Infrastructure will be located on both sides of the Gulgong – Sandy Hollow Railway Line. This will comprise coal stockpiling, washing plant and rail

loading facilities on a balloon loop. Coal will be transported by rail to the Port of Newcastle.

The underground and open cut mines would operate concurrently with all coals washed on site in a two-stage Dense Medium Cyclone (DMC) plant yielding up to 13 Mtpa of product coal.

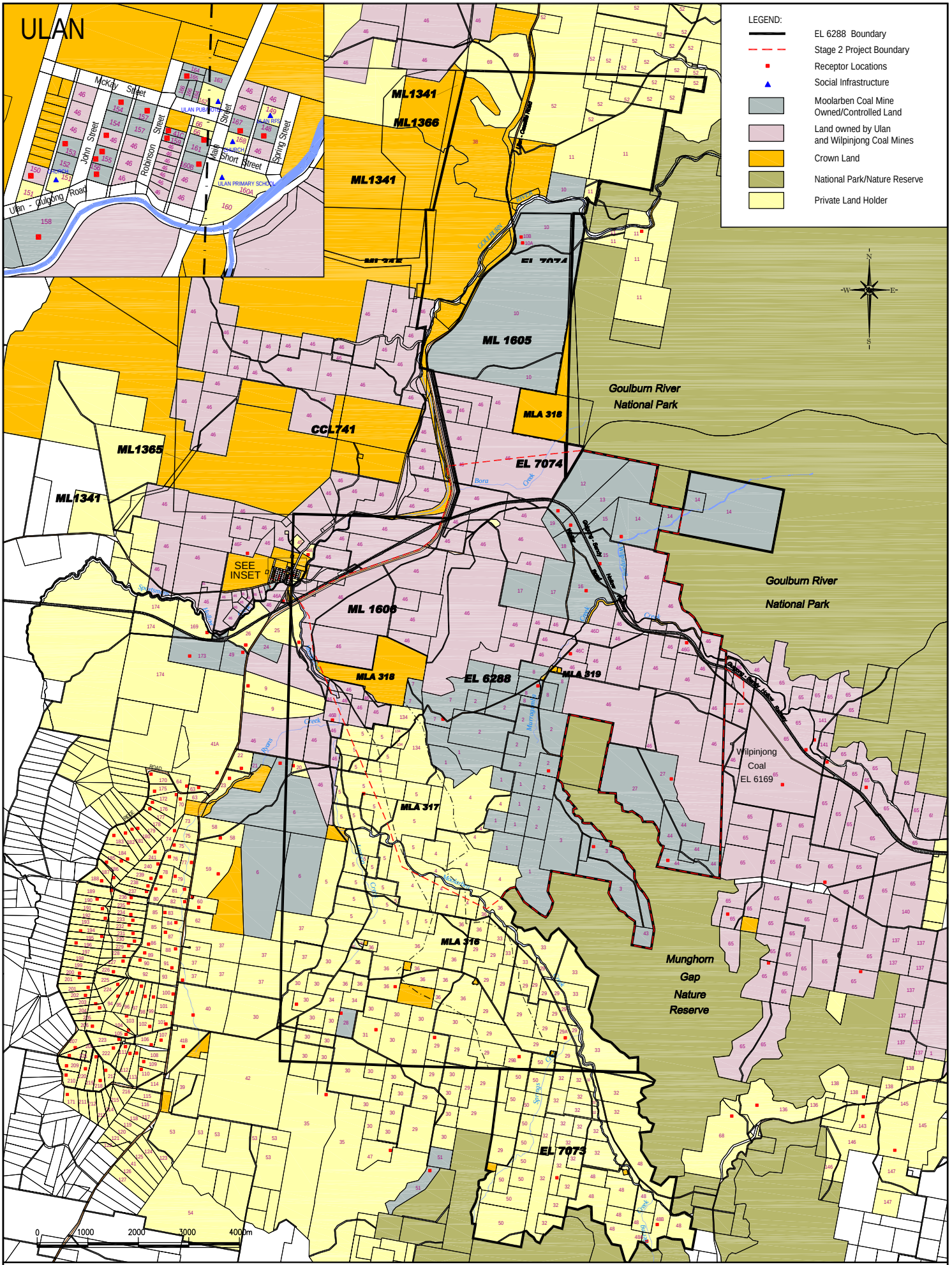
1.4 Surrounding Land Uses and Receivers

Clause 1 of Schedule 3 in the Stage 1 Project Approval lists several receivers that were identified as noise-affected and could be acquired by MCM on request by the receiver. These receivers are listed in **Table 1** below.

TABLE 1
Noise-affected receivers (acquisition upon request) in Stage 1 consent.

Receiver	Owner / Description
R4	M. Swords (no dwelling)
R5	M & P Swords "The Lagoon"
R6	**KC Thompson (vacant land) [ACQUIRED]**
R15	**Green [ACQUIRED]**
R20	AJ & NN Williamson
R25	GG Tuck-Lee & S H Symons
R29a	E. Mayberry "Croydon"
R29b	E. Mayberry
R29	E. Mayberry (no dwelling)
R33	K & R Mayberry
R36	D & Y Rayner
R50	C. Mayberry (no dwelling)
R134	MJ & H Swords (no dwelling)
R163	**CM & JJ Key [ACQUIRED]**
R164	**JJ Key [ACQUIRED]**
R166	**CM Key [ACQUIRED]**

Ambient noise monitoring locations for Stage 2, and land ownership as defined in the body of the Environmental Assessment Report (EAR), are shown in **Figure 1**. Residential receivers considered in this assessment are shown in **Table 2**. Many of the noise-affected receivers shown in Table 1 are included in Table 2 and the current assessment to highlight the stages of the MCP at which these receivers fall into the 'acquisition zone'. As an example, R29a and R29b do not become noise affected until commencement of mining in OC3, which may not occur until 12 years or more after commencement of the project.



Pegasus Technical

Moolarben Coal Project

Stage 2 Major Project Application Area and Land Ownership

Figure 1

CAD FILE: 03384B.dwg

TABLE 2
MCP Stage 2 assessed receivers (per Figure 1).

Receiver	Description
162	Ulan Pub/Hotel
168	Anglican Church
160A	Ulan Public School
151	Catholic Church
158	**Carlisle, K.E. & R.A. [ACQUIRED BY MCM]**
46A	Flannery Centre [OWNED BY ULAN COAL MINE]
25	Tuck-Lee, G.G. & Symons, S.H.
26	Robinson, G.V.
49	**Brooks, A.M. [ACQUIRED BY MCM]**
169	Tinker, E.H. & R.J.
173	**Richter, H. [ACQUIRED BY MCM]**
9	I.C.I. Australia Operations
22	Aiton, A.L
23	Woodhead, A & E
41A	Libertis, P.
63	Whiticker, B.F & B
64	Goninan & Boland
70	Coventry, D.J. & A.
172	Kimber, A & T
170	Roberts, W & T
58	Bevege, M. L.& J. L.
59	Szymkarcuk, G. & G. M.
61	Miller, M.A.
60	Rayner, B.D. & D.M.
37	Szymkarczuk, J.
40	Devenish, J.
41B	Libertis, P.
106	Reid, T.B. & J.H.
171	McGregor, J.M.
46B	Ulan Coal Mines Ltd.
20	Williamson, A.J & N.N
5	Swords, M. & P.
30	Cox, R.
31	Cox, M.
36	Rayner, D. & Y.
29	E Mayberry (no residence)
29B	Mayberry, E.
29A	Mayberry, E.
35	P Johnson
47	Andrews, S.F. & M.R.
32	Stokes, D. & J.
48B	O'Sullivan, J.G. & J.W.
68	Batty, G.C. & E.M.
136	Maranda, D.T.
8	**Davies, C. & H. [ACQUIRED BY MCM]**
46C	Murragamba House (Unoccupied) [OWNED BY ULAN COAL MINE]
15	**Green, L. [ACQUIRED BY MCM]**
44	**Power, E., D., & C. [ACQUIRED BY MCM]**
27	**Helm, G.C. & J.K. [ACQUIRED BY MCM]**
46G	UCML (Ray Mitchell) [OWNED BY ULAN COAL MINE]
65B	Cumbo Land Pty Ltd (WMCL)

2.0 DESCRIPTION OF TERMS

This section of the report aims to convey an understanding of several commonly used acoustical terms. Various terms are explained in plain language and the effects of certain atmospheric conditions on noise propagation are discussed. Noise level percentiles are explained with the aid of a diagram of a hypothetical noise signal.

The descriptions in this section are not formal definitions of the terms. Formal definitions may be found in AS1633-1985 "Acoustics – Glossary of terms and related symbols".

2.1 General Terms

Sound Power Level

The amount of acoustic energy (per second) emitted by a noise source. Usually written as "L_w" or "SWL", the Sound Power Level is expressed in decibels (dB) and cannot be directly measured. L_w is usually calculated from a measured sound pressure level.

Sound Pressure Level

The "noise level", in decibels (dB), heard by our ears and/or measured with a sound level meter. Written as "SPL", the sound pressure level generally decreases with increasing distance from a source. Noise levels are often written as dB(A) rather than dB. The "A-weighting" is a correction applied to the measured noise signal to account for the ear's ability to hear sound differently at different frequencies. The A-weighted sound pressure level therefore represents the measured (or predicted) noise level as it would be heard by the typical human ear.

Temperature Inversion

An atmospheric state in which the air temperature increases with altitude. Sound travels faster in warmer air than in cold air, so that during an inversion the top of a "sound wave" will move faster than the bottom. This bends (refracts) sound back towards the ground. The result is a "trapping" of sound energy near the ground and an increase in noise levels. Similarly, daytime air temperatures typically reduce with altitude (approximately 1-2 ^{0}C/100m called the adiabatic lapse rate) and sound refracts upward slightly. The result is slightly reduced noise levels compared with a uniform or 'neutral' atmosphere.

Wind Shear

A moving air mass will experience a "friction drag" at the ground in much the same way as a lava flow will flow quickly on top and "roll over" the lava

beneath which must drag along the ground. This increasing wind speed with altitude is called “wind shear”.

For a sound wave travelling down wind, the top of the wave moves faster than the bottom and the wave bends towards the ground. However, for a wave travelling into the wind the top of the wave is slowed down more than the bottom is and the wave bends upwards. **Figure 2** shows several examples of how atmospheric effects can bend sound waves.

FIGURE 2
Sound refraction under temperature inversions and wind gradients.

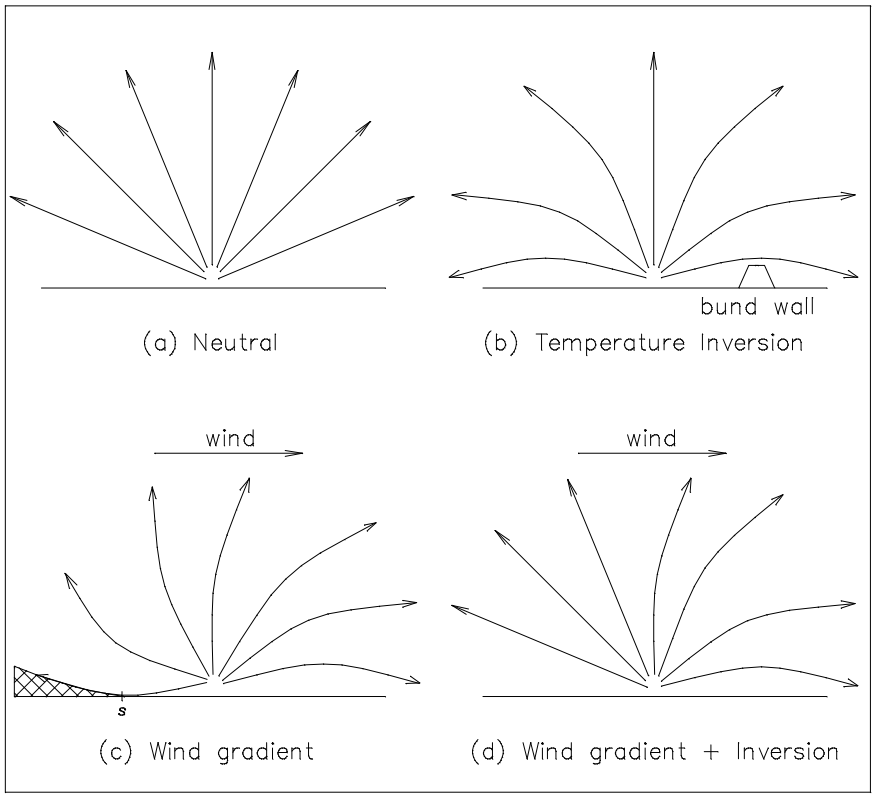


Figure 2 shows that sound rays can be refracted over a barrier (usually a bund wall or small hill) during a temperature inversion, increasing noise levels in the ‘shadow zone’.

Neutral Atmospheric Conditions

An atmosphere that is at a temperature of approximately 23^0C from ground level to an altitude of 200m or more. There are no fluctuations in density or humidity and no wind. Such conditions rarely occur, as temperature will usually vary with altitude and there is always movement in various directions in different layers of the atmosphere.

Prevailing Atmospheric Conditions

Atmospheric conditions (with regards to potential effects on noise propagation) which are characteristic of the study area. These will typically include seasonal wind directions and velocities. Temperature

inversions will be included as prevailing if they occur, on average, for more than 2 nights per week in winter.

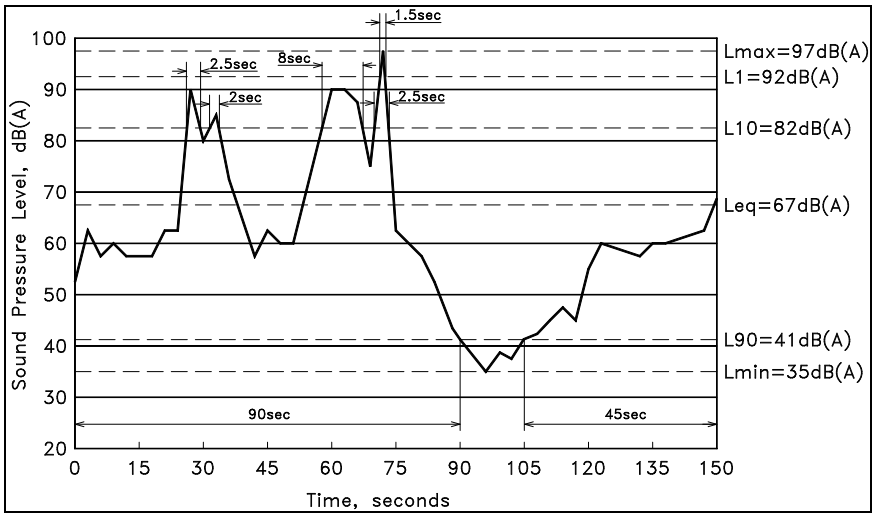
Adverse Atmospheric Conditions

Adverse conditions will include simultaneous winds and temperature inversions, even if the inversions occur for less than 2 nights per week in winter. This represents the worst case scenario for potential noise enhancement due to atmospheric effects.

2.2 Noise Level Percentiles

A noise level percentile (L_n) is the noise level (SPL) in decibels which is exceeded for "n" % of a given monitoring period. Several important L_n percentiles will be explained by considering the hypothetical time signal in **Figure 3**.

FIGURE 3
Hypothetical time signal to illustrate noise level percentiles.



The signal in Figure 3 has a duration of 2.5 minutes (ie 150 seconds) with noises occurring as follows:

- The instrument is located beside a road and records crickets in nearby grass at a level of around 60 dB (A);
- At about the 30 second mark a motorcycle passes on the road, followed by a car;
- At 60 seconds a truck passes;
- After the truck passes it sounds its air horn at the 73 second mark;
- The crickets are startled into silence as the truck fades into the distance;
- All is quiet until 105 seconds when the crickets slowly start to make noise, reaching full pitch by 120 seconds; and
- The measurement stops at 150 seconds, just when an approaching car starts to become audible.

L_{A1} Noise Level

Near the top of Figure 3, there is a dashed line at 92 dB(A). A small spike of 1.5 sec duration extends above this line at around 73 seconds. Since 1.5 sec is 1% of the signal duration (150 seconds), the L_1 (or L_{A1} to signify A-weighting) noise level of this sample is 92 dB(A) and is from the truck's air horn. The L_1 percentile is often called the *average peak noise level* and is used by the NSW Department of Environment and Climate Change (DECC) as a measure of potential disturbance to sleep.

L_{A10} Noise Level

The dashed line at 82 dB(A) is exceeded for four periods of duration 2.5 sec, 2 sec, 8 sec and 2.5 sec, respectively. The total of these is 15 sec, which is 10% of the total sample period. Therefore, the L_{A10} noise level of this sample is 82 dB(A). The L_{A10} percentile is called the *average maximum noise level* and has been widely used as an indicator of annoyance caused by noise.

L_{A90} Noise Level

In similar fashion to L_{A1} and L_{A10}, Figure 3 shows that the noise level of 41 dB(A) is exceeded for 135 seconds (90 + 45 =135). As this is 90% of the total sample period, the L_{A90} noise level of this sample is 41 dB(A). The L_{A90} percentile is called the *background noise level*.

L_{Aeq} Noise Level

Equivalent continuous noise level. As the name suggests, the L_{Aeq} of a fluctuating signal is the continuous noise level which, if occurring for the duration of the signal, would deliver equivalent acoustic energy to the actual signal. L_{Aeq} can be thought of as a kind of 'average' noise level. Recent research suggests that L_{Aeq} is the best indicator of annoyance caused by industrial noise and the DECC *NSW Industrial Noise Policy* (INP) takes this into consideration.

L_{Amax} and L_{Amin} Noise Levels

These are the maximum and minimum SPL values occurring during the sample. Reference to Figure 3 shows these values to be 97 dB(A) and 35 dB(A), respectively.

3.0 THE EXISTING ENVIRONMENT

The existing meteorological and acoustic environments have been studied as part of this Environmental Assessment (EA) and the MCP Stage 1 EA.

3.1 Meteorology

Meteorological data from weather monitoring stations near the Rayner residence (R36) and in Ulan Village were analysed by Holmes Air Sciences (HAS) for the Stage 1 EA. More recent wind roses presented in the Ulan Coal Mine Annual Environmental Monitoring Report (AEMR) for 2007 were analysed for this assessment because they represent a complete set of measured data, whereas the data used for the Stage 1 EA were a composite of measured data and The Air Pollution Model (TAPM) predictions. The following data are the most significant with respect to noise propagation:

- Extremes of relative humidity (RH) are rarely experienced. For modelling purposes, a value of 70% RH was adopted;

- Mild temperature inversions (F class Pasquill stability) occur during more than 30% of nights in winter, with only a minimal occurrence of G class conditions. An inversion strength of $+3^{0}$C/100m was adopted in the noise models (as per procedures in the INP, Appendix C). Meteorological data from the MCP weather station in Ulan Village suggest that winds are predominantly from the northeast under F class stability conditions. This wind direction is slightly noise-decreasing with respect to residences near Ulan village and the OC4 western out-of-pit emplacement. At the Rayner weather station, winds coinciding with mild temperature inversions are predominantly from the southeast. Again, this is noise decreasing with respect to receivers R30 and R31 (and all receivers south of these). To present a worst case impact assessment, no drainage wind was modelled with the temperature inversion; and

- Wind roses presented in the Ulan Coal Mine AEMR for 2007 show that gradient winds (vector component up to 3 m/s) are predominantly east-northeasterly in summer/autumn and south westerly in winter/spring. A wind speed of 3m/s (at 10m above ground level) from each of these directions was modelled to determine the noise impact under these 'prevailing' wind conditions.

Typical calm daytime conditions of no wind, 70% RH and -1^{o}C/100m vertical temperature gradient (ie, dry adiabatic lapse rate, DALR) were also modelled to represent daytime noise levels under calm conditions.

3.2 Ambient Noise Levels

Ambient noise monitoring was conducted at three receivers surrounding the project site during the period 10 to 16 June 2008 (refer to Figure 1 for noise monitoring locations). Existing L_{Aeq} and L_{A90} (Rating Background Levels, RBL) levels are summarised in **Table 3**. Noise data charts are shown in **Appendix A**.

TABLE 3
Measured ambient noise levels (June 2008).

Location	L_{Aeq}, period			L_{A90}, period		
	Day	Evening	Night	Day	Evening	Night
R160 Ulan Public School	56	50	50	32	32	30
R26 Robinson	51	49	43	31	32	30
R36 Rayner	54	40	32	30	30	30

For the purposes of setting noise criteria relative to ambient noise levels, the INP considers an RBL which is equal to:

- The measured background noise level if this is >=30 dB(A),L_{90}; or
- 30dB(A) if the measured level is <30 dB(A),L_{90}.

Analysis of the noise data indicates that Wilpinjong Coal Mine does not significantly contribution to the acoustic environment at the measurement locations. Noise criteria contained in the Stage 1 Project Approval will be adopted for the Stage 2 assessment. These criteria are detailed in Section 5.1 of this report.

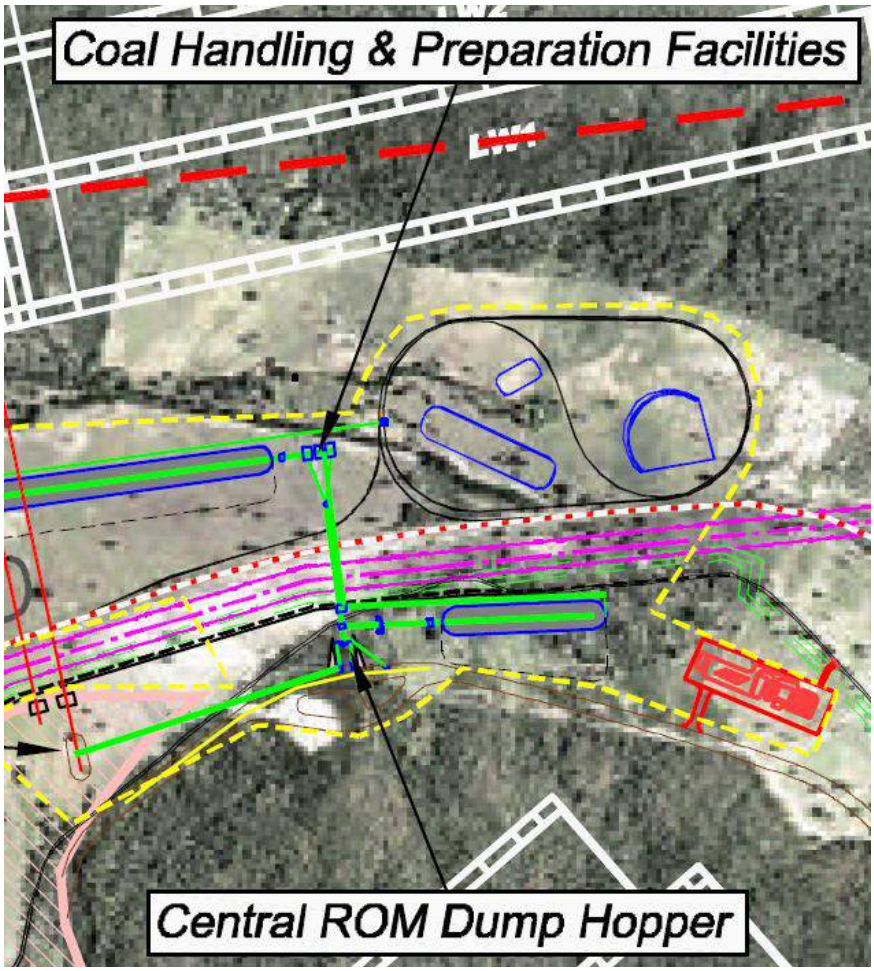
4.0 CONSTRUCTION NOISE

The Stage 1 EA noise assessment considered construction of an environmental bund west of OC1 and all surface structures. Stage 2 would introduce additional surface facilities and construction of these requires assessment for potential noise impacts. Surface facilities for Stage 2 are shown in **Figure 4** below.

Changes from the approved Stage 1 layout and additional structures are:

- One of the two product stockpiles has been relocated to the southern side of the train line;
- An additional ROM dump hopper and sizing station to receive coal from OC4;
- Additional conveyors to transfer coal to/from the approved washery; and
- Additional stacker and reclaimer at the new stockpile.

FIGURE 4
Approved Stage 1 and proposed Stage 2 surface facilities.



Construction of the additional items listed above would require earthworks followed by building of the structures. A sound power level of 118 dB(A) was adopted for a grader and D9 dozer conducting earthworks. General metal fabrication including hammering and grinding has a sound power level of 120 dB(A) and would occur as high as 25m above ground level (when constructing the proposed sizing station).

The assessment of construction noise from the additional Stage 2 components was conducted using RTA Technology's Environmental Noise Model (ENM) v3.06. Point calculations were performed to predict levels at several receivers nearest to the site. Worst case noise levels[3] for all assessed meteorological conditions (including inversions) are shown in **Table 4** along with predicted worst case Stage 1 construction noise levels at these receivers and the cumulative levels.

[3] Predicted levels are $L_{Aeq(15\ minute)}$ for comparison with operational noise criteria because L_{A10} construction noise criteria as defined in the DECC Environmental Noise Control Manual (ENCM) are not normally applied to coal mines.

TABLE 4
Predicted worst case construction noise levels.

Receiver	Stage 2	Stage 1	TOTAL
R46G (UCML)	24	<25	<28
R160A (Ulan School)	26	46	46
R46B (UCML)	19	43	43
R26 (Robinson)	24	44	44

The results in Table 4 show that additional construction works associated with Stage 2 may combine with Stage 1 construction noise to increase noise levels to no more than 28 dB(A) at R46G. This is 7 dB below the operational noise criterion at this receiver.

Stage 2 construction works will not contribute any noise additional to that predicted for Stage 1 construction activities at any other receiver. Consent conditions in the Stage 1 approval relating to construction noise are therefore unaffected by construction noise from the proposed Stage 2.

5.0 OPERATIONAL NOISE

Noise criteria during the initial construction and site establishment period are contained in the Stage 1 Construction Noise Management Plan (CNMP) (subject to approval). The present assessment commences with Year 2 mining operations and the criteria and activities prior to this will not be considered further.

5.1 Operational Noise Criteria

Operational noise criteria from the Stage 1 Project Approval are shown in **Table 5** below. These criteria will be adopted for the 'whole-of-project' noise emissions including all components of Stages 1 and 2. Those receivers shaded yellow have been acquired by MCM or are subject to acquisition by MCM on request of the receiver under the Stage 1 Project Approval.

TABLE 5
MCP Stage 1 approved operational noise criteria. These will be applied to Stage 2 noise emissions.

Receiver	Operational Noise Criteria			
	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
162 (Ulan Hotel)	65 when in use and under all weather conditions			
168 (church)	35 (internal) when in use and under all weather conditions			
160A (school)	35 (internal) when in use and under all weather conditions			
151 (church)	35 (internal) when in use and under all weather conditions			
158*	38	38	38	45
46A*	38	38	38	45
25	N/A (receiver is in Stage 1 acquisition zone)			
26	38	38	38	45
49	38	38	38	45
169	37	37	37	45
173	37	37	37	45

Receiver	Operational Noise Criteria			
	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
9 (Orica)	65 when in use and under all weather conditions			
22	38	38	37	45
23	38	38	37	45
41A	38	38	37	45
63	38	38	37	45
64	38	38	37	45
70#	38	38	37	45
172	38	38	37	45
170	38	38	37	45
58	35	35	35	45
59	35	35	35	45
61	35	35	35	45
60	35	35	35	45
37	35	35	35	45
40	35	35	35	45
41B	35	35	35	45
106	35	35	35	45
171	35	35	35	45
46B	35	35	35	45
20	35	35	35	45
5	35	35	35	45
30	35	35	35	45
31	35	35	35	45
36	35	35	35	45
29	35	35	35	45
29B	35	35	35	45
29A	35	35	35	45
35	35	35	35	45
47	35	35	35	45
32	35	35	35	45
48B	35	35	35	45
68	35	35	35	45
136	35	35	35	45
8	35	35	35	45
46C	35	35	35	45
15	35	35	35	45
44	35	35	35	45
27	35	35	35	45
46G	35	35	35	45
65B	35	35	35	45

* Adopted from criteria at R26 and R49.
# Adopted from criteria at R170 and R172.

Schedule 3 of the Stage 1 Project Approval also contains land acquisition criteria for the MCP and cumulative operational and road traffic noise criteria. These criteria are reproduced in **Tables 6 to 8**. Noise emissions from the combined Stage 1 and Stage 2 activities associated with MCP will be assessed against these criteria.

TABLE 6
MCP Land Acquisition Criteria.

Day/Evening/Night $L_{Aeq(15min)}$	Land Number
43 / 43 / 43	158*, 46A*, 26, 49
43 / 43 / 42	22, 23, 41A, 63, 64, 70#, 170, 172
40 / 40 / 40	All other private land owners

* Adopted from criteria at R26 and R49.
# Adopted from criteria at R170 and R172.

TABLE 7
Cumulative noise criteria applicable at receivers not identified in Table 1.

Assessment criteria	Acquisition criteria
$L_{Aeq(11\ hour)}$ 50 dB(A) - Day	$L_{Aeq(11\ hour)}$ 53 dB(A) - Day
$L_{Aeq(4\ hour)}$ 45 dB(A) - Evening	$L_{Aeq(4\ hour)}$ 48 dB(A) - Evening
$L_{Aeq(9\ hour)}$ 40 dB(A) - Night	$L_{Aeq(9\ hour)}$ 43 dB(A) - Night

TABLE 8
Cumulative road traffic noise criteria.

Road	Day/Evening $L_{Aeq(1\ hour)}$	Night $L_{Aeq(1\ hour)}$
Ulan Road	60	55

5.2 Noise Impact Assessment Procedure

The assessment of operational noise was conducted using ENM. All major noise producing items were modelled at their known (for stationary sources such as the rail load-out and surface facilities) or typical (for mobile sources such as dump trucks) positions and noise contours and point calculations were generated for the surrounding area and receivers.

The rural terrain category was adopted for noise modelling and various ground types were assigned to ground contours. Areas of disturbance within the mine site were assigned ground type 9 (exposed earth). Most of the open land was assigned ground type 4 (grass) and heavily trred areas were assigned ground type 3 (forest).

5.2.1 Noise Sources

Noise data for significant sources associated with the MCP were obtained from Spectrum Acoustics' extensive database of measured coal mining plant noise. All data used were for machinery identical to that proposed for MCP (Komatsu 830E haul trucks, Liebherr excavators, Komatsu 375 dozers, coal load-out facility, diesel locomotives, etc). Sound power levels of major operational noise sources used in the modelling are shown below in **Table 9**.

Minor noise sources such as water carts have not been included in the modelling since the overburden/coal truck pass-bys at any point on a haul route would outnumber a water cart by at least 10-to-one. The noise contribution of a water cart would therefore be at least 10 dB below the

contribution from the haul trucks and not contribute to overall noise emissions from the site.

TABLE 9
Operational noise source sound power levels. (Calculated 15-minute L_{Aeq} levels as used in the noise model and measured maximum levels).

Operational noise source	Sound power level, dB(A)		Source Height, m
	$L_{eq(15\ min)}$	L_{max}	
Loading empty coal wagons	101	121	3
4 x loco's idling on loop	112	112	3
Trucks at ROM hopper	115	125	3
Primary crusher	114	118	5
Dozer on dump	115	130	2
Overburden drill	114	116	1
O/B excavator (996)	116	125	5
Coal excavator (R9350)	115	122	5
Overburden dump (per pit)*	115	125	3
Overburden haul (on slope)*	115	120	3
Overburden haul (on flat)*	113	118	3
Coal haul (from pit to processing area)*	111	116	3
Transfer station	115	118	15
Sizing station	116	118	20
Dump hopper (OC4)	114	121	5
Coal washery	116	118	15
Conveyors (per 100m)	96	N/A	2-10
Ventilation fan (enclosed)	102	102	5
Personnel carrier	110	115	1
Stacker/reclaimers (each)	105	N/A	10

* All sources involving trucks assume 10-12 truck pass-bys per 15 minute period so that all haul trucks proposed for the various years of mining are included. Haulage sources are placed at approximately 500m intervals on haul routes.

In order to achieve the above noise levels, some equipment will require noise attenuation as summarised below:

- Liebherr 996 excavators will be fitted with upgraded mufflers to reduce exhaust noise tones below 500 Hz; and

- Komatsu 830E haul trucks will be fitted with upgraded mufflers and grid-box silencers to reduce noise emissions in both uphill and downhill travel.

Sound power levels in Table 9 for major noise sources (excavators, dozers and trucks) were calculated from direct measurement of similar plant items in operation. The above noise control features were considered in the calculation of $L_{Aeq(15\text{-}minute)}$ levels for the excavators and trucks and are included in purchase orders placed by MCM with the suppliers.

A maximum sound power level of 125 dB(A) for the 996 excavators was measured by a dynamic test in which the machine was operated at the

engine revs at which maximum rated power was generated (in accordance with Australian and International Standards). Discussions held with the proponent and supplier revealed that the excavators do not operate at greater than 70% of rated maximum power under typical working conditions and a noise reduction of 5-6 dB(A) would result. Further analysis of the noise emission spectrum revealed that an after-market muffler system could be fitted which would lower the total sound power level during a full operating cycle by a further 3 dB(A) resulting in the modelled sound power level of 116 dB(A). [A maximum noise level of 125 dB(A) was retained for the 996 excavators for assessing potential sleep disturbance as this is the level of noise produced by impacts (boulders, bucket, horn etc) when the machine is in operation].

For the Komatsu 830E haul trucks, a 3 dB reduction in uphill travel noise (under load) is achievable with a modified exhaust system based on measurements conducted by Spectrum Acoustics at a coal mine in the Hunter Valley. Since these are diesel-electric trucks, they have a retard braking system which is a known source of high noise levels.

Previous measurements of a Komatsu 630E at the Ashton mine site have confirmed that a simple grid-box silencer reduces retard noise by approximately 15dB. These noise control measures were included in the calculation of the $L_{Aeq(15\text{-}minute)}$ sound power level of each 500m section of coal and overburden haul roads carrying their respective vehicle numbers.

5.2.2 Modelled Scenarios

Noise modelling was conducted for the following atmospheric conditions:

- *Daytime calm (neutral)* – Air temperature 20^0C, 70% relative humidity (RH), no wind, -1^oC/100m vertical temperature gradient;
- *Inversion* – Air temperature 5^0C, 70% RH, $+3^o$C/100m vertical temperature gradient;
- *Prevailing wind (summer/autumn)* – Air temperature 20^0C, 70% RH, 3m/s wind from ENE; and
- *Prevailing wind (winter/spring)* – Air temperature 20^0C, 70% RH, 3m/s wind from SW.

Noise models were generated for each of the following operational scenarios, for each of the four atmospheric conditions discussed above. These scenarios are considered to be the worst cases in terms of noise generation and potential impacts.

***Scenario (1) YEAR 2: OC1 (with bund) and OC4*:** Out-of-pit emplacement west of OC1 has been completed to a height of 15m above natural ground level and overburden emplacement is occurring in-pit behind this bund. Mining is also occurring at the southern end of OC4. A combined 39.5 Mt of material is being moved in this year. Coal transfer, processing and rail facility are in full operation. Noise sources for this scenario are shown in **Figure B1 in Appendix B**.

***Scenario (2) YEAR 7: Commence OC2, OC4 continuing*:** Mining commences at the northern end of OC2. OC4 has progressed to the NW and is east of the southern end of OC2. A combined 39.5 Mt of material is being moved in this year. Coal haulage from OC2 is screened by a 6m high bund along the western edge of the haul road up to out of pit emplacement 1 (which presents a considerably higher noise barrier). Noise sources for this scenario are shown in **Figure B2 in Appendix B**.

***Scenario (3) YEAR 12: Commence OC3, OC4 continuing*:** Commencement of mining at northern end of OC3 after completion of OC2. Minimal extraction (nominally 1Mtpa product coal) is extracted from OC3 with the majority of coal sourced from OC4. Mining noise sources for this scenario are shown in **Figure B3 in Appendix B**.

***Scenario (4) YEAR 16: OC4 (continuing)*:** OC4 is at peak production. Mining in OC3 has progressed approximately 1km to the south east of its commencement point. Noise sources for this scenario are shown in **Figure B4 in Appendix B**.

***Scenario (5) YEAR 19: OC4 (continuing)*:** OC4 has progressed further to the east. OC3 is near its southern limit. Noise sources for this scenario are shown in **Figure B5 in Appendix B**.

***Scenario (6) YEAR 24: OC4 (completion)*:** OC4 is at the eastern extent of its extraction area. Noise sources for this scenario are shown in **Figure B6 in Appendix B**.

In all of the above scenarios, two drills and two topsoil scrapers are operatind at ground level in front of the advancing extraction area(s). Significant noise-producing mining equipment to be used in scenarios 1-6 above are summarised in **Table 10**.

TABLE 10
Equipment numbers for modelled years of open-cut mining.

Noise source	Type	Year of operation					
		2	7	12	16	19	24
O/B excavator	996 Liebherr	2	4	5	7	6	6
Coal excavator	R9350 Liebherr	2	2	2	2	2	2
O/B trucks	Komatsu 830E	13	17	17	17	17	17
Coal trucks	Komatsu 830E	12	12	12	12	12	12

Noise source	Type	Year of operation					
		2	7	12	16	19	24
Dozers - dump	Komatsu 375-5	2	4	5	7	6	6
Dozers - face	Komatsu 375-5	2	4	5	7	6	6
Graders	Komatsu 825	4	4	4	4	4	4
O/B drills	Sandvik	2	2	2	2	2	2
Coal drills	Sandvik	1	2	2	2	2	2
Coal dozers	Komatsu 275-5	2	2	2	2	2	2

Operational noise level predictions in this report apply to times of day as summarised in **Table 11**. As all operations will be 24-hour, the predicted levels are compared with night time criteria to present a worst case.

TABLE 11
Applicable times for predicted noise levels.

Met Condition	Applicable time(s) for predicted noise levels
Neutral	Daytime, during calm conditions
ENE wind	Day, evening and night during spring-summer
SW wind	Day, evening and night during autumn-spring
Inversion	Night, winter only (per INP)

5.3 Predicted Operational Noise Levels

Operational noise levels predicted using the ENM point calculation mode are presented below for the modelled operational and meteorological scenarios.

5.3.1 Scenario 1: Year 2

Predicted noise levels for the Year 2 scenario are summarised in **Table 12**. All exceedances of the most stringent (night time for residential receivers) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow are either included in the Stage 1 acquisition zone or have been acquired by MCM. Noise contours for this scenario are shown in **Figures C1 to C4** in **Appendix C**.

TABLE 12
Predicted Year 2 noise levels. Extraction sites in OC1 and OC4.

Receiver*	Predicted noise level dB(A), $L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	25	36	36	25	65
168 (church)	25	35	36	25	45
160A (school)	25	35	36	25	45
151 (church)	25	37	37	25	45
158*	25	36	38	25	38
46A	24	35	38	24	38
25	24	34	36	24	38
26	23	35	37	20	38
49	23	35	37	20	38
169	20	32	35	<20	37
173	20	33	34	<20	37
9 (Orica)	24	37	38	20	65

Receiver*	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
22	22	34	35	<20	37
23	22	33	34	<20	37
41A	21	33	34	<20	37
63	20	31	32	<20	37
64	20	31	32	<20	37
70	20	30	31	<20	37
172	20	30	31	<20	37
170	20	25	29	<20	37
58	<20	30	30	<20	35
59	<20	26	28	<20	35
61	<20	25	25	<20	35
60	<20	25	25	<20	35
37	<20	21	23	<20	35
40	<20	23	23	<20	35
41B	<20	23	23	<20	35
106	<20	22	22	<20	35
171	<20	<20	<20	<20	35
46B	20	35	35	<20	35
20	20	34	35	<20	35
5	<20	31	35	<20	35
30	<20	28	30	<20	35
31	<20	20	24	<20	35
36	<20	28	30	<20	35
29	<20	<20	<20	<20	35
29B	<20	30	30	<20	35
29A	<20	30	20	<20	35
35	<20	24	25	<20	35
47	<20	21	21	<20	35
32	<20	25	21	<20	35
48B	<20	20	<20	<20	35
68	<20	<20	<20	<20	35
136	<20	20	<20	<20	35
8	**>45**	**>45**	**45**	**>45**	35
46C	**>45**	**47**	**45**	**47**	35
15	45	**>45**	**39**	**45**	35
44	24	30	20	35	35
27	24	**37**	20	**36**	35
46G	25	**38**	20	**36**	35
65B	<20	27	<20	23	35

* Receivers shaded yellow have been acquired by MCM or are in the Stage 1 acquisition zone.

5.3.2 Year 2 Recommendations

Exceedances of the acquisition criterion at properties not owned by MCM have been predicted at R46C (Unoccupied). The major noise source is the OC4 coal haul route. This unoccupied property will need to pass into MCM ownership as it sits within the footprint of OC4 and would be mined through in approximately Year 12.

Exceedances of 1-3 dB have been predicted at receiver R46G. This property would also be mined through at approximately Year 20 and would therefore pass into MCM ownership.

Noise compliance monitoring sites should be chosen from representative locations west of the project site (not included in the Stage 1 acquisition zone) where predicted noise levels are equal to, or 1-2 dB below, the noise criteria. These locations include:

R26 (Robinson) R169 (Tinker)
R46B (if occupied) 22 (Aiton)

5.3.3 Scenario 2: Year 7

Predicted noise levels for the Year 7 scenario are summarised in **Table 13**. All exceedances of the most stringent (night time) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow have been acquired by MCM or are included in the Stage 1 acquisition zone. Noise contours for this scenario are shown in **Figures C5 to C8** in Appendix C.

TABLE 13
Predicted Year 7 noise levels. Commencement of OC2 and continuation of OC4.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	24	34	34	24	65
168 (church)	24	34	34	24	45
160A (school)	24	34	34	24	45
151 (church)	23	35	33	23	45
158	23	35	33	23	38
46A	23	35	34	23	38
25	25	35	35	25	38
26	25	36	36	25	38
49	25	36	36	25	38
169	23	34	34	22	37
173	23	34	34	21	37
9 (Orica)	28	38	38	26	65
22	30	**39**	**40**	26	37
23	28	**38**	**39**	25	37
41A	28	**38**	**38**	25	37
63	26	36	37	23	37
64	26	35	36	23	37
70	25	35	35	21	37
172	25	35	35	21	37
170	20	31	33	<20	37
58	22	34	35	20	35
59	20	32	32	<20	35
61	<20	29	29	<20	35
60	<20	29	29	<20	35
37	<20	27	27	<20	35
40	<20	26	27	<20	35
41B	<20	26	26	<20	35

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
106	<20	25	25	<20	35
171	<20	<20	<20	<20	35
46B	**38**	**>45**	**>45**	**36**	35
20	35	**42**	**45**	30	35
5	**39**	**45**	**>45**	35	35
30	<20	31	31	<20	35
31	<20	28	25	<20	35
36	20	30	31	<20	35
29	<20	24	<20	<20	35
29B	<20	30	26	<20	35
29A	<20	30	23	<20	35
35	<20	27	27	<20	35
47	<20	22	23	<20	35
32	<20	23	20	<20	35
48B	<20	<20	<20	<20	35
68	<20	<20	<20	<20	35
136	<20	<20	<20	<20	35
8	**>45**	**>45**	**45**	**>45**	35
46C	**>45**	**>45**	**45**	**>45**	35
15	**45**	.>45	40	**>45**	35
44	24	33	24	35	35
27	24	38	23	**40**	35
46G	25	40	25	**39**	35
65B	<20	23	<20	28	35

5.3.4 Year 7 Recommendations

Minor to moderate (1-3dB) criterion exceedances are predicted at R22 (Aiton), R23 (Woodhead) and R41A (Libertis) under adverse conditions upon commencement of mining in OC2, placing these receivers in a noise management zone. One or more of these receivers should be included as noise monitoring locations upon commencement of OC1 to determine the exact noise levels and corresponding operational/meteorological conditions during the 5 years of mining prior to commencement of OC2.

The Noise Management Plan for Stage 2 must specifically address these three receivers. As a minimum, a noise model verification study should be conducted before commencement of mining in OC2 and all attempts must be made to ensure that the project criteria can be achieved at these receivers. If noise levels cannot reasonably and feasibly be kept within the noise criteria, then an agreement on acceptable noise levels, noise mitigation or property acquisition should be negotiated prior to commencement of mining in OC2.

At least one of the following receivers with predicted levels 1-2dB below the criteria should also be included as OC2 noise monitoring locations:

R63 (Whiticker) R70 (Coventry) R172 (Kimber)
R64 (Goninan and Boland)

As discussed in Section 5.3.2 receivers R46C and R46G lie within the OC4 footprint and will be required to fall into MCM ownership. Receiver R46B has predicted levels above the acquisition criterion upon commencement of OC2 and therefore falls into an acquisition zone.

5.3.5 Scenario 3: Year 12

Predicted noise levels for the Year 12 scenario are summarised in **Table 14**. All exceedances of the most stringent (night time) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow have been acquired by MCM or are included in the Stage 1 acquisition zone. Noise contours for this scenario are shown in **Figures C9 to C12** in Appendix C.

TABLE 14
Predicted Year 12 noise levels. Commencement of OC3 and continuation of OC4.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	24	35	34	24	65
168 (church)	24	35	34	24	45
160A (school)	24	35	34	24	45
151 (church)	23	34	33	23	45
158	23	34	33	23	38
46A	23	33	33	23	38
25	25	32	34	25	38
26	20	32	33	<20	38
49	20	32	33	<20	38
169	<20	31	30	<20	37
173	<20	31	30	<20	37
9 (Orica)	20	33	34	20	65
22	<20	33	33	<20	37
23	<20	33	32	<20	37
41A	<20	32	32	<20	37
63	<20	31	31	<20	37
64	<20	30	30	<20	37
70	<20	30	28	<20	37
172	<20	30	28	<20	37
170	<20	27	26	<20	37
58	<20	31	30	<20	35
59	<20	29	29	<20	35
61	<20	27	28	<20	35
60	<20	27	28	<20	35
37	<20	28	27	<20	35
40	<20	29	27	<20	35
41B	<20	28	27	<20	35
106	<20	27	26	<20	35
171	<20	<20	<20	<20	35
46B	25	35	35	25	35
20	20	35	35	20	35
5	25	**37**	**36**	25	35

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
30	20	35	**36**	<20	35
31	<20	25	30	<20	35
36	29	**41**	**42**	26	35
29	<20	26	25	<20	35
29B	25	35	29	25	35
29A	21	34	27	24	35
35	<20	28	30	<20	35
47	<20	30	29	<20	35
32	<20	25	20	<20	35
48B	<20	25	<20	<20	35
68	<20	23	<20	<20	35
136	<20	23	<20	<20	35
8	**>45**	**>45**	**>45**	**>45**	35
46C	**>45**	**>45**	**>45**	**>45**	35
15	**45**	**>45**	**40**	**>45**	35
44	22	32	22	28	35
27	25	**38**	25	34	35
46G	29	**39**	26	**38**	35
65B	<20	31	<20	27	35

5.3.6 Year 12 Recommendations

The results in Table 14 confirm that commencement of mining in OC3 will trigger the acquisition requirement for receiver R36 (Rayner). Noise levels become marginal at receivers R29A and R29B (Mayberry) and it is anticipated that commencement of mining in OC3 will trigger acquisition negotiations with these receivers. All of these receivers are included in the Stage 1 acquisition zone.

A minor (1dB) exceedance at R30 (Cox) suggests that this receiver should be included as an attended noise monitoring location during at least the last year of mining in OC2. Given the virtual absence of other noise sources (road traffic and Ulan Mine noise) near this receiver a portable real-time noise monitor should be installed at this location upon commencement of mining in OC3. The results of the attended and real-time monitoring will be used to determine if there are any reasonable and feasible methods to ensure compliance with the criteria at this receiver.

5.3.7 Year 16 Operational Noise

Predicted noise levels for the Year 16 scenario are summarised in **Table 15**. All exceedances of the most stringent (night time) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow have been acquired by MCM or are included in the Stage 1 acquisition zone. Noise contours for this scenario are shown in **Figures C13 to C16** in Appendix C.

TABLE 15

Predicted Year 16 noise levels. Above ground mining in OC4 and OC3.

Receiver	Predicted noise level dB(A), $L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	20	33	33	25	65
168 (church)	20	33	33	23	45
160A (school)	20	33	33	23	45
151 (church)	20	33	33	24	45
158	20	32	32	21	38
46A	21	32	32	21	38
25	22	30	33	23	38
26	<20	31	32	20	38
49	<20	31	32	20	38
169	<20	30	30	<20	37
173	<20	29	30	<20	37
9 (Orica)	<20	31	33	<20	65
22	<20	31	31	<20	37
23	<20	30	30	<20	37
41A	<20	30	30	<20	37
63	<20	30	30	<20	37
64	<20	30	29	<20	37
70	<20	27	27	<20	37
172	<20	27	27	<20	37
170	<20	24	25	<20	37
58	<20	28	29	<20	35
59	<20	26	27	<20	35
61	<20	24	24	<20	35
60	<20	24	24	<20	35
37	<20	23	23	<20	35
40	<20	23	25	<20	35
41B	<20	23	25	<20	35
106	<20	22	23	<20	35
171	<20	<20	<20	<20	35
46B	23	34	35	24	35
20	20	33	34	21	35
5	22	34	35	24	35
30	<20	29	30	<20	35
31	<20	29	30	<20	35
36	<20	30	30	<20	35
29	<20	24	24	<20	35
29B	<20	**40**	35	<20	35
29A	<20	**38**	30	<20	35
35	<20	25	27	<20	35
47	<20	25	25	<20	35
32	<20	25	23	<20	35
48B	<20	25	<20	<20	35
68	<20	23	<20	<20	35
136	<20	23	<20	<20	35
8	Dwelling demolished (OC4)				
46C	Dwelling demolished (OC4)				
15	**44**	**>45**	**44**	**>45**	35
44	25	**36**	29	29	35
27	33	**42**	35	**38**	35
46G	**36**	**>45**	30	**>45**	35

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
65B	<20	35	<20	34	35

5.3.8 Year 16 Recommendations

By Year 16, noise emissions from OC4 and all other project-related noise sources are mainly confined to receivers east of Munghorn Gap Nature Reserve with the exception of R29A and R29B which are both in the OC3 acquisition zone.

Predicted noise levels of up to 35 dB(A) at R65B suggest that the noise models for future years need to be extended further to the east. Accordingly, an extra 4km to the east was added for the Year 19 and Year 24 models which covered the following additional receivers:

R65C (Wilpinjong) R141 (Wilpinjong) R65D (Wilpinjong) R65E (Wilpinjong)

The southern half of the noise model was also extended 4km to the east and incorporated the following receivers:

R138 (WC & VM Langshaw) R143 (KH & ME Kattau)

R146 (RW & DG Langshaw)

5.3.9 Scenario 5: Year 19

Predicted noise levels for the Year 19 scenario are summarised in **Table 16**. All exceedances of the most stringent (night time) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow have been acquired by MCM or are included in the Stage 1 acquisition zone. Noise contours for this scenario are shown in **Figures C17 to C20** in Appendix C.

TABLE 16
Predicted Year 19 noise levels. Above ground mining in OC4 and OC3 near its southern limit.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	<20	32	34	21	65
168 (church)	<20	32	33	21	45
160A (school)	<20	32	33	21	45
151 (church)	<20	31	33	20	45
158	<20	31	33	20	38
46A	<20	31	33	20	38
25	21	30	35	23	38
26	<20	30	33	20	38
49	<20	30	33	20	38
169	<20	28	31	<20	37
173	<20	28	30	<20	37
9 (Orica)	<20	30	34	<20	65

Receiver	Predicted noise level dB(A), $L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
22	<20	29	31	<20	37
23	<20	29	31	<20	37
41A	<20	28	30	<20	37
63	<20	28	30	<20	37
64	<20	28	30	<20	37
70	<20	27	28	<20	37
172	<20	27	28	<20	37
170	<20	26	27	<20	37
58	<20	28	28	<20	35
59	<20	27	28	<20	35
61	<20	26	27	<20	35
60	<20	26	27	<20	35
37	<20	26	27	<20	35
40	<20	26	27	<20	35
41B	<20	26	27	<20	35
106	<20	25	26	<20	35
171	<20	21	<20	<20	35
46B	22	34	35	24	35
20	20	32	33	21	35
5	21	33	34	24	35
30	<20	24	33	<20	35
31	<20	24	35	<20	35
36	<20	25	27	<20	35
29	<20	21	28	<20	35
29B	Dwelling demolished (OC3)				
29A	Dwelling demolished (OC3)				
35	<20	25	30	<20	35
47	<20	25	34	<20	35
32	<20	25	24	20	35
48B	<20	30	20	20	35
68	<20	30	<20	20	35
136	<20	20	<20	20	35
138*	<20	<20	<20	<20	35
143*	<20	<20	<20	<20	35
146*	<20	<20	<20	<20	35
8	Dwelling demolished (OC4)				
46C	Dwelling demolished (OC4)				
15	**44**	**>45**	**40**	**>45**	35
44	25	**36**	32	34	35
27	35	**43**	**37**	35	35
46G	**38**	**45**	**37**	**45**	35
65B	<20	32	<20	31	35
65C*	21	34	20	34	35
141*	22	35	20	35	35
65D*	<20	33	<20	33	35
65E*	<20	30	<20	31	35

* Additional properties east and south of MCP that may receive MCP noise after Year 16.

5.3.10 Year 19 Recommendations

Table 16 shows that Year 19 MCM noise levels approach the project-specific noise criterion of 35 dB(A) at the four Wilpinjong-owned properties R65C/D/E and R141. The cumulative noise criterion of 40 dB(A),$L_{eq(night)}$ from Table 6 may also apply at these receivers, however, and the operational condition of Wilpinjong mine as well as the status of these residents in approximately 20 years time is unclear. Noise monitoring at these receivers may be required at some time beyond Year 19 of MCP operations to determine whether further ameliorative action is required.

Of greater concern are the privately owned receivers R138, R143 and R146 to the southeast of OC4. Noise levels well below the criteria have been predicted at these receivers.

Predicted noise levels within 5 dB of the criterion at receivers R35 (Johnson) and R47 (Andrews) suggest that these receivers should be included as noise compliance monitoring locations upon commencement of OC3.

5.3.11 Year 24 Operational Noise

Predicted noise levels for the Year 24 scenario are summarised in **Table 17**. All exceedances of the most stringent (night time) criteria in Table 5 are shown in bold type and exceedances of acquisition criteria in Table 6 are shaded grey. Receivers shaded light yellow have been acquired by MCM or are included in the Stage 1 acquisition zone. Noise contours for this scenario are shown in **Figures C21 to C24** in Appendix C.

TABLE 17
Predicted Year 24 noise levels. Mining in OC4 is at its eastern limit.

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
162 (Ulan Hotel)	<20	30	30	<20	65
168 (church)	<20	30	30	<20	45
160A (school)	<20	30	30	<20	45
151 (church)	<20	30	30	<20	45
158	<20	30	30	<20	38
46A	<20	30	29	<20	38
25	<20	29	30	<20	38
26	<20	28	27	<20	38
49	<20	28	27	<20	38
169	<20	27	26	<20	37
173	<20	26	25	<20	37
9 (Orica)	<20	28	27	<20	65
22	<20	26	26	<20	37
23	<20	26	26	<20	37
41A	<20	26	25	<20	37
63	<20	26	25	<20	37
64	<20	26	25	<20	37
70	<20	25	24	<20	37
172	<20	25	24	<20	37

Receiver	Predicted noise level dB(A),$L_{eq(15min)}$				Criterion
	Neutral	Inversion	ENE wind	SW wind	
170	<20	24	24	<20	37
58	<20	25	25	<20	35
59	<20	24	24	<20	35
61	<20	23	23	<20	35
60	<20	23	23	<20	35
37	<20	22	22	<20	35
40	<20	22	22	<20	35
41B	<20	21	21	<20	35
106	<20	20	21	<20	35
171	<20	<20	<20	<20	35
46B	<20	28	29	<20	35
20	<20	27	27	<20	35
5	<20	28	26	<20	35
30	<20	24	23	<20	35
31	<20	<20	<20	<20	35
36	<20	25	22	<20	35
29	<20	<20	<20	<20	35
29B	<20	25	23	<20	35
29A	<20	25	21	<20	35
35	<20	22	21	<20	35
47	<20	20	<20	<20	35
32	<20	20	20	<20	35
48B	<20	<20	<20	<20	35
68	<20	<20	<20	<20	35
136	<20	<20	<20	<20	35
138	<20	20	<20	<20	35
143	<20	20	<20	<20	35
146	<20	<20	<20	<20	35
8	Dwelling demolished				
46C	Dwelling demolished				
15	**>45**	**>45**	**40**	**>45**	35
44	32	**42**	**39**	30	35
27	Dwelling demolished				
46G	Dwelling demolished				
65B	27	**37**	24	35	35
65C	27	**39**	25	**38**	35
141	27	**39**	26	**38**	35
65D	25	**37**	24	35	35
65E	22	35	20	33	35

5.3.12 Year 24 Recommendations

Predicted Year 24 noise criterion exceedances at the Wilpinjong-owned receivers R65B/C/D/E and R141 would be mitigated or managed, if required, following noise monitoring commencing approximately five years before this time as recommended in Section 5.3.10.

5.4 Sleep Disturbance

Assessment of potential sleep disturbance during night time hours usually begins by considering the DECC recommendation that further assessment is required if maximum noise levels[4] (L_{Amax}) exceed the background level (L_{A90}) by more than 15 dB at a bedroom window. If this level is exceeded then further consideration of potential disturbance to sleep includes the nature and level of ambient noise in the area, with some guidance also offered in Appendix B of the DECC *Environmental Criteria for Road Traffic Noise* (ECRTN, 1999).

As in the EA for the MCP Stage 1, maximum noise levels at the nearest or potentially worst impacted receiver for each component of the project are conservatively estimated by adding the difference between source L_{Aeq} and L_{max} sound power levels in Table 15 to the predicted contributions from the five main sources contributing to the total predicted L_{Aeq}. Potential sleep disturbance due to noise emissions from the approved OC1-OC3 have been included due to the slight change in assessable wind direction (from ESE to ENE) for the Stage 1 and Stage 2 noise assessments. Worst case maximum levels for the two wind directions are included in the following analysis.

5.4.1 Year 2 Maximum Levels

The nearest non-project related residential receiver to mining in OC1 is R26 (Robinson). The five highest contributing sources to worst case predicted $L_{Aeq(15min)}$ levels are shown below, along with the differences between L_{eq} and L_{max} levels for those sources and the estimated L_{max} for each source.

Source No. and description	L_{Aeq}	L_{max}-L_{Aeq}	L_{max}(est.)
6 Dumping (high)	35.6	10	45.6
5 Dozer at dump (high)	32.3	15	47.3
103 Truck at ROM	25.7	10	35.7
1 Truck in pit (uphill)	24.5	8	32.5
4 Drill 1	20.5	2	22.5
TOTAL L_{Aeq}	**38**		

The above results show that maximum noise levels from overburden dumping in Pit 1 may exceed the sleep disturbance criterion by 2 dB under worst case conditions when Pit 1 is at its closest point to R26 suggesting that further assessment is required.

The DECC website contains an INP Application Note relating to sleep disturbance which admits to a general lack of knowledge about sleep disturbance and that the "background + 15 dB" criterion is *"not ideal"*.

[4] The sleep disturbance criterion is technically the $L_{A1(1minute)}$ level. As this is the loudest 0.6s during a 1-minute period, the L_{Amax} level is usually adopted.

The application note directs readers to a research review presented in the appendices to the ECRTN.

Appendix B5 of the ECRTN shows several graphs from laboratory and field studies aimed at determining the likelihood of sleep disturbance as a function of maximum noise levels. Of the graphs that directly plot maximum levels, one suggests a zero probability of awakening reactions to internal noise levels less than 55 dB(A). Another graph, which summarises 11 studies between 1978 and 1990, suggests no awakenings below 45 dB(A),L_{max}.

It is widely accepted that indoor noise levels with a window partially open are approximately 10 dB below the external noise level. The maximum noise level of 47.3 dB(A) from the dozer in the above example would therefore equal approximately 37 dB(A) inside a bedroom of R26 with an open window facing the MCP. The studies in the ECRTN therefore suggest minimal likelihood of this noise level causing awakenings.

Notwithstanding the above finding, attended noise monitoring at R26 should included measurement of L_{max} levels at the most exposed bedroom window to determine compliance with the sleep disturbance criterion.

5.4.2 Year 7 maximum levels

The non-project related residential receiver with the highest predicted noise level from MCP (OC2) is R22 (Aiton). The five highest contributing sources to worst case predicted $L_{Aeq(15min)}$ levels are shown below, along with the differences between L_{eq} and L_{max} levels for those sources and the estimated L_{max} for each source.

Source No. and description	L_{Aeq}	L_{max}-L_{Aeq}	L_{max}(est.)
6 Dumping	31.5	10	41.5
5 Excavator 1	31.1	9	40.1
3 Excavator 2	30.9	9	39.9
1 Truck in pit (uphill)	30.6	8	38.6
4 Drill 1	28.7	2	30.7
TOTAL L_{Aeq}	**39**		

The above results for R22 (Aiton) suggest that maximum noise levels from MCP in Year 7 will be below the 45 dB(A) sleep disturbance criterion at this and more distant receivers.

5.4.3 Year 12 Maximum Levels

The non-project related residential receiver with the highest predicted noise level from MCP (OC 3) is R30 (Cox). The highest five contributing sources to worst case predicted $L_{Aeq(15min)}$ levels are shown below, along

with the differences between L_{eq} and L_{max} levels for those sources and the estimated L_{max} for each source.

Source No. and description	L_{Aeq}	L_{max}-L_{Aeq}	L_{max}(est.)
62 Excavator	31.8	9	40.8
65 Dumping	29.2	10	39.2
66 Drill	27.2	2	29.2
64 Truck in pit (uphill)	26.5	8	34.5
63 Truck in pit (uphill)	26.0	8	34.0
TOTAL L_{Aeq}	**36**		

The above maximum levels are 4dB or more below the sleep disturbance criterion of 45 dB(A).

The above results show that L_{max} noise levels from any individual source are 9 dB or less above the total predicted L_{Aeq} level. Based on the maximum predicted L_{Aeq} noise level of 20 dB(A) at R138 (Langshaw), it is unlikely that maximum noise levels greater than 30 dB(A) would be experienced at this receiver at any time beyond Year 12. This is well below the 45 dB(A) sleep disturbance assessment level.

5.5 Cumulative Mining Noise Levels

Cumulative noise impacts with existing and possible future (reduced) noise emissions from Ulan Coal Mine have been addressed in the EA for Stage 1 of the MCP and resulted in the setting of project-specific (MCP) and cumulative noise criteria in the Project Approval. Noise criteria for the initial six month period of environmental bund establishment and further 12 months of surface facilities construction were relative to the existing daytime noise emissions from Ulan Coal Mine. Noise criteria for 24-hour mining operations at MCP were based on the completion of a noise reduction program by Ulan Coal Mine.

Reference to the Wilpinjong EA shows the only residences that would potentially be affected by mine noise from both Wilpinjong and MCP are within the Murragamba Valley. This determination was made by identifying receivers inside the minimum (20dB(A)) noise contours for both mines. All identified receivers have either been purchased by MCM or are in negotiations as they would be consumed by the proposed OC4.

The 2008 Annual Environmental Management Report (AEMR) for Wilpinjong Mine identifies receivers to the south of Wilpinjong as the source of noise complaints leading to targeted noise mitigation and management actions. Although actual noise levels are not disclosed, it is important that a minimal noise contribution from MCP should occur at these receivers.

The nearest receiver south of Wilpinjong Mine to all approved and proposed components of the MCP is Langshaw (Property No. 138), nominated as noise monitoring location N4 in Wilpinjong's numbering system. This receiver, shown schematically in **Figure 4** below, is over 6 km from the nearest MCP component and is outside the 20 dB(A) contour for all modelled scenarios and meteorological conditions.

It is expected from the modelling, then, that MCP would be inaudible at this receiver at all times. It is recommended, however, that this receiver be included as a monitoring point in the attended monitoring program upon commencement of mining in OC4. Upon confirmation that noise emissions from MCP do not present a cumulative noise problem, to the satisfaction of DECC and DoP, monitoring at this location may cease.

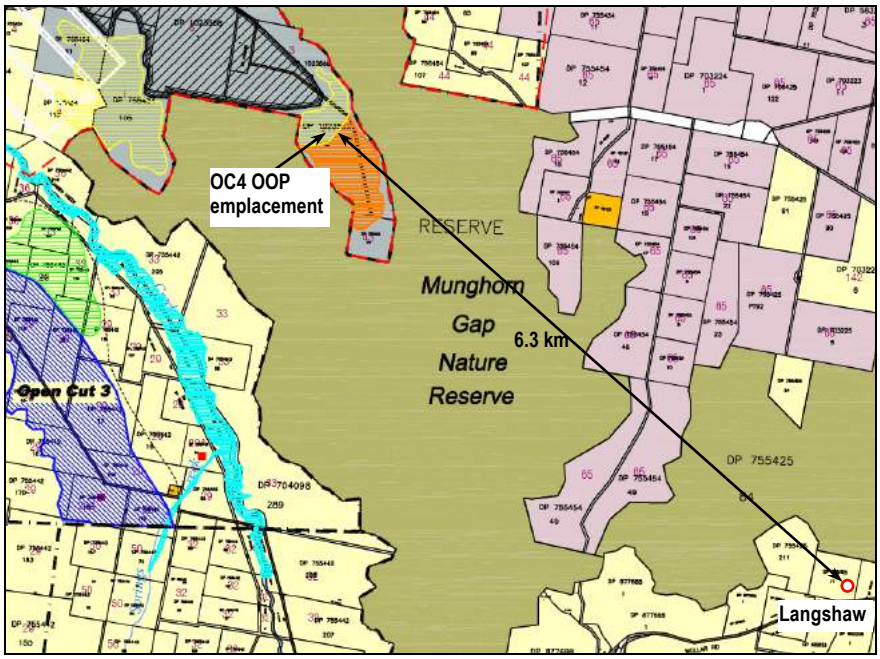
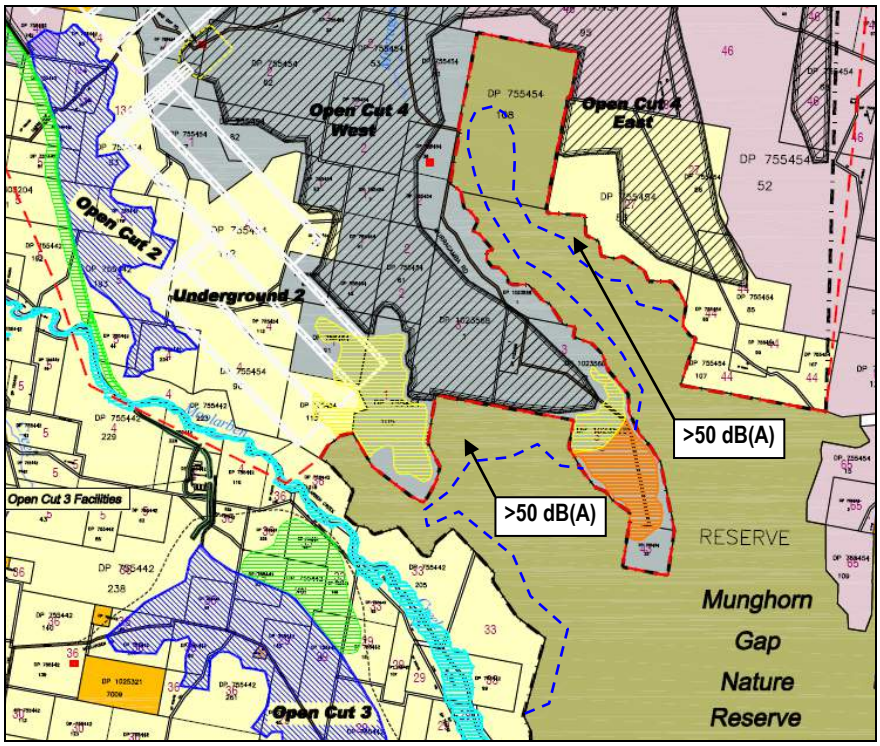


Figure 4. Location of Wilpinjong noise receiver N4 (Langshaw) in relation to MCP.

5.6 DECC Estate

A noise criterion of 50 dB(A),$L_{eq(15\ minute)}$ for the Goulburn River National Park (GRNP) and Munghorn Gap Nature Reserve (MGNR) is included in the Stage 1 Approval. No noise levels above this criterion have been predicted in the GRNP for any stage of the project. Noise levels above 50 dB(A),$L_{eq(15\ minute)}$ have been predicted along parts of the edge of the MGNR as illustrated in **Figure 5**.

Figure 5
Areas within the blue dotted lines in MGNR where levels >50 dB(A) are predicted.



6.0 OFF-SITE RAIL TRAFFIC

6.1 Train Noise Criteria

6.1.1 Train Noise Criteria – MCP

Stage 2 of the MCP would increase the annual product coal from the currently approved level of 10Mtpa to 13Mtpa. This would result in additional train movements, and a corresponding increase in noise levels, to the east on the Gulgong – Sandy Hollow Rail Line between the site and Muswellbrook. Condition 59 of the Stage 1 Project Approval stipulates that no coal will be transported from the site to the west without obtaining approval from DoP.

Chapter 163 of the DECC *Environmental Noise Control Manual* (ENCM) specifies limits on train noise levels as follows:

Descriptor	Planning Levels	Maximum Levels
Leq, 24 hour	55dB(A)	60dB(A)
Lmax	80dB(A)	85dB(A)

These criteria will be assessed as the DECC preferred maximum levels from train noise generated by MCP.

6.1.2 Train Noise Criteria – Cumulative

The Australian Rail Track Corporation (ARTC) operates the Gulgong-Sandy Hollow and Main Northern railways. ARTC's EPL 3142 does not contain environmental noise limits but states the objective of progressive reduction of noise levels from rail lines through Pollution Reduction Programs (PRPs).

While the Gulgong-Sandy Hollow and Main Northern railways are not currently subject to a PRP, Section U1.1 of EPL 3142 provides the following goals to work towards in developing a PRP:

Descriptor	Design Goal
Leq, (15 hour), day	65dB(A)
Leq, (9 hour), night	60dB(A)
Lmax (24 hour)	85dB(A)

These criteria will be considered here in the assessment of cumulative train noise levels as a result of the proposed production increase at MCP.

6.2 Train Noise Impact Assessment

The following subsections present results for two train noise assessment methodologies. The first method is a theoretical approach identical to that adopted in the Stage 1 noise assessment. The second method is based on numerous train noise measurements conducted specifically for the assessment of train noise emissions from Stage 2 of the MCP.

6.2.1 Theoretical Method

The following assessment is largely reproduced from the Stage 1 assessment of train noise with additional trains from the proposed Stage 2 expansion included where appropriate.

The Wilpinjong EA considered noise impacts from existing and consented freight trains (including coal trains from Ulan Coal mine) travelling east from the site as well as the cumulative levels including proposed trains from Wilpinjong. Results are summarised in Table 37 of the Wilpinjong Noise and Blasting Impact Assessment (WNBIS) conducted by Richard Heggie Associates (RHA, 2005).

Based on a rail haulage volume of 10 Mtpa, the WNBIS gives the projected numbers of trains from Wilpinjong as four 1542m trains per day on average and up to six per day during peak periods. Up to 3.85 trains per day (ie approximately four) would be required to haul MCP Stage 1 coal. The proposed Stage 2 production level of 13 Mtpa would generate five trains per day (ie one train additional to the four currently approved).

Subtracting the predicted day and night time existing / consented L_{Aeq} train noise levels from the predicted cumulative levels given in the WNBIS provides a good estimate of the predicted contribution from Wilpinjong trains alone. These values are summarised in **Table 18** below.

TABLE 18
Predicted noise levels from Wilpinjong coal trains (source RHA, 2005).

Distance to receiver	Daytime (Wilpinjong trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	58	58	85
60 m	55	55	81
90 m	53	54	78
Distance to receiver	**Night time (Wilpinjong trains only)**		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	57	58	85
60 m	54	55	81
90 m	52	53	78

Since the product coal tonnages and calculated train numbers for Stage 2 of MCP and Wilpinjong differ by a factor of (13/10) = 1.3 the calculated train noise levels for MCP Stage 2 will equal the values in Table 18 plus a factor of $10\log_{10}(1.3)$ = 1.3 dB. The predicted noise levels from Stage 2 MCP trains are summarised in **Table 19**.

TABLE 19
Predicted noise levels from MCP based on 13 Mtpa product coal.

Distance to receiver	Daytime (Moolarben trains only)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	59	59	85
60 m	56	56	81
90 m	54	55	78
Distance to receiver	**Night time (Moolarben trains only)**		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	58	59	85
60 m	55	56	81
90 m	53	54	78

The levels in Table 19 are marginally within the DECC recommended maximum levels of 60 dB(A),$L_{eq(24hr)}$ and 85 dB(A),L_{max}. Predicted cumulative train noise levels as presented in the WNBIS (Table 37) are reproduced below in **Table 20**.

TABLE 20
Predicted cumulative train noise levels in WNBIS (RHA, 2005).

Distance to receiver	Daytime (existing/consented trains + Wilpinjong trains)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	65	65	85
60 m	62	62	81
90 m	60	61	78
Distance to receiver	**Night time (existing/consented trains + Wilpinjong trains)**		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	65	85
60 m	61	62	81
90 m	59	60	78

The cumulative train noise levels from all existing trains and MCP Stage 2 are therefore equal to the logarithmic sum of values in Tables 19 and 20 as shown in **Table 21**.

TABLE 21
Predicted cumulative train noise levels including projected train numbers from MCP Stage 2.

Distance to receiver	Daytime (existing/consented* trains + Moolarben trains)		
	Average $L_{Aeq(15\ hour)}$	Peak $L_{Aeq(15\ hour)}$	Passby L_{Amax}
30 m	66	66	85
60 m	63	63	81
90 m	61	62	78
Distance to receiver	**Night time (existing/consented* trains + Moolarben)**		
	Average $L_{Aeq(9\ hour)}$	Peak $L_{Aeq(9\ hour)}$	Passby L_{Amax}
30 m	64	66	85
60 m	61	63	81
90 m	59	61	78

* Includes Wilpinjong trains.

The cumulative train noise levels in Table 21 are identical to the predicted levels for Stage 1 of MCP except for a 1 dB increase in the night time levels for peak train numbers.

Train noise levels are likely to exceed the daytime and night time cumulative noise levels of 65 dB(A),$L_{eq(15hr)}$ and 60 dB(A),$L_{eq(9hr)}$ at receivers within 100m of the train line. Peak train movements will extend the criterion exceedance 'set-back' out to approximately 120m. The maximum L_{max} level of 85 dB(A) is predicted to be exceeded at receivers within 30m of the line.

6.2.2 Measurement Method

Measurements of several train pass-bys were taken at 20 m from the Main Northern Rail Line at Hexham, near the Port of Newcastle, on 16 June 2008. **Table 22** summarises the train types, durations, L_{Aeq} and L_{max} levels.

TABLE 22
Summary of train noise measurements at 20m from MNRL at Hexham, 16 June 2008.

Train type	Measured values		
	Pass-by L_{Aeq}	Pass-by duration (s)	Pass-by L_{Amax}
1. Coal, empty, 3 x 80 class loco's, 68 wagons	74.1	86	80.6
2. Coal, full, 4 x 80 class loco's, 81 wagons	72.7	128	83.4
3. 3-car passenger	84	11	93.6
4. Coal, empty, 1 x 40 class loco, 38 wagons	75.1	64	83.3
5. 3-car passenger	83.6	14	95.4
6. 3-car passenger	85.5	12	95.6
7. Freight, 3 x loco's, 55 wagons	89.6	62	97.1
8. Coal, empty, 1 x 80 class loco, 42 wagons	79.1	37	82.1
9. Freight, 3 x loco's, 47 wagons	80.0	89	88.5
10. Coal, empty, 3 x 80 class loco, 79 wagons	77.2	76	83.8
11. Coal, full, 3 x 40 class loco's, 36 wagons	77.1	36	84.7

The above results show that the passenger and freight trains produced significantly higher maximum noise levels than the coal trains. In order to compare noise emissions from all trains directly and to provide a basis for assessment of MCP Stage 2 train noise emissions against the criteria, $L_{Aeq(t)}$ values in Table 22 are converted to $L_{Aeq(9hr)}$ and $L_{Aeq(15hr)}$ values in **Table 23** by the following factors:

$$L_{Aeq(9hr)} = L_{Aeq(t)} + 10\log_{10}(t/32400)\ \text{dB} \quad \text{and}$$
$$L_{Aeq(15hr)} = L_{Aeq(t)} + 10\log_{10}(t/54000)\ \text{dB}$$

The resulting values are the noise contribution from a single train pass-by to the total daytime and night-time train noise levels. Each train contributes a higher level to night-time levels than daytime levels because the night-time period is only (9/15) = 60% the duration of the daytime period.

TABLE 23
$L_{Aeq(9hr)}$ and $L_{Aeq(15hr)}$ noise contributions from individual train pass-bys.

Train type	Pass-by L_{Aeq}	Pass-by duration (s)	$L_{Aeq(9hr)}$ (at 20 m)	$L_{Aeq(15hr)}$ (at 20 m)
1. Coal, empty	74.1	86	48.3	46.1
2. Coal, full	72.7	128	48.7	46.5
3. Passenger	84	11	49.3	47.1
4. Coal, empty	75.1	64	48.1	45.9
5. Passenger	83.6	14	50.0	47.8
6. Passenger	85.5	12	51.2	49.0
7. Freight	89.6	62	62.4	60.2
8. Coal, empty	79.1	37	49.7	47.5
9. Freight	80.0	89	54.4	52.2
10. Coal, empty	77.2	76	50.9	48.7
11. Coal, full	77.1	36	47.6	45.4

The coal trains proposed to be used for MCP are the largest units with 91 wagons pulled by three or four 80 or 90 class locomotives. Measured trains 2 and 10 were full and empty coal trains, respectively, with 3-4 locomotives and 79 or more wagons. Train noise measurements were taken with a Bruel & Kjaer Type 1 2260 Investigator sound level meter in third octave bands at 1-second statistical intervals. The pass-by times for

the observed number of wagons were therefore directly obtainable and scaled up to calculate the pass-by times for full and empty 91-wagon trains. The extra 10-15 seconds of pass-by time were copied and appended to each time trace to produce a time-signal for 91-wagon trains. Noise level contributions were then calculated from these time-signals using Bruel & Kjaer Evaluator software.

Modified time-traces for the 91-wagon full and empty coal trains are shown in **Figures 6 and 7**.

Figure 6
Time-trace for full 91-wagon coal train pass-by at 20m.

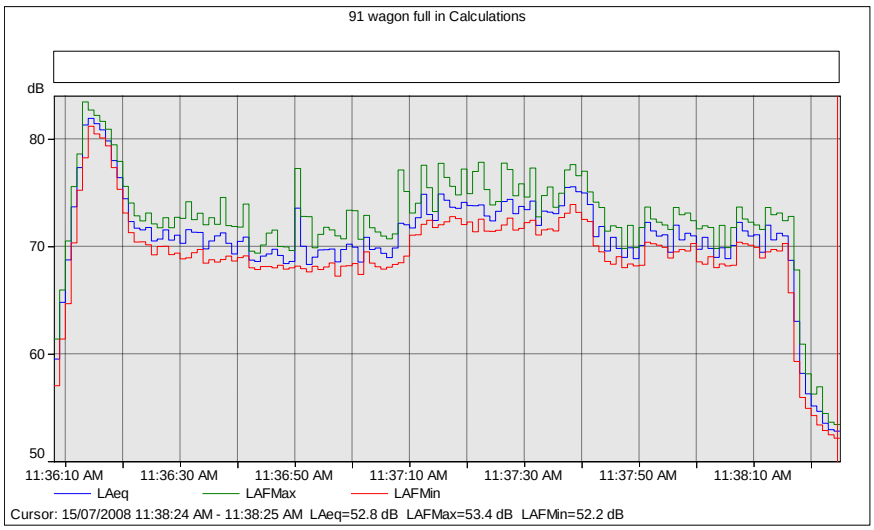


Figure 7
Time-trace for empty 91-wagon coal train pass-by at 20m.

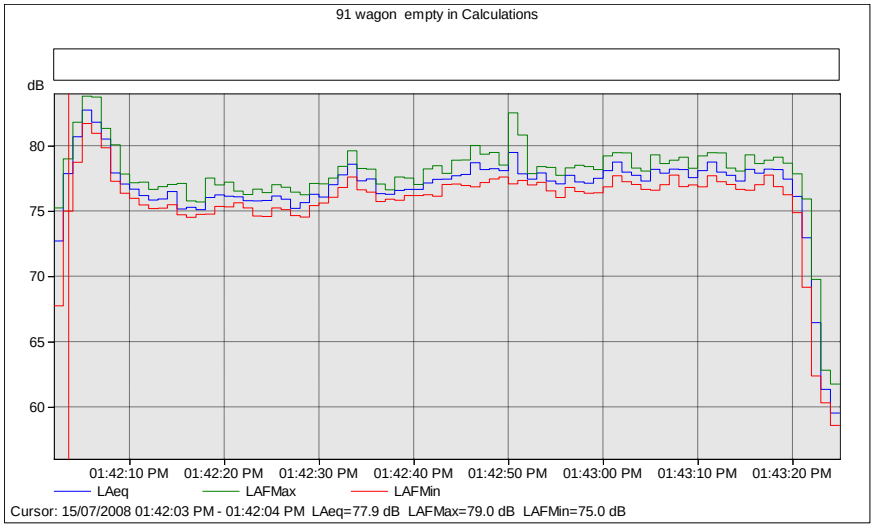


Table 24 summarises the important parameters for the 91-wagon coal train pass-bys. The table includes an estimate of pass-by speed calculated from the known length of the trains (20 m per locomotive and 16.2 m per wagon) and the pass-by time. (For this calculation, the time used is from the peak of the locomotive pass-by to the peak of the final wagon pass-by and not the total duration of time signals in Figures 6 and 7).

TABLE 24
Calculated parameters for 91-wagon coal trains.

Train type	Pass-by L_{Aeq}	Pass-by duration (s)	Speed (km/h)	$L_{Aeq(9hr)}$ (at 20 m)	$L_{Aeq\ (15hr)}$ (at 20 m)
91-wagon Full	72.7	137	45	49.0	46.8
91-wagon Empty	77.4	83	72	51.5	49.3

The results in Table 24 show that the full train is quieter than the empty train, although of longer duration, and contributes slightly less to the daytime/night-time noise levels than an empty train.

Coal production and tonnages for Ulan, Wilpinjong and MCP Stage 2 require the equivalent of four, four and five 91-wagon trains per day, respectively. This equals 13 full and 13 empty train pass-bys per 24-hour period at residences between Ulan and Muswellbrook. Assuming the trains would, and do, arrive at any time in a 24-hour period, with equal likelihood in any given hour, the above train numbers will results in 5 full and 5 empty trains during the night and 8 full/empty trains during the day.

Table 25 summarises the total calculated noise levels from coal trains servicing Ulan, Wilpinjong and MCP Stage 2 using the known conversion that the noise level at a given point from *N* identical sources equals the noise from one source plus $10\log_{10}(N)$.

TABLE 25
Train noise levels at 20m for trains from Ulan, Wilpinjong and MCP Stage 2.

Train type	$L_{Aeq(9hr)}$ (1 event)	$L_{Aeq(15hr)}$ (1 event)	No. Events (Night)	No. Events (Day)	$L_{Aeq(9hr)}$ (5 events)	$L_{Aeq\ (15hr)}$ (8 events)
91-wagon Full	49.0	46.8	5	8	56	55.8
91-wagon Empty	51.5	49.3	5	8	58.5	58.3
TOTALS	**53.4**	**51.0**	**10**	**16**	**60.4**	**60.2**

Total coal train noise levels in Table 25 are marginally above the 60 dB(A) night-time design goal discussed in Section 6.1.1 and almost 5 dB below the 65 dB(A) daytime design goal.

Based on the noise levels in Table 23, however, adding one freight train during both the day and night could increase the total train noise levels to 65 dB(A) in both periods. This is comparable to the theoretically calculated train noise levels in Table 21 and it is likely that exceedances of the night-time design will occur at residences within 60m of the train line.

These results suggest that further investigation of off-site train noise levels may be required by the coal transport service provider. This is particularly relevant for residences near the train line, which would typically be in Denman.

6.2.3 Train Vibration Assessment

Vibration levels in habitable rooms should comply with the criteria in the DECC document *Assessing vibration: a technical guideline* ("the

guideline"). The guideline defines the vibration associated with events such as train passbys as "intermittent".

The guideline indicates that the assessment of intermittent vibration should be done using a Vibration Dose Value (VDV), which is defined as the fourth root interval with respect to time of the acceleration after it has been weighted. The VDV is fully described in British Standard BS 6472: 1992 "*Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)*".

Table 26 shows the acceptable VDV's for intermittent vibration taken from Table 2.4 of the guideline.

TABLE 26
Acceptable VDV's for intermittent vibration ($m/s^{1.75}$)

Area, Time	Preferred Value	Maximum Value
Residential – Day	0.20	0.40
Residential – Night	0.13	0.26

Day time is between 7am and 10pm

Vibration levels from several train pass bys were measured by Spectrum Acoustics near Singleton NSW using an ARL EL-235 vibration logger. The logger was placed at 20m from the well ballasted track and set to a trigger level of 0.5 mm/s. The logger was not triggered during several coal train pass-bys and it was conservatively estimated that each pass-by produced a maximum vibration level of 0.45 mm/s. A maximum level of 0.56 mm/s was recorded during the passage of a freight train, which had a duration of 115 seconds.

The calculation of the individual vibration dose values (VDVi) are based on the equations detailed in Section 2.4.1 of the guideline. The calculations take into account vibration level and duration. As discussed above, there would be five full/empty coal trains during the night and 8 full/empty trains during the day. The duration of coal train pass-bys is approximately 130 seconds (full) and 90 seconds (empty) and each pass-by produces a peak vibration level of 0.45 mm/s which will be assumed to remain constant throughout the entire pass-by. Calculated VDV levels are summarised in **Table 27**.

TABLE 27
Calculated vibration dose values (at 20m) for cumulative coal trains.

Type	Duration (s)	Number	PPV, mm/s	a, mm/s^2	VDVi	VDV
Full	130	5	0.45	0.02	0.11	1.57E-4
Empty	90	5	0.45	0.02	0.10	1.178E-4
VDV (Night)						**0.13**
Full	130	8	0.45	0.02	0.13	2.72E-4
Empty	90	8	0.45	0.02	0.12	1.88E-4
VDV (Day)						**0.15**

Note: The VDVi value is for the given number of pass-bys and not for a single pass-by.

The night time vibration dose of 0.13 m/s$^{1.75}$ from coal trains only is equal to the DECC preferred value in Table 26. A single freight train with a PPV of 0.56 mm/s and a duration of 115 sec has a calculated vibration dose of 0.09 m/s$^{1.75}$ at 20m from the track. Addition of one freight train would increase the night time value to 0.22 m/s$^{1.75}$.

Daytime values are below the recommended level of 0.2 m/s$^{1.75}$ but would exceed this value with the addition of one freight train. It is therefore likely that any future assessment of off-site train noise impacts should include an assessment of vibration levels at individual receivers.

7.0 OFF-SITE ROAD TRAFFIC

7.1 Traffic Noise Criteria

Condition 6 of the MCP Stage 1 Project Approval requires that noise levels generated by road traffic from all mines (Ulan, Wilpinjong and MCP) should not exceed the following criteria at residences near Ulan Road:

Day/Evening	60 dB(A),$L_{eq(1hr)}$
Night	55 dB(A),$L_{eq(1hr)}$

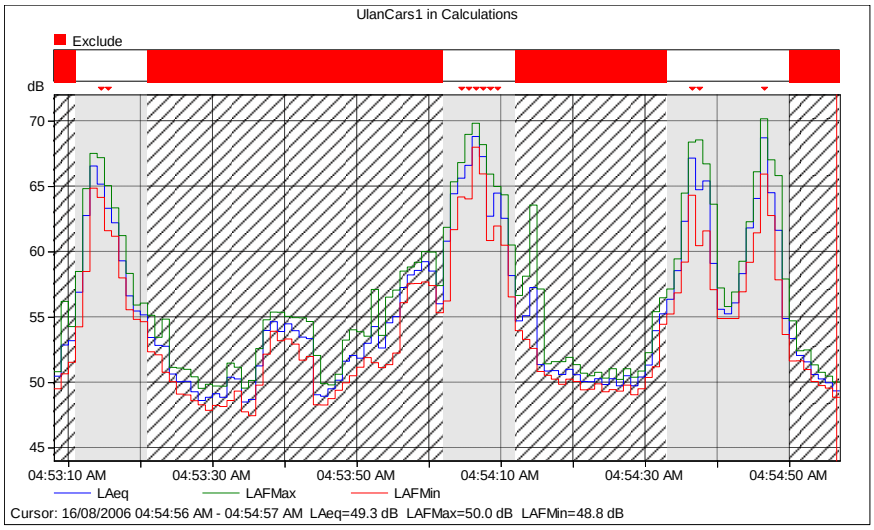
Since these are 1-hour criteria, they will be applied to shift changes as the worst case for maximum traffic noise impacts.

7.2 Predicted Traffic Noise Levels

Noise measurements conducted by Spectrum Acoustics in Ulan Village on 16 August 2006 included four light vehicles passing by on route to (presumably) Ulan or Wilpinjong mines, enabling an accurate calculation of traffic noise levels to be performed. A 1-second time-trace of these vehicles is shown below in **Figure 8**. (Note: the internal clock on the sound level meter was 1 hour slow).

FIGURE 8

Time-trace of four light vehicles pass-bys in Ulan village.



The maximum pass-by noise levels at 12m from the centre-line of the near lane of traffic ranged from 67-70 dB(A). Removing the data between car pass-bys using Bruel & Kjear Evaluator software revealed that the four cars contributed 63.4 dB(A),$L_{eq(37\ sec)}$.

A sound exposure level (SEL) is essentially a 1-second L_{eq} and is a useful measure for adding discrete noises together. The SEL for the four cars is

$$SEL\ (4\ cars) = 63.4 + 10Log_{10}(37) = 79.1\ dB(A).$$

The Traffic Impact Assessment (TIA) for MCP Stage 2 estimates the maximum hourly traffic load of up to 207 vehicles (associated with MCP) would occur around the morning shift change between 6 am and 7 am. Of these approximately 25% (or 52 vehicles) may pass through Ulan village. Since this is 13 times the number of measured cars in Figure 8 (ie 4) we have

$$SEL\ (52\ cars) = 79.1 + 10Log_{10}(13) = 90.2\ dB(A).$$

The traffic noise criterion is over a 1-hour period, so the above SEL at a point 12 m from the centre of the near lane of Ulan Road is 'averaged' over one hour as

$$L_{Aeq(1hr)} = 90.2 - 10log_{10}(3600) = 54.6\ dB(A).$$

Since there are no non-project related residences in Ulan village[5], the criteria apply to all other receivers between Ulan and Gulgong. The nearest residence to Cope Road (Ulan-Gulgong Road) is approximately 2.8 km west of Ulan Village and at a distance of 30m from the road. Applying a (cylindrical) distance loss factor to the above traffic noise level at 12 m gives a level at 30 m from the road of

[5] Ulan Public School is adjacent to the main road, however the peak traffic levels at shift change will occur outside school hours.

$$54.6 \text{ dB(A)} + 10\log_{10}(12/30) = 50.6 \text{ dB(A)}$$

This is more than 4 dB below the approved night-time traffic noise criterion of 55 dB(A), although traffic from sources other than MCP would increase the overall noise level. Attended traffic noise monitoring should be conducted at or near this location to determine compliance with the criterion. This would be conducted as part of the regular noise compliance monitoring surveys.

8.0 BLAST OVERPRESSURE AND VIBRATION

8.1 Blasting Criteria

Blasting overpressure and ground vibration criteria are provided in conditions 11 and 12 of the MCP Stage 1 Project Approval as reproduced below.

Airblast Overpressure Impact Assessment Criteria

11. The Proponent shall ensure that the airblast overpressure level from blasting at the project does not exceed the criteria in Table 5 at any residence on privately owned land.

Table 5: 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%

Ground Vibration Impact Assessment Criteria

12. The Proponent shall ensure that the ground vibration level from blasting at the project does not exceed the criteria in Table 6.

Table 6: Ground vibration impact assessment criteria

Receiver	Peak particle velocity (mm/s)	Allowable exceedance
Residence on privately owned land	5	5% of the total number of blasts over a period of 12 months
	10	0%
330kV transmission line	50	0%
Aboriginal rock shelters	40	0%

Note: The impact assessment criteria for Aboriginal rock shelters applies unless the Proponent develops site specific impact assessment criteria to the satisfaction of the Director-General.

8.2 Blast Impact Assessment Procedure

The following sections provide standard equations for predicting blast overpressure and ground vibration levels, sourced from the United States Bureau of Mines.

8.2.1 Blast Overpressure

Unweighted airblast overpressure levels (OP) are predicted from **Equation 1** below.

$$OP = 165 - 24(\log_{10}(D) - 0.3\log_{10}(Q)), \quad dB \qquad (1)$$

where D is distance from the blast to the assessment point (m) and
Q is the weight of explosive per delay (kg).

Analysis of 12 months blast data for a coal mine in the Hunter Valley has shown Equation 1 to underestimate overpressure levels by up to 3 dB for small blasts (Maximum Instantaneous Charge (MIC) 100-400kg) and overestimate by 1 dB for larger blasts (MIC > 400kg). Given the range of MIC values considered in this assessment (450-850 kg) no correction has been applied to Equation 1 to provide a small element of conservatism.

8.2.2 Blast Vibration

The basic equations for calculation of peak particle vibration (PPV) levels from blasting are as follows:

$$PPV = 1140\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \qquad \text{(for average ground type)} \qquad (2)$$

$$PPV = 500\left(\frac{D}{Q^{0.5}}\right)^{-1.6}, \text{ mm/s} \qquad \text{(for hard rock)} \qquad (3)$$

where D and Q are defined as in Equation 1.

A coefficient value of 1000 has been used to approximate reasonably soft ground in the blast vibration calculations to provide a conservative assessment as no specific site law has been established through trial blasting.

8.3 Blast Impact Predictions

8.3.1 Residential Receivers

Predicted blast overpressure and ground vibration levels are shown in **Table 28** for non-project related receivers within 2000 m of approved OC 1 – 3 and proposed OC4. Calculations are based on a range of MIC values up to the maximum value of 850 kg provided by the Mining Engineer for OC1 – OC3. A maximum MIC of 1788 kg has been provided for OC4 only.

The figure in parentheses next to each receiver distance indicates the relevant closest Open Cut, although predicted levels from 1788 kg MIC blasts in OC4 have been calculated to all nominated receivers. Levels greater than the 5% exceedance limits (115 dB overpressure and 5 mm/s vibration) are shaded grey.

TABLE 28
Predicted blast overpressure and ground vibration levels.

Receiver	Distance (m)[a]	MIC 450 kg		MIC 650 kg		MIC 850 kg		MIC 1788 kg[d]	
		PPV[b]	OP[c]	PPV	OP	PPV	OP	PPV	OP
R49 Olive-Lea	1630 (OC1)	1.0	109	1.0	109	1.3	110	1.4	111
R26 Robinson	1600 (OC1)	1.0	109	1.0	109	1.3	110	1.4	111
R30 M Cox	1325 (OC3)	1.4	111	1.4	111	1.9	113	1.5	112
R32 Stokes	1835 (OC3)	0.8	107	0.8	107	1.1	109	0.9	108
R44 Power	875 (OC4)	2.7	116	2.7	116	3.7	117	4.9	118
R27 Helm	1975 (OC4)	0.7	107	0.7	107	0.9	108	1.2	109

[a] Distance from receiver to closest point of nearest OC.
[b] Peak vertical ground vibration, mm/s.
[c] Blast overpressure, dB.
[d] MIC for OC4 only.

The above results suggest that blast overpressure levels may exceed the 5% exceedance limit of 115 dB at R44 (Power) (now MCM acquired) for all expected charge weights in OC4. The ridge line of Munghorn Gap Nature Reserve rises to approximately 40m above the direct line of sight between R44 and the nearest point of OC4. While this represents a substantial noise barrier, the peak blast frequencies below 20 Hz are unlikely to be significantly attenuated by the ridge.

No privately owned receivers, (other than those subject to acquisition in Stage 1) are expected to be impacted by blasting to a level that will require acquisition.

8.3.2 Non-residential Locations

Rail Line and Road Infrastructure

Blasting in the north-eastern corner of OC 1 may come within 300m of the Ulan Road bridge over the Gulgong – Sandy Hollow rail line east of the UCML rail loop. At this distance, MIC values less than 650 kg must be used if the 20mm/s vibration limit for rail culverts is to be satisfied.

Blasting within OC 4 will come within 50m if the Ulan-Wollar Road bridges over Murragamba Creek and an unnamed creek in the north east of Open Cut 4. Monitoring of ground vibration levels should be conducted at this location when mining is within a distance of approximately 400m.

Blasting within the north eastern area of OC 4 will also come within 100m of the Gulgong – Sandy Hollow rail line and its associated culverts. Monitoring of ground vibration levels should be conducted at this location when mining is within a distance of approximately 400m.

330 kV Transmission Line

Blasting in OC 1 and OC 4 will come within 200m of the 330 kV transmission line adjacent to Ulan-Wollar Road and Gulgong – Sandy Hollow rail line. A ground vibration level of 61 mm/s is predicted at this

location for a large (1788 kg MIC) blast in OC4. This is above the acceptable level of 50 mm/s detailed in Section 8.1. Monitoring of ground vibration levels should be conducted at this location when mining in OC4 is within a distance of approximately 500m. Subject to blast monitoring results, it may be necessary to reduce MIC values in OC4 for blasts within approximately 400m of this structure.

It should be noted that blasting will commence at large distances from any sensitive infrastructure and ample site data will be available to enable appropriate blast design near these structures.

Moolarben Creek Dam

Moolarben Creek Dam is a rock-fill structure with a reinforced concrete lining on the upstream side. As such, the concrete component is the critical structure in terms of potential vibration levels. Mining blasts produce vibrations at frequencies greater than approximately 2 Hz, peaking at around 8 Hz. At typical PPV the displacement at these frequencies is small and does not present a significant risk to the earth/rock-fill part of the dam. Damage, such as slumping, has been known to occur during seismic activity when ground vibrations may contain components down to 0.1 Hz (10 second wavelength) with large vertical displacement. Mine blasts do not produce vibrations at these lower frequencies.

Australian Standard 2187.2-1993 recommends that reinforced concrete structures should not be subjected to ground vibration levels greater than 25 mm/s PPV. Various international codes and standards allow for twice this level of vibration.

Since completion of the Stage 1 assessment, the NSW Dams Safety Committee (DSC) has indicated their preference that ground vibration at dam walls be assessed against an initial screening criterion of 10 mm/s PPV. This conservative level has been adopted in the following assessment of potential blast-induced vibration levels.

The MCP Stage 1 EA contains a conservative analysis of blast vibration levels in the absence of site data to formulate site laws. Re-calculation of blast vibration levels based on various MIC values gives the following set-back distances to achieve the 10 mm/s vibration criterion at the dam wall.

MIC (kg)	421	806	915	1,235	1,788
Set-back (m)	370	510	540	630	875

The above values should be used by the blasting contractor in the blast design for OC1 (ie, the nearest pit to the dam). The MCM Blast Monitoring Program lists Moolarben Creek Dam as a monitoring site. During the first

3 months blast monitoring with a DECC approved instrument should be conducted on the concrete structure of the dam wall for all blasts. During this time, the blast monitoring results would feed back into the design of future blasts to ensure compliance with the criterion. Monitoring of every blast could be discontinued if levels are consistently below the criterion during the first three months.

Rock Art Site

An aboriginal rock art site has been identified near the top of the escarpment east of OC2. This site is 550 m east of the approved OC 2 and 350 m west of the nearest point of the proposed OC4.

Predicted peak ground vibration levels at this site are 9 mm/s from OC2 (850 kg MIC) and 34 mm/s from OC4 (1,788 kg MIC). These levels are below the conservative 40 mm/s criterion contained in the MCP Stage 1 Project Approval.

9.0 SUMMARY OF IMPACTS AND RECOMMENDATIONS

9.1 Impacted Receivers

Noise levels above the project specific criteria have been predicted at seven Ulan or Wilpinjong Mine owned properties as summarised below.

Receiver	Owner	Criterion	Predicted	Year of impact	Source
46B	Ulan	35	>45	7	OC4
46C	Ulan	35	47	2	OC4 haulage
46G	Ulan	35	36 to >45	After Year 7	OC4
65B	Wilpinjong	35	up to 38	After Year 19	OC4
65C	Wilpinjong	35	up to 38	After Year 19	OC4
65D	Wilpinjong	35	up to 38	After Year 19	OC4
141	Wilpinjong	35	up to 38	After Year 19	OC4

Receivers R46C/G lie within the footprint of OC4 and will fall into MCM ownership. Recommendations have been made to assess cumulative noise levels and the residential status of the remaining receivers at some time prior to when the excessive noise levels are predicted to occur.

The assessment has found that no additional receivers west or south of the site would be included in an acquisition zone as a result of Stage 2 components of the project. Receivers R27 (Helm) and R44 (Power) would be included in the OC4 acquisition zone and have recently been acquired by MCM.

Some receivers are predicted to have received noise levels close to the noise criteria and up to a 3 dB exceedance under adverse weather conditions. Some of these receivers[6] should be included as attended noise monitoring locations and include the following:

Open Cut 1 – commences Year 2

Receiver	Exceedance (dB)
R26 (Robinson)	N/A[7]
R169 (Tinker)	N/A
R22 (Aiton)	N/A

Open Cut 2 – commences Year 7

Receiver	Exceedance (dB)
R22 (Aiton)	up to 3
R23 (Woodhead)	up to 2
R41A (Libertis)	1
R63 (Whiticker)	N/A
R64 (Goninan & Boland)	N/A
R70 (Coventry)	N/A
R172 (Kimber)	N/A

Open Cut 3 – commences Year 12

Receiver	Exceedance (dB)
R30 (Cox)	1
R35 (Johnson)	N/A
R47 (Andrews)	N/A

The four receivers with predicted exceedances of up to 3 dB will be incorporated in a Noise Management Plan requiring attended and/or real-time noise monitoring to be conducted for at least a year prior to commencement of the MCP component responsible for the noise exceedance. Based on this noise monitoring, and noise model validation studies, noise management/mitigation options will be investigated with the intent of achieving the noise criteria. Where this is not reasonably or feasibly possible, it may be necessary to enter into negotiated agreements with the affected receivers.

[6] For example, monitoring at R22 would be representative of receivers R23, R41A, R63 and R64.

[7] Signifies predicted levels equal to or less than the criteria.

10.0 CONCLUSION

A noise and vibration impact assessment has been conducted for the proposed Stage 2 of the MCP in the Western Coalfields of NSW, 40 km northeast of Mudgee and 25 km east of Gulgong.

The assessment has found that two residential receivers in the Murragamba Valley would be sufficiently impacted by noise and vibration to be in an acquisition zone. These receivers heve recently been purchased by MCM.

Mining activities in the proposed Open Cut 4 have been found through preliminary modelling to result in noise levels west of the project site being elevated by 2-4 dB compared with Stage 1 modelling. As a result, recommendations have been made to apply acoustic treatment to major plant items as follows:

- Liebherr 996 excavators will be fitted with upgraded mufflers to reduce exhaust noise tones below 500 Hz; and
- Komatsu 830E haul trucks will be fitted with upgraded mufflers and grid-box silencers to reduce noise emissions in both uphill and downhill travel.

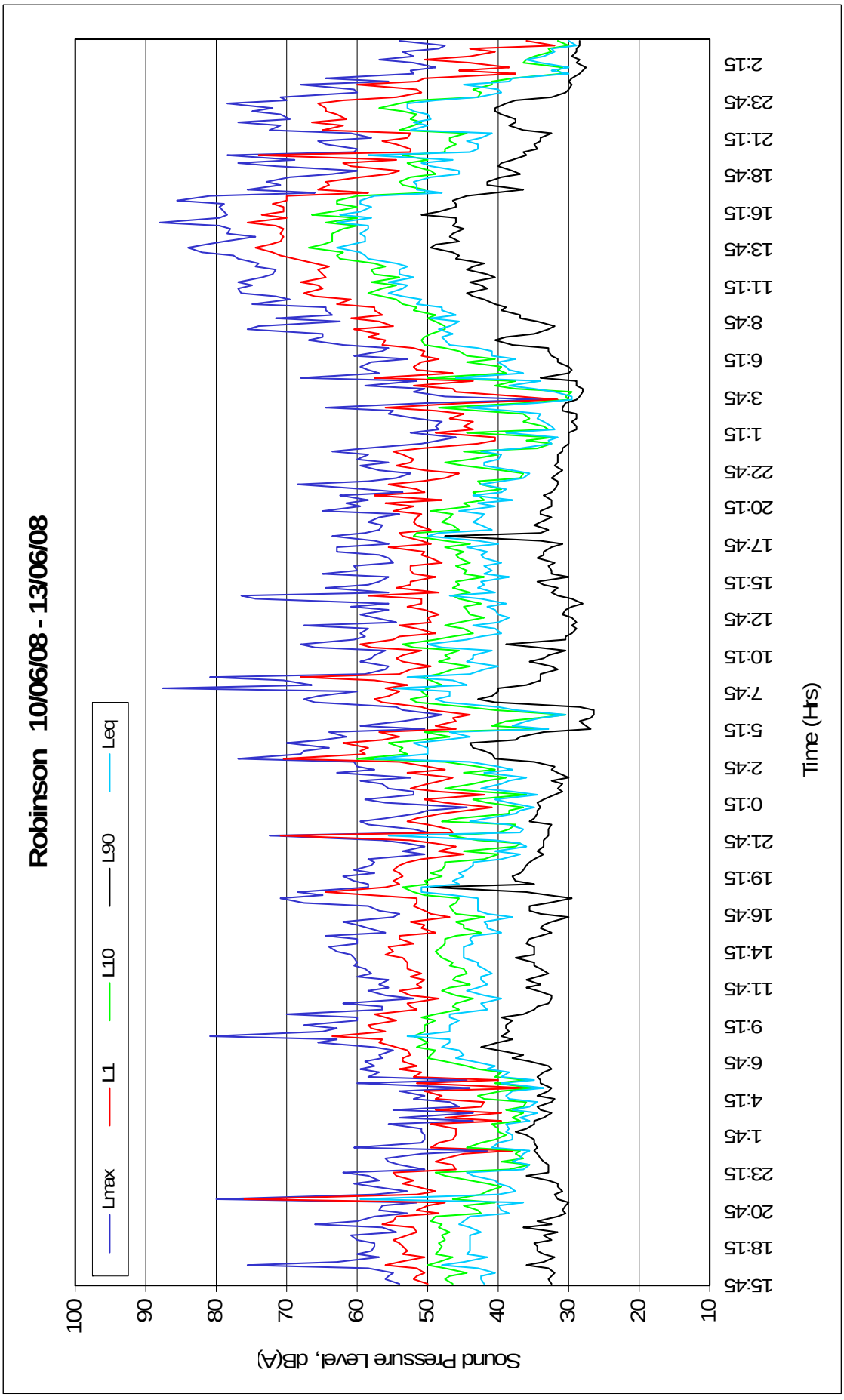
With the above noise reduction in place, noise levels west of the site at receivers considered in the Stage 2 assessment are similar to those predicted in the Stage 1 assessment. Several of these may have noise levels from the MCP up to 3 dB above the criterion under worst case conditions and it has been recommended that attended noise monitoring locations be conducted at receivers at least 12 months prior to commencement of the MCP component responsible for the exceedance. The results of the noise monitoring will be used as part of a noise management/mitigation strategy to ensure compliance with the noise criteria at these receivers.

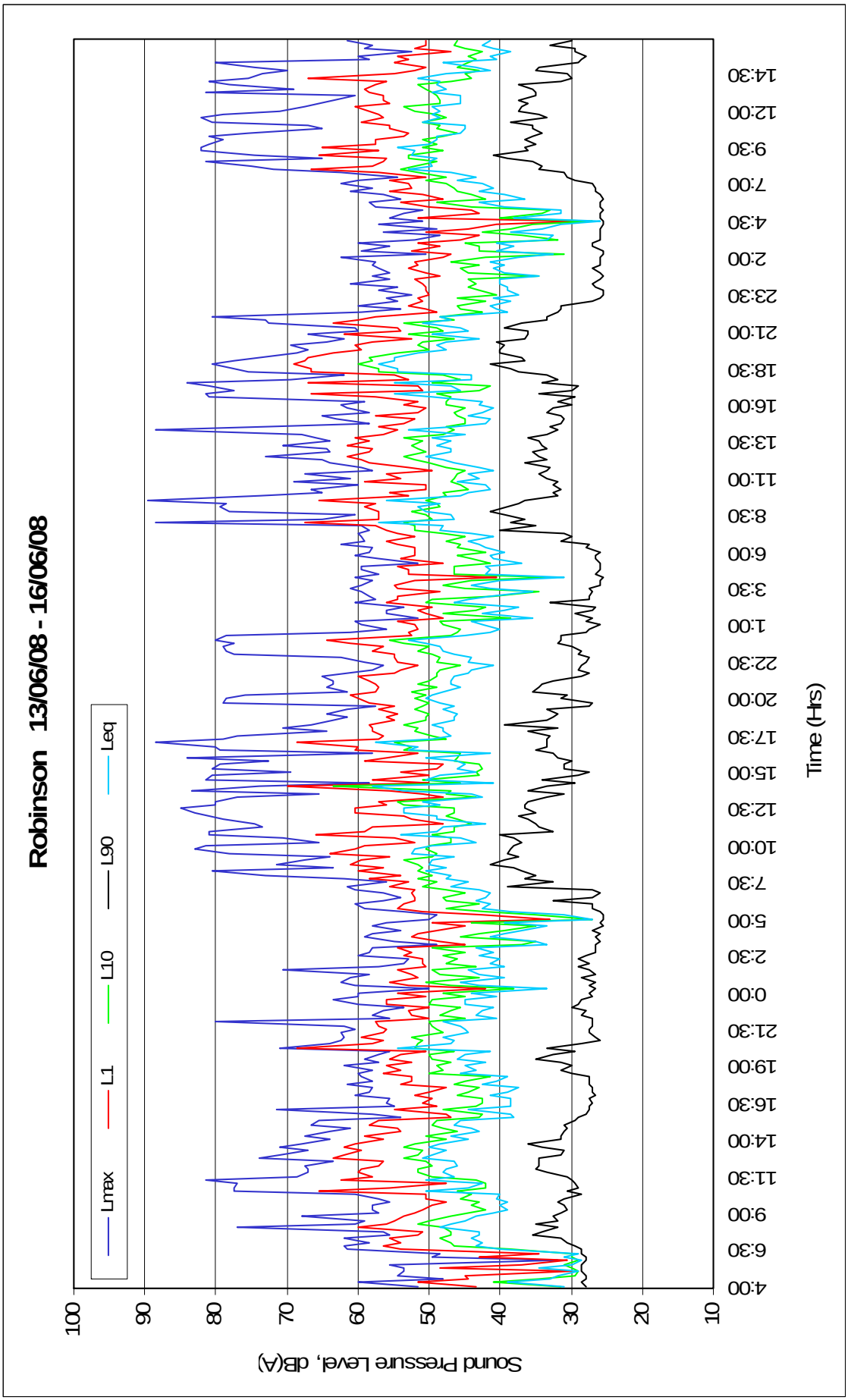
Cumulative train noise and vibration criteria may be exceeded at some receivers close to the train line between Ulan and Muswellbrook. Future assessment of impacts may be required at affected receivers.

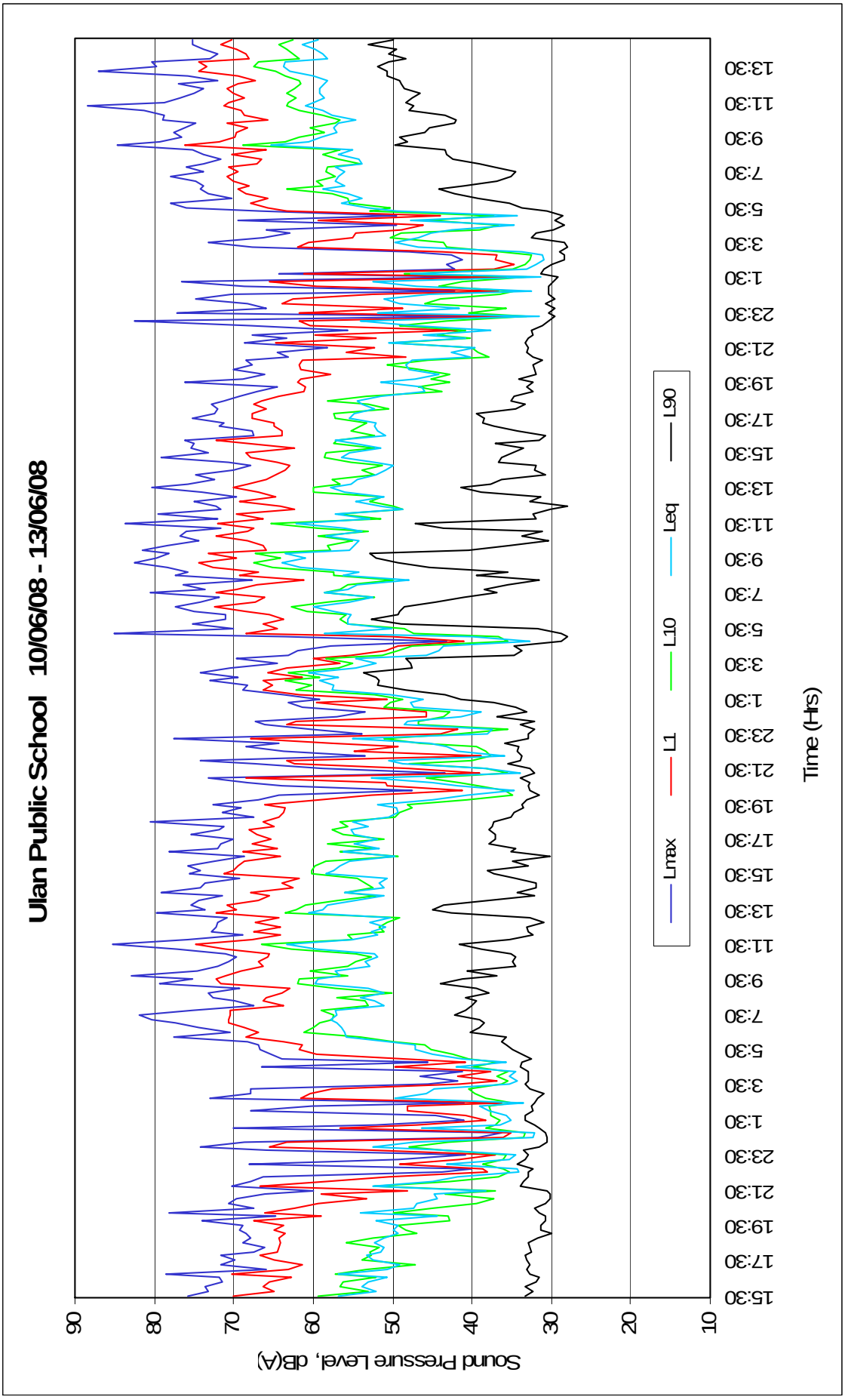
In summary, it has been found that Stage 2 of the MCP could operate within the applicable noise and vibration guidelines.

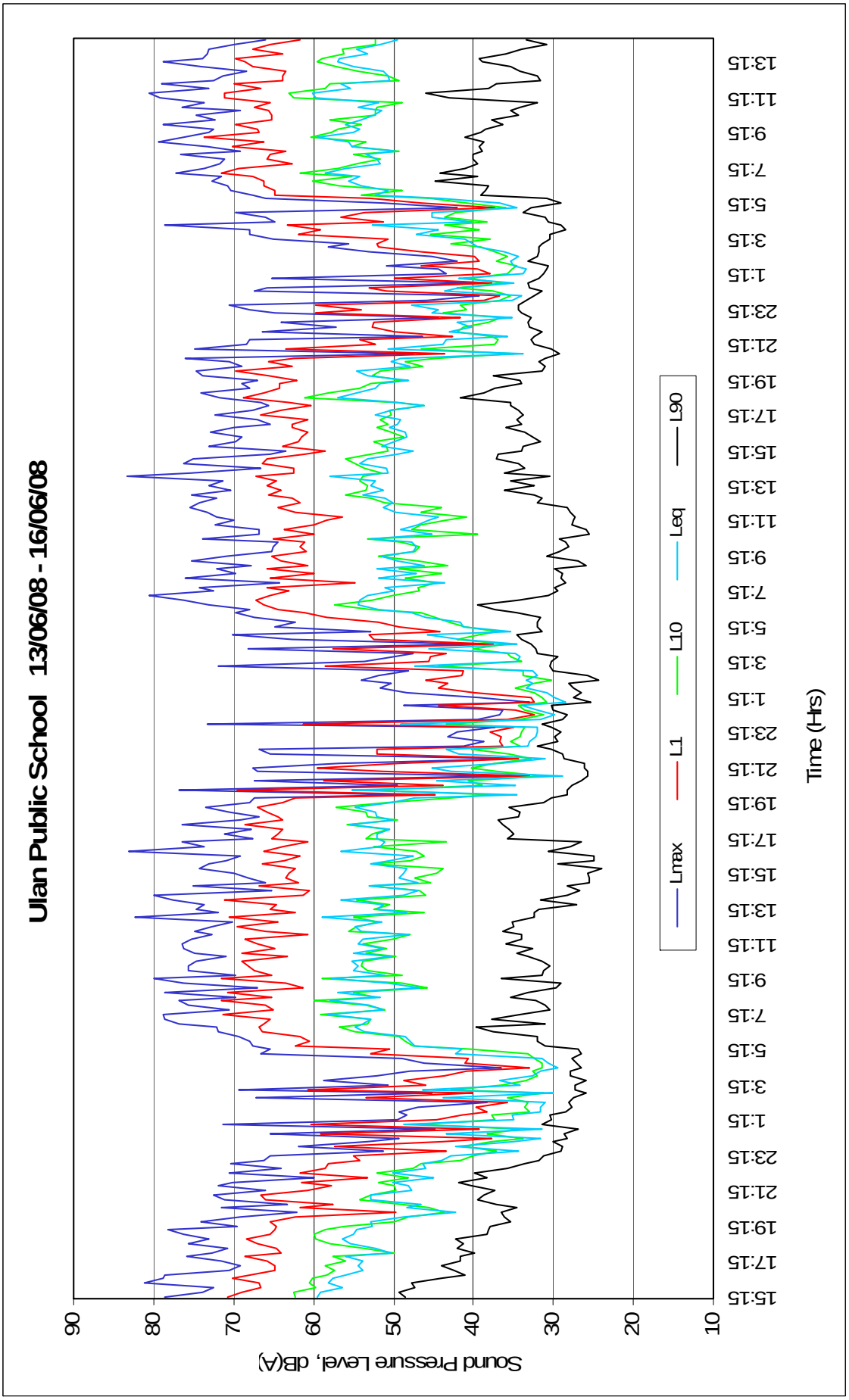
APPENDIX A

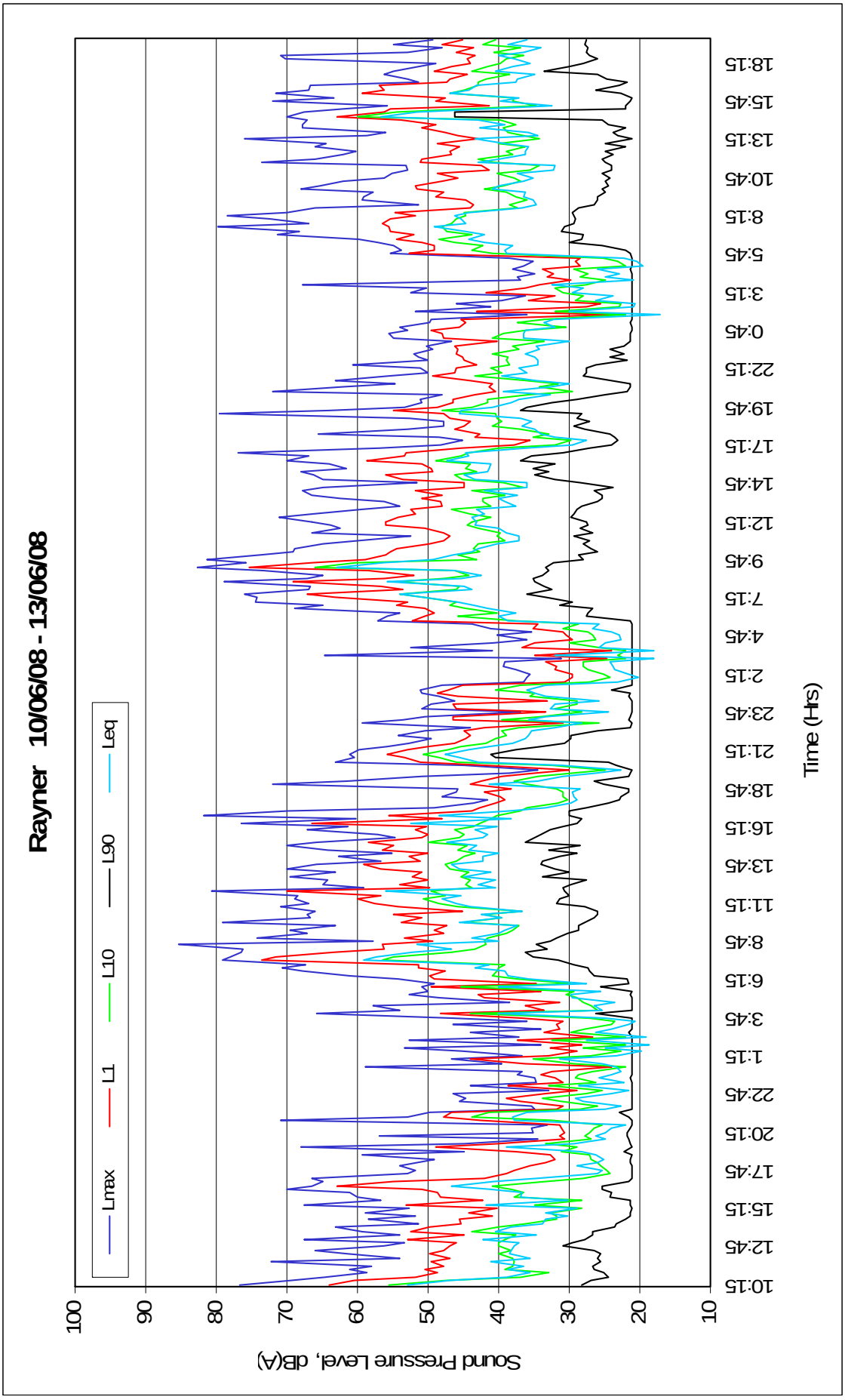
Ambient Noise Level Charts

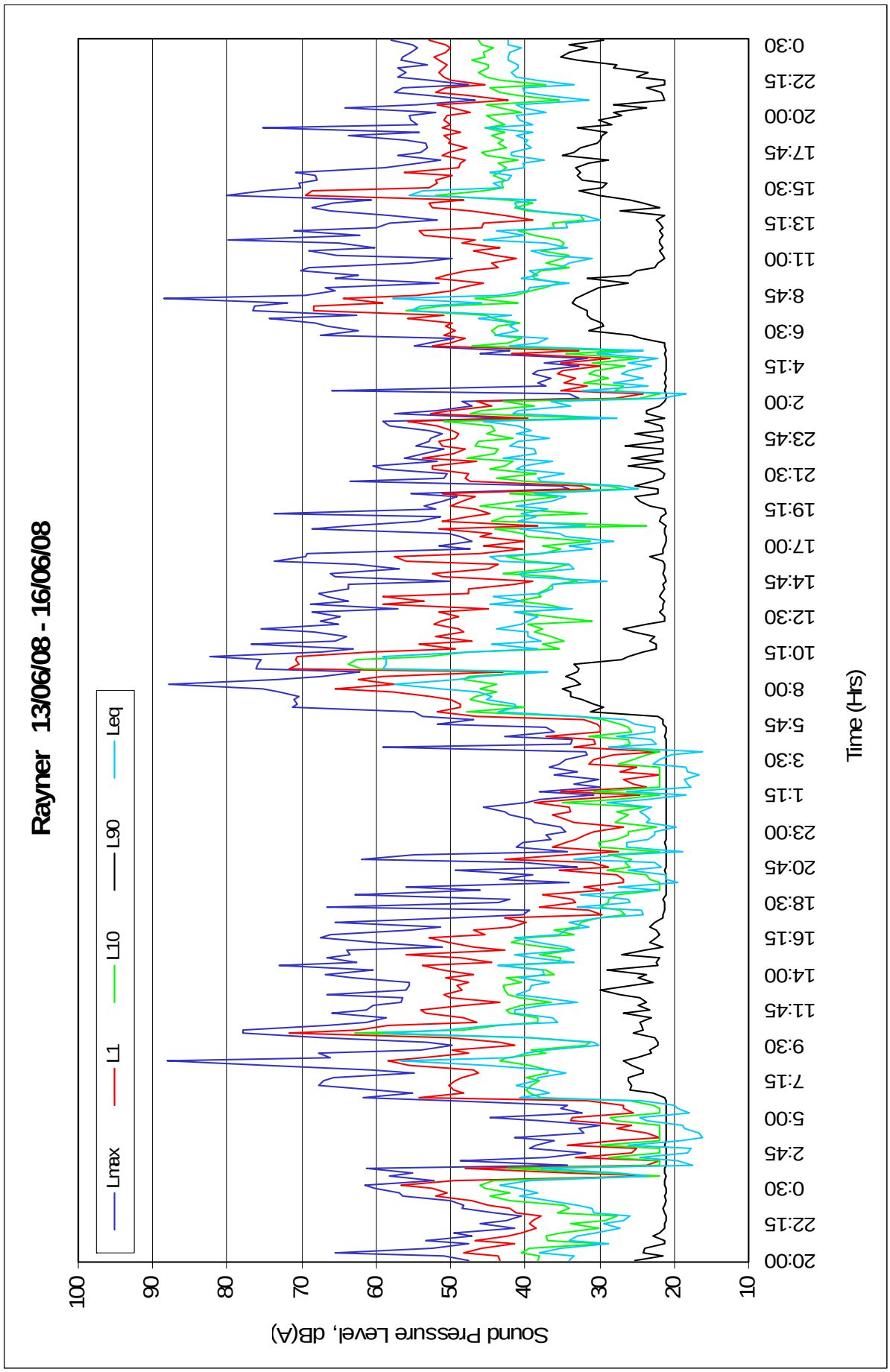

Robinson 10/06/08 - 13/06/08
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
Time (Hrs)
15:45
18:15
20:45
23:15
1:45
4:15
6:45
9:15
11:45
14:15
16:45
19:15
21:45
0:15
2:45
5:15
7:45
10:15
12:45
15:15
17:45
20:15
22:45
1:15
3:45
6:15
8:45
11:15
13:45
16:15
18:45
21:15
23:45
2:15


Robinson 13/06/08 - 16/06/08
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
Time (Hrs)
4:00
6:30
9:00
11:30
14:00
16:30
19:00
21:30
0:00
2:30
5:00
7:30
10:00
12:30
15:00
17:30
20:00
22:30
1:00
3:30
6:00
8:30
11:00
13:30
16:00
18:30
21:00
23:30
2:00
4:30
7:00
9:30
12:00
14:30


Ulan Public School 10/06/08 - 13/06/08
Sound Pressure Level, dB(A)
90
80
70
60
50
40
30
20
10
Time (Hrs)
15:30
17:30
19:30
21:30
23:30
1:30
3:30
5:30
7:30
9:30
11:30
13:30
15:30
17:30
19:30
21:30
23:30
1:30
3:30
5:30
7:30
9:30
11:30
13:30
15:30
17:30
19:30
21:30
23:30
1:30
3:30
5:30
7:30
9:30
11:30
13:30
Lmax
L1
L10
Leq
L90


Ulan Public School 13/06/08 - 16/06/08
Sound Pressure Level, dB(A)
90
80
70
60
50
40
30
20
10
Time (Hrs)
15:15
17:15
19:15
21:15
23:15
1:15
3:15
5:15
7:15
9:15
11:15
13:15
15:15
17:15
19:15
21:15
23:15
1:15
3:15
5:15
7:15
9:15
11:15
13:15
15:15
17:15
19:15
21:15
23:15
1:15
3:15
5:15
7:15
9:15
11:15
13:15
Lmax
L1
L10
Leq
L90


Rayner 10/06/08 - 13/06/08
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
Time (Hrs)
10:15
12:45
15:15
17:45
20:15
22:45
1:15
3:45
6:15
8:45
11:15
13:45
16:15
18:45
21:15
23:45
2:15
4:45
7:15
9:45
12:15
14:45
17:15
19:45
22:15
0:45
3:15
5:45
8:15
10:45
13:15
15:45
18:15
Lmax
L1
L10
L90
Leq


Rayner 13/06/08 - 16/06/08
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
Time (Hrs)
20:00
22:15
0:30
2:45
5:00
7:15
9:30
11:45
14:00
16:15
18:30
20:45
23:00
1:15
3:30
5:45
8:00
10:15
12:30
14:45
17:00
19:15
21:30
23:45
2:00
4:15
6:30
8:45
11:00
13:15
15:30
17:45
20:00
22:15
0:30

APPENDIX B

Noise Source Locations

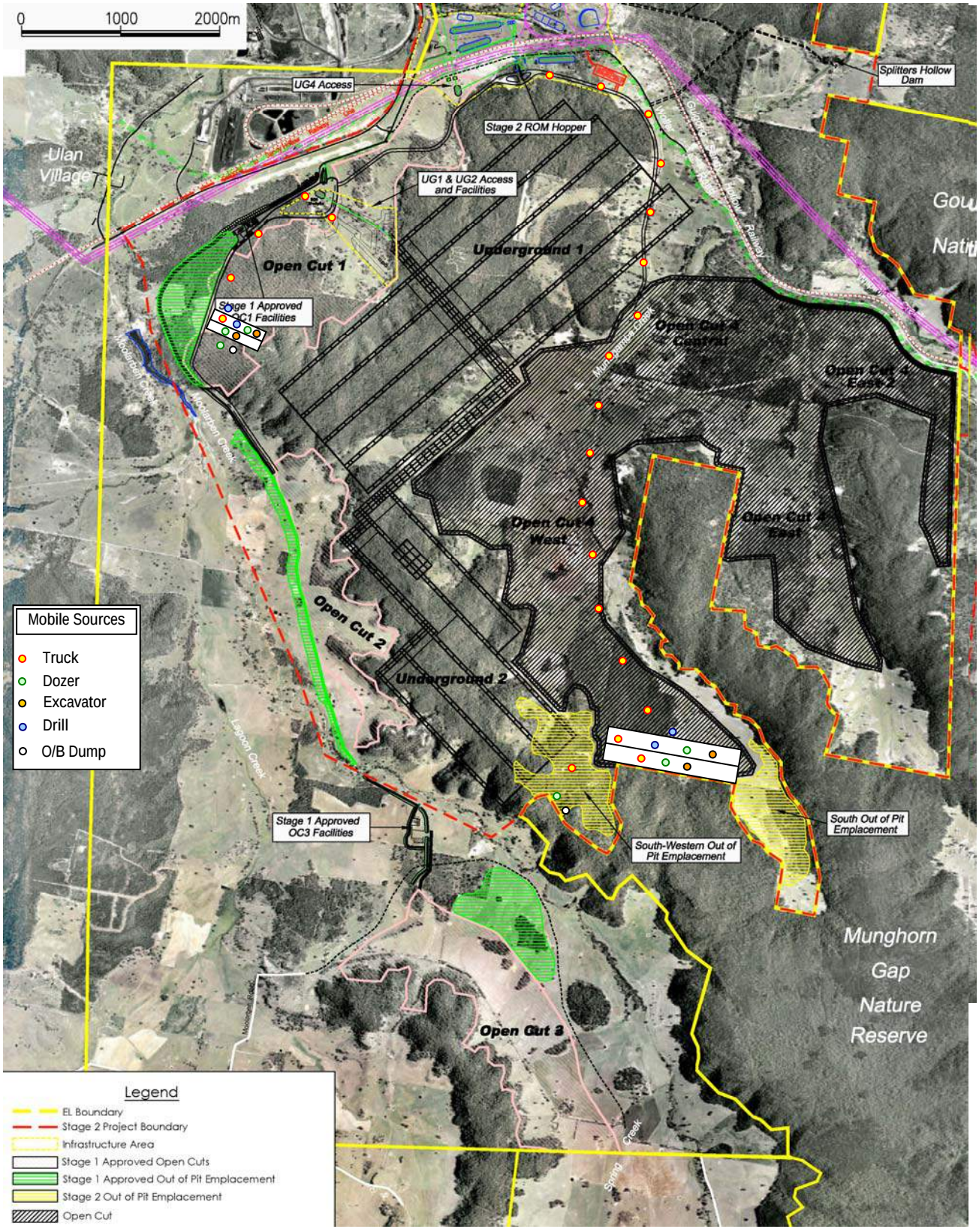


Figure B1. Major mobile noise source locations – Year 2.

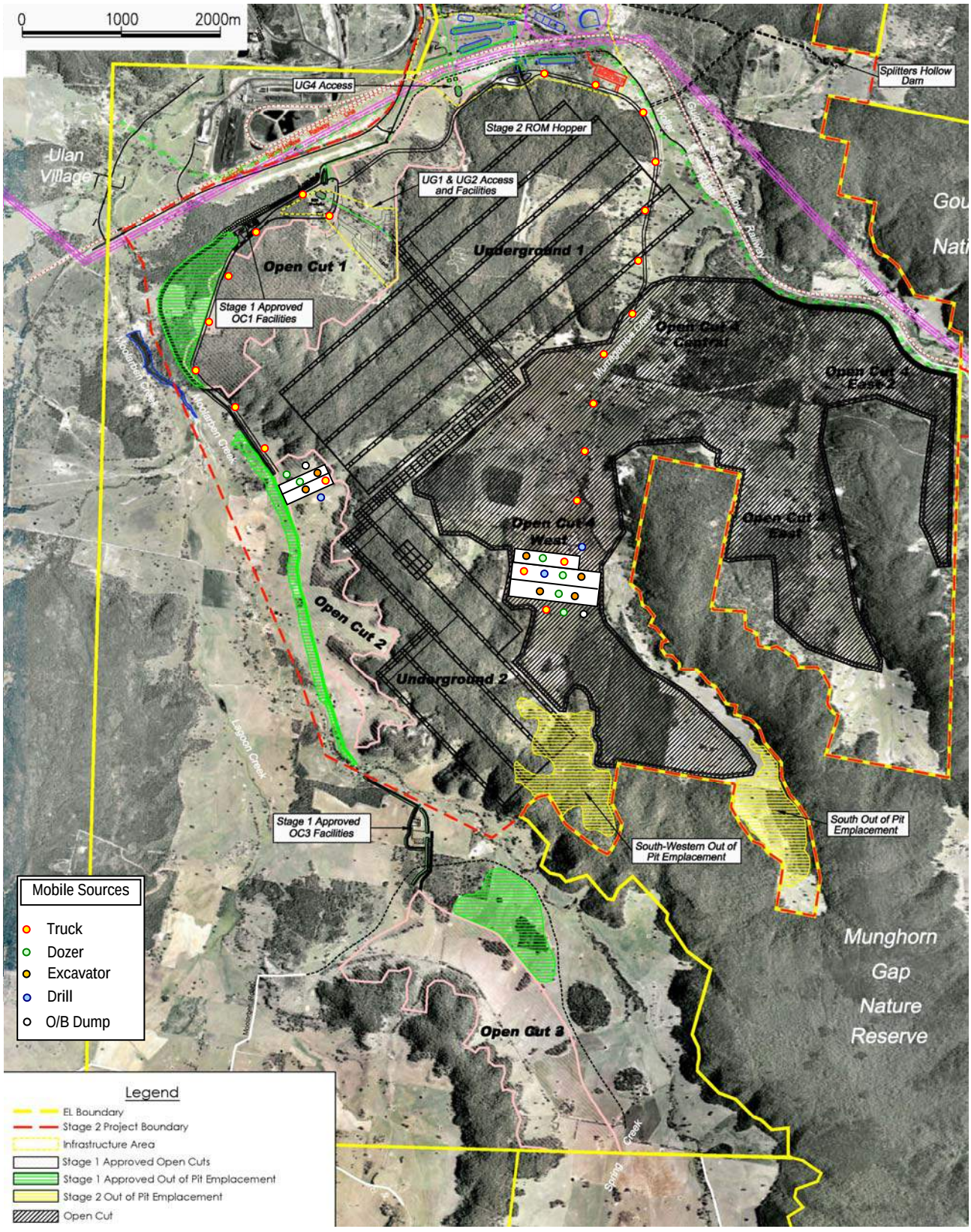


Figure B2. Major mobile noise source locations – Year 7.

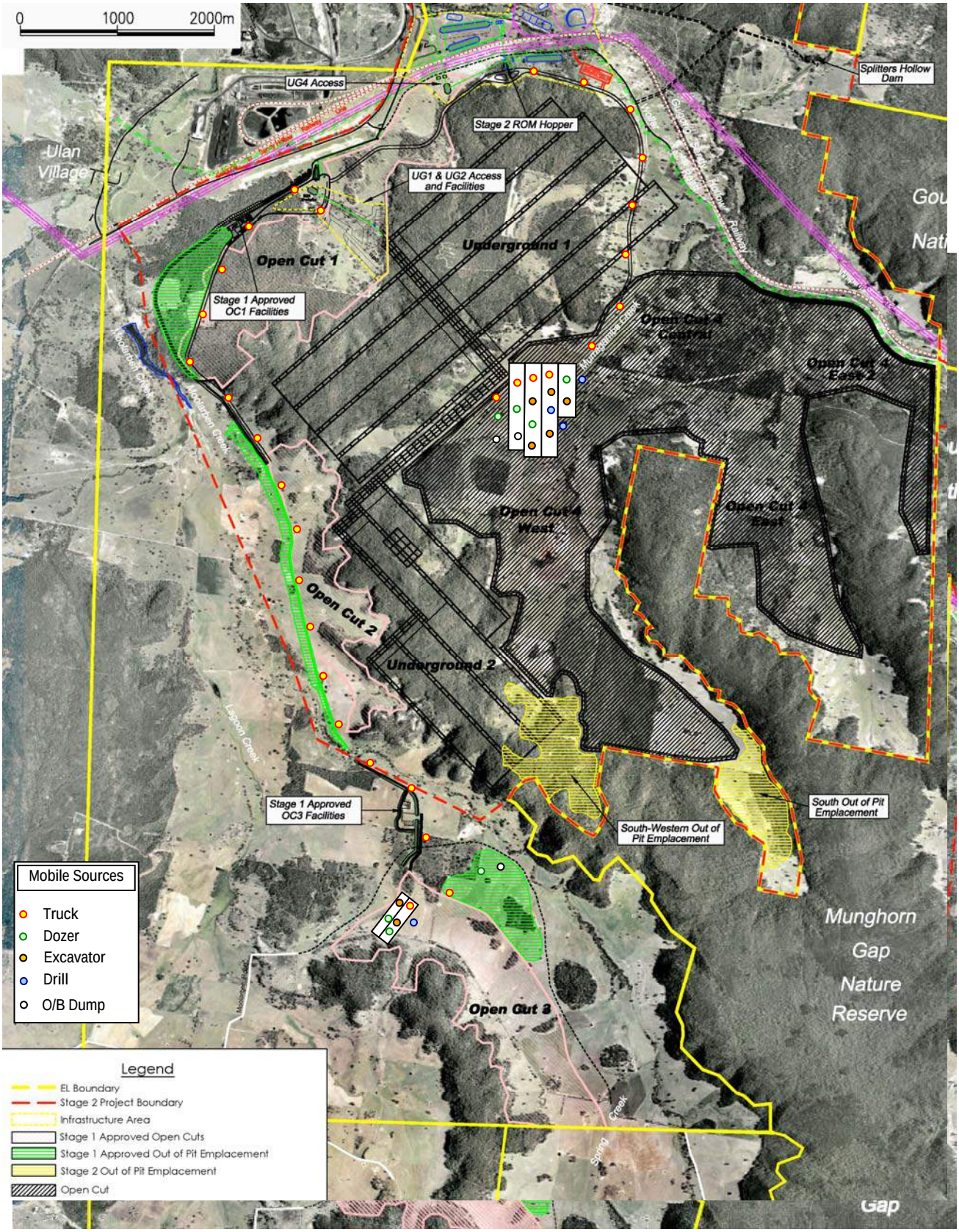


Figure B3. Major mobile noise source locations – Year 12.

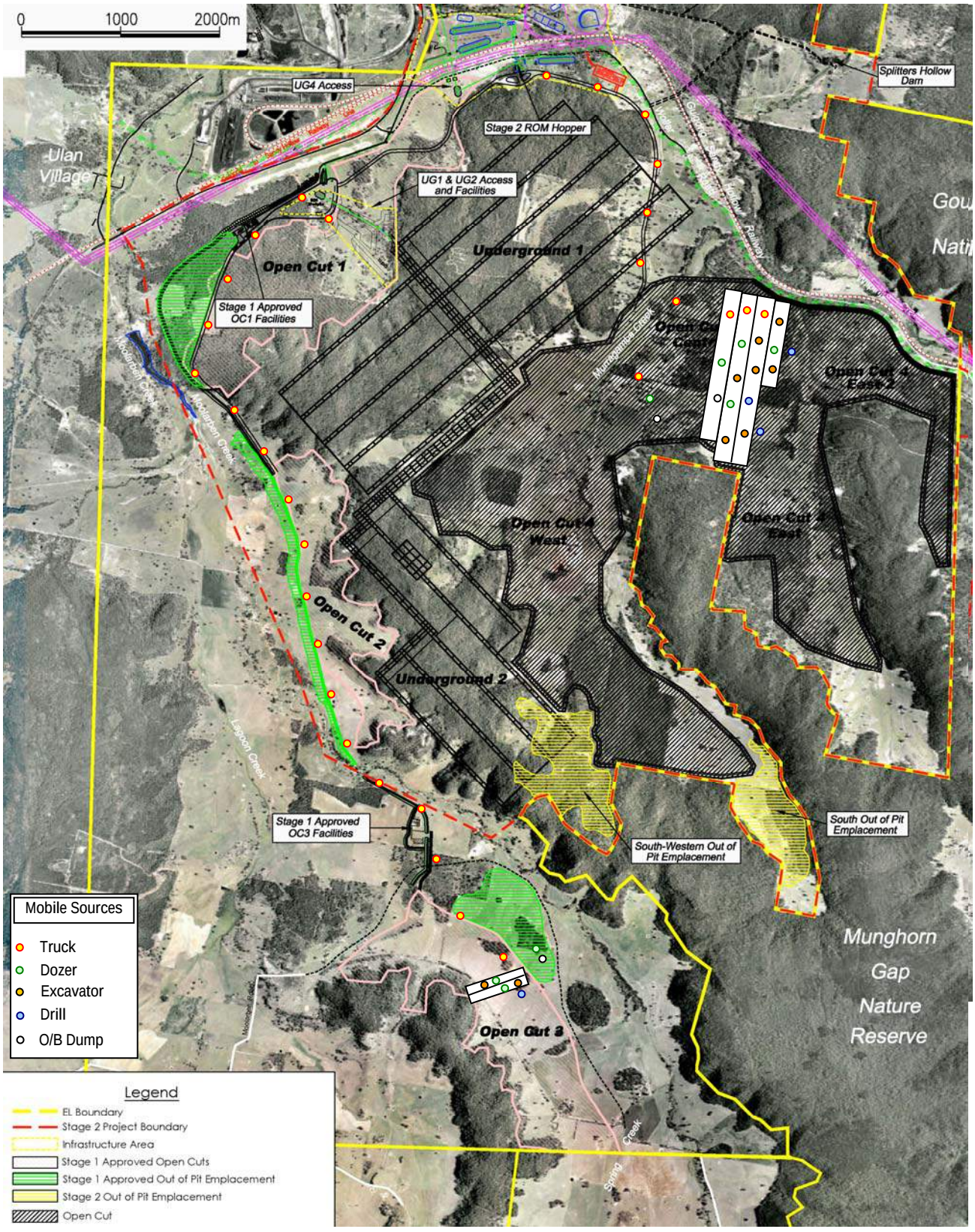


Figure B4. Major mobile noise source locations – Year 16.

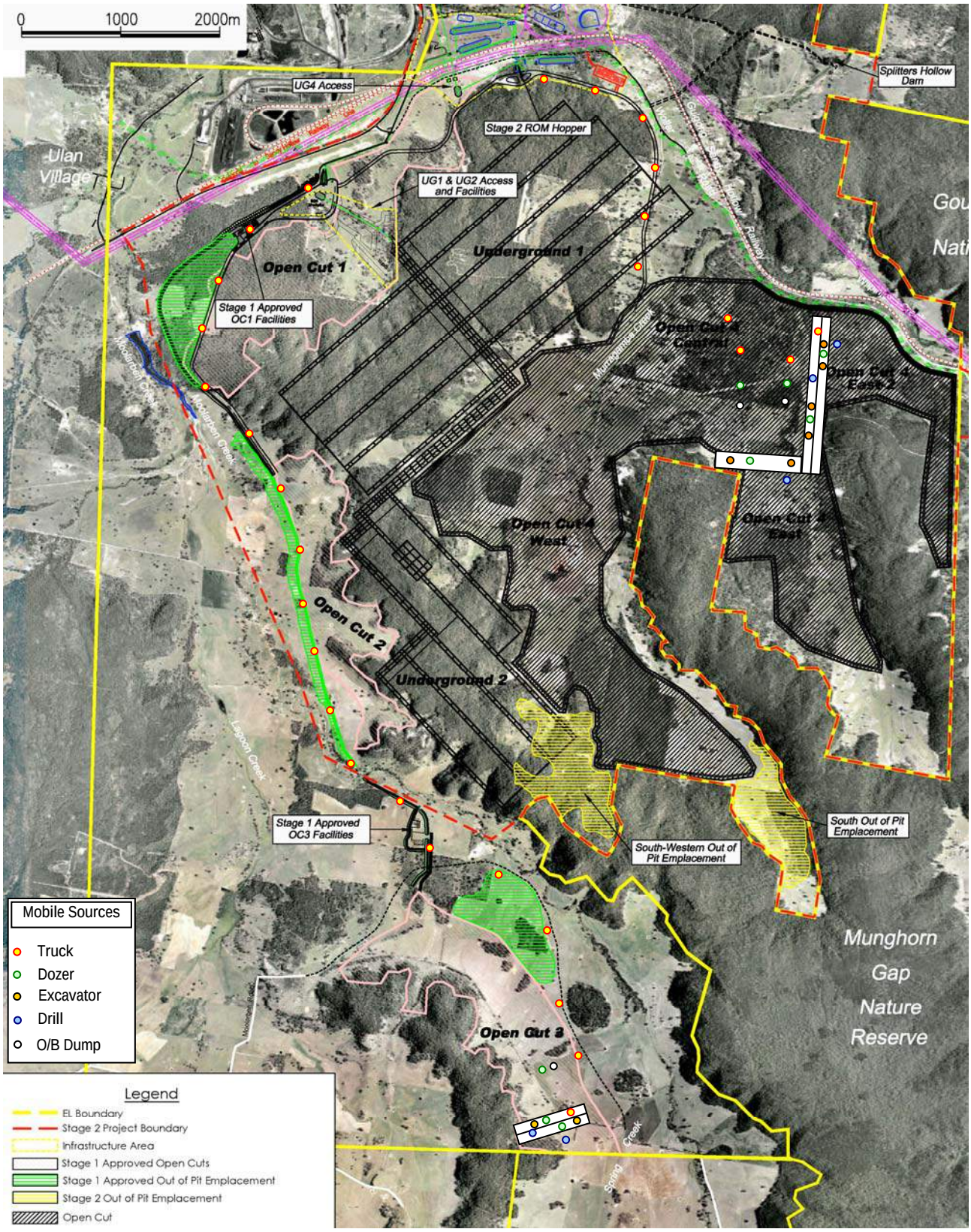


Figure B5. Major mobile noise source locations – Year 19.

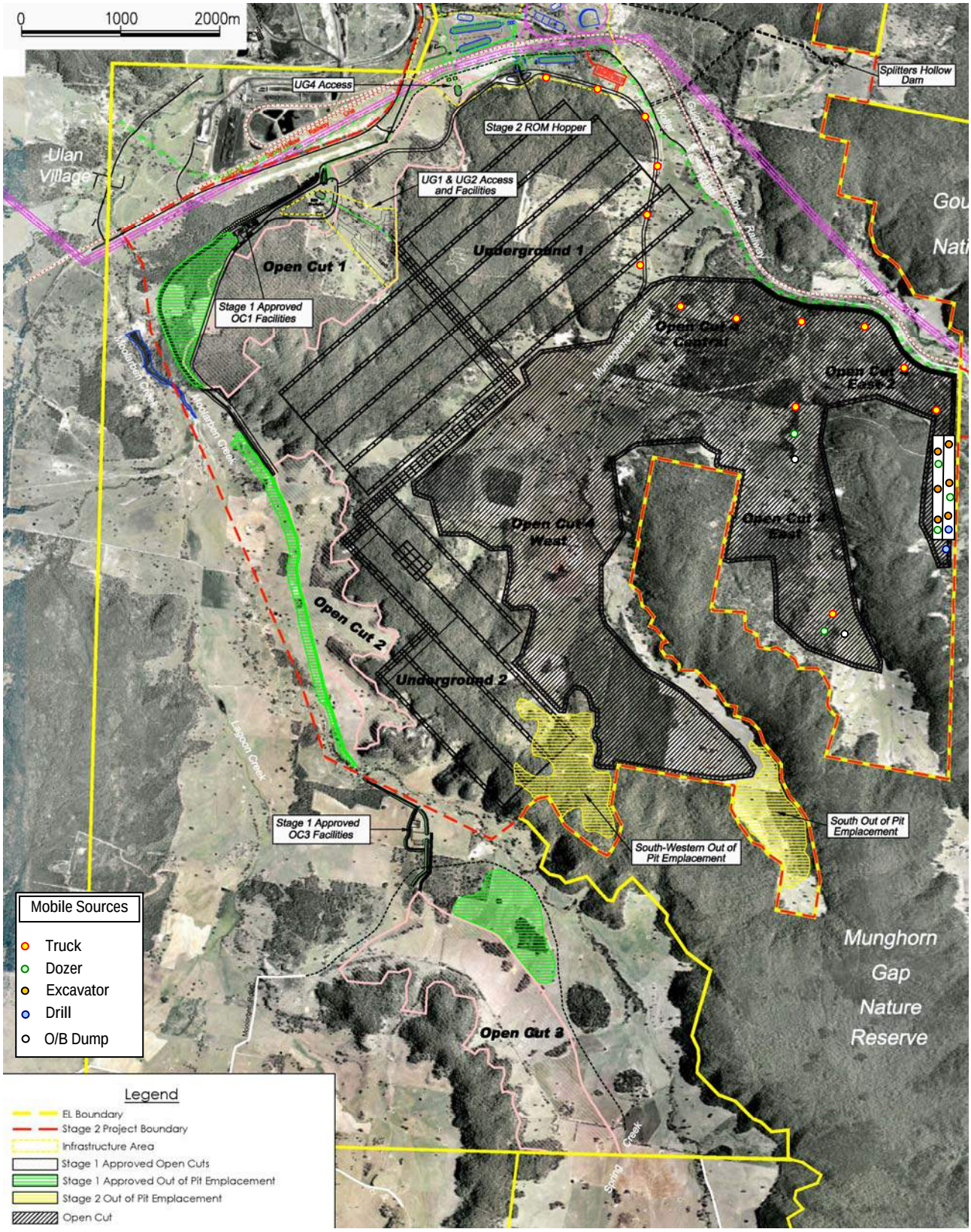
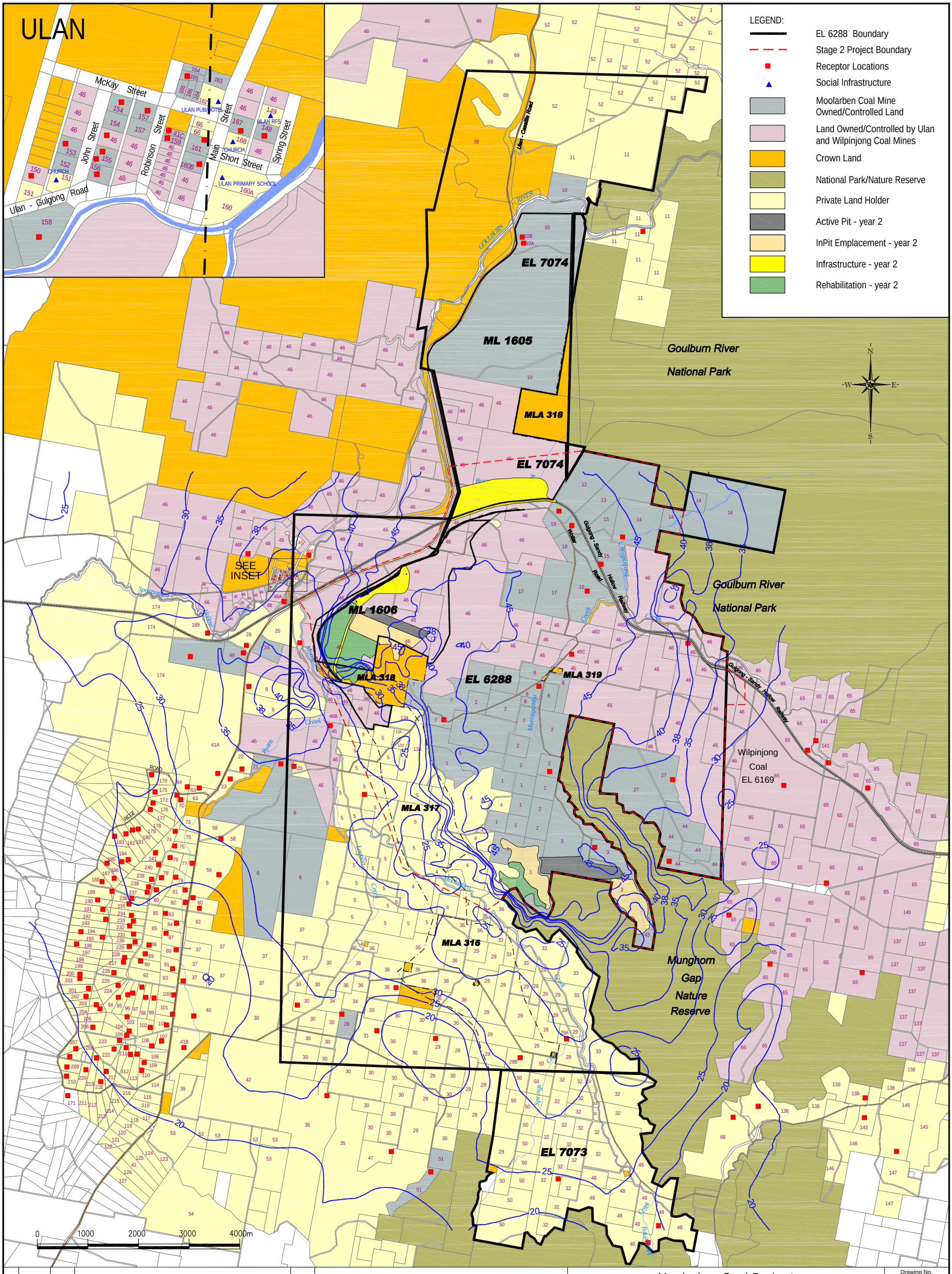


Figure B6. Major mobile noise source locations – Year 24.

APPENDIX C

Noise Level Contours



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

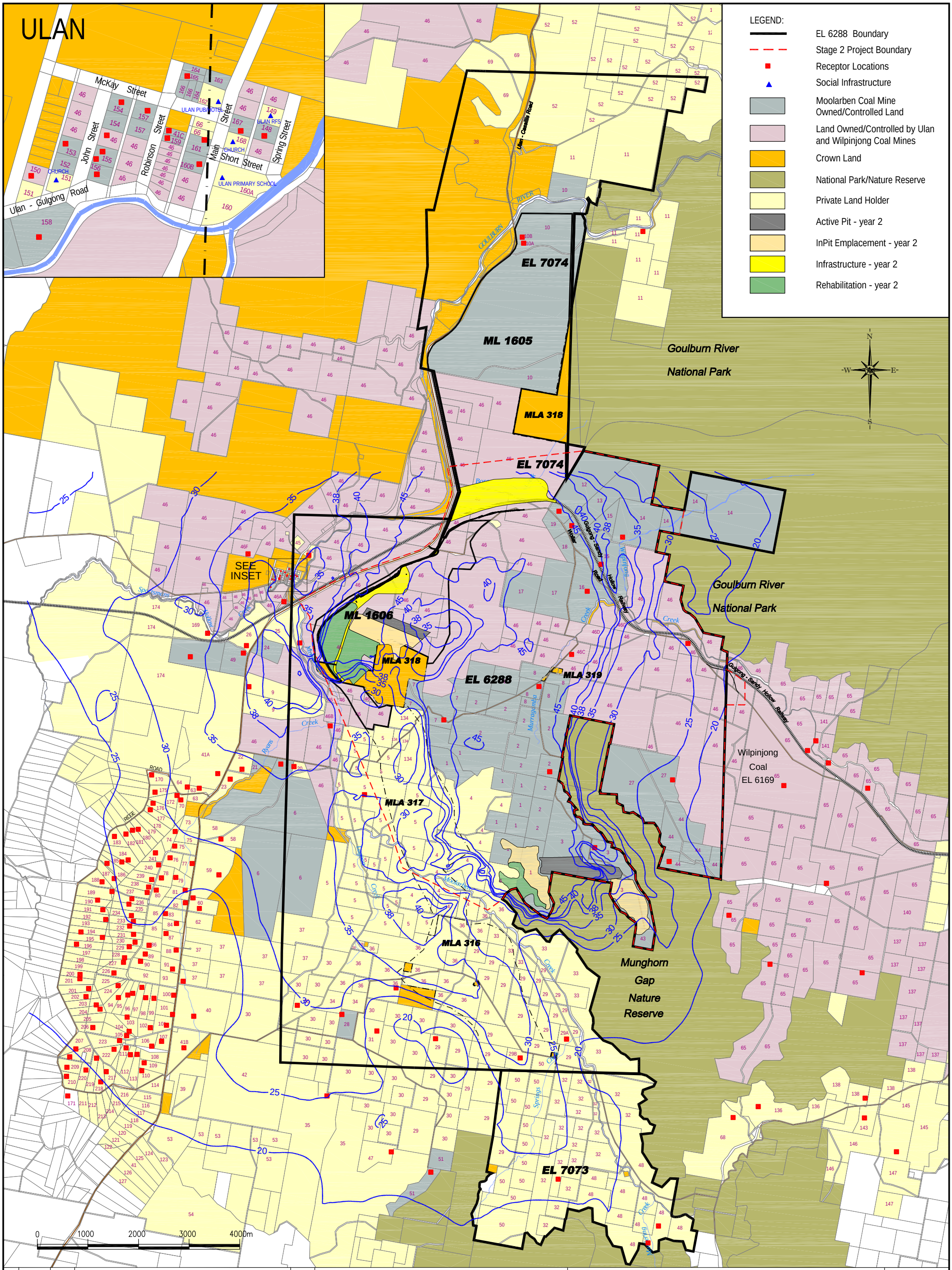
Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 2 Operational Noise Contours
LAeq(15minute) Temperature Inversion - Figure C1

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03270	C	28.08.08	NTS	CP	CS	JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 2 Operational Noise Contours
LAeq(15minute) ENE Wind - Figure C2

Date	Scale:	Drawn	Checked	Approved	Sheet Size
28.08.08	NTS	CP	CS	JB	A3

Drawing No. 03271

Revision No. C

ULAN

LEGEND:

- EL 6288 Boundary
- Stage 2 Project Boundary
- Receptor Locations
- Social Infrastructure
- Moolarben Coal Mine Owned/Controlled Land
- Land Owned/Controlled by Ulan and Wilpinjong Coal Mines
- Crown Land
- National Park/Nature Reserve
- Private Land Holder
- Active Pit - year 2
- InPit Emplacement - year 2
- Infrastructure - year 2
- Rehabilitation - year 2

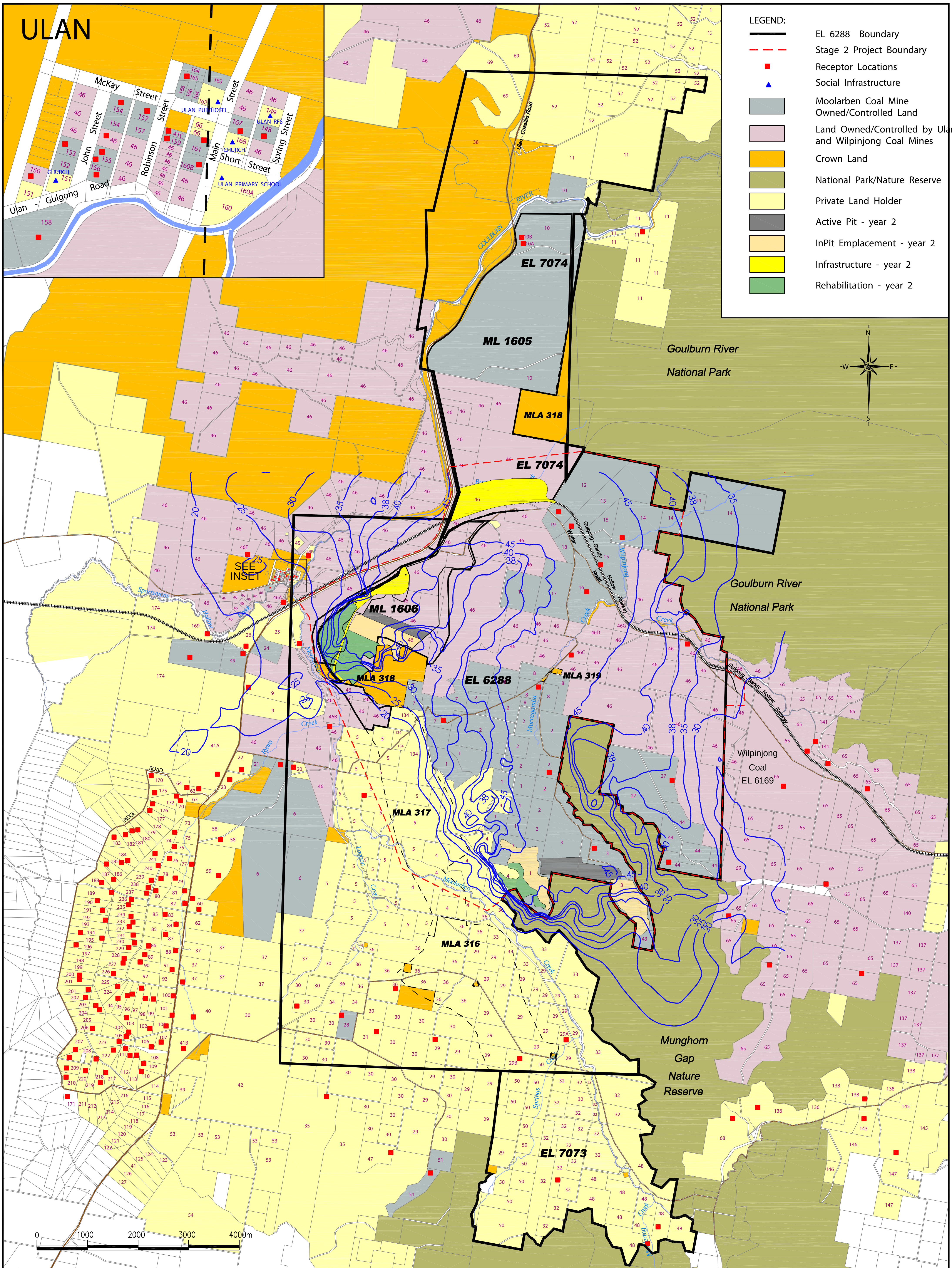
EL 7074
ML 1605
MLA 318
EL 7074
ML 1606
MLA 318
EL 6288
MLA 319
MLA 317
MLA 316
EL 7073
SEE INSET
Goulburn River National Park
Goulburn River National Park
Munghorn Gap Nature Reserve
Wilpinjong Coal EL 6169
Ulan - Gulgong Road
McKay Street
John Street
Robinson Street
Main Street
Short Street
Spring Street
ULAN PUB/MOTEL
ULAN RFS
CHURCH
CHURCH
ULAN PRIMARY SCHOOL
Ulan - Cassilis Road
GOULBURN RIVER
Sportsmans Creek
Byrans Creek
Murragamba Creek
Leadville Creek
Moolarben Creek
Springs Creek
Wollar Gulgong Sandy Hollow Railway
Wollar Gulgong Sandy Hollow Railway
RIDGE ROAD
N
S
W
E
0 1000 2000 3000 4000m

REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited
Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 2 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - Figure C3

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03272	C	28.08.08	NTS	CP	CS	JB	A3



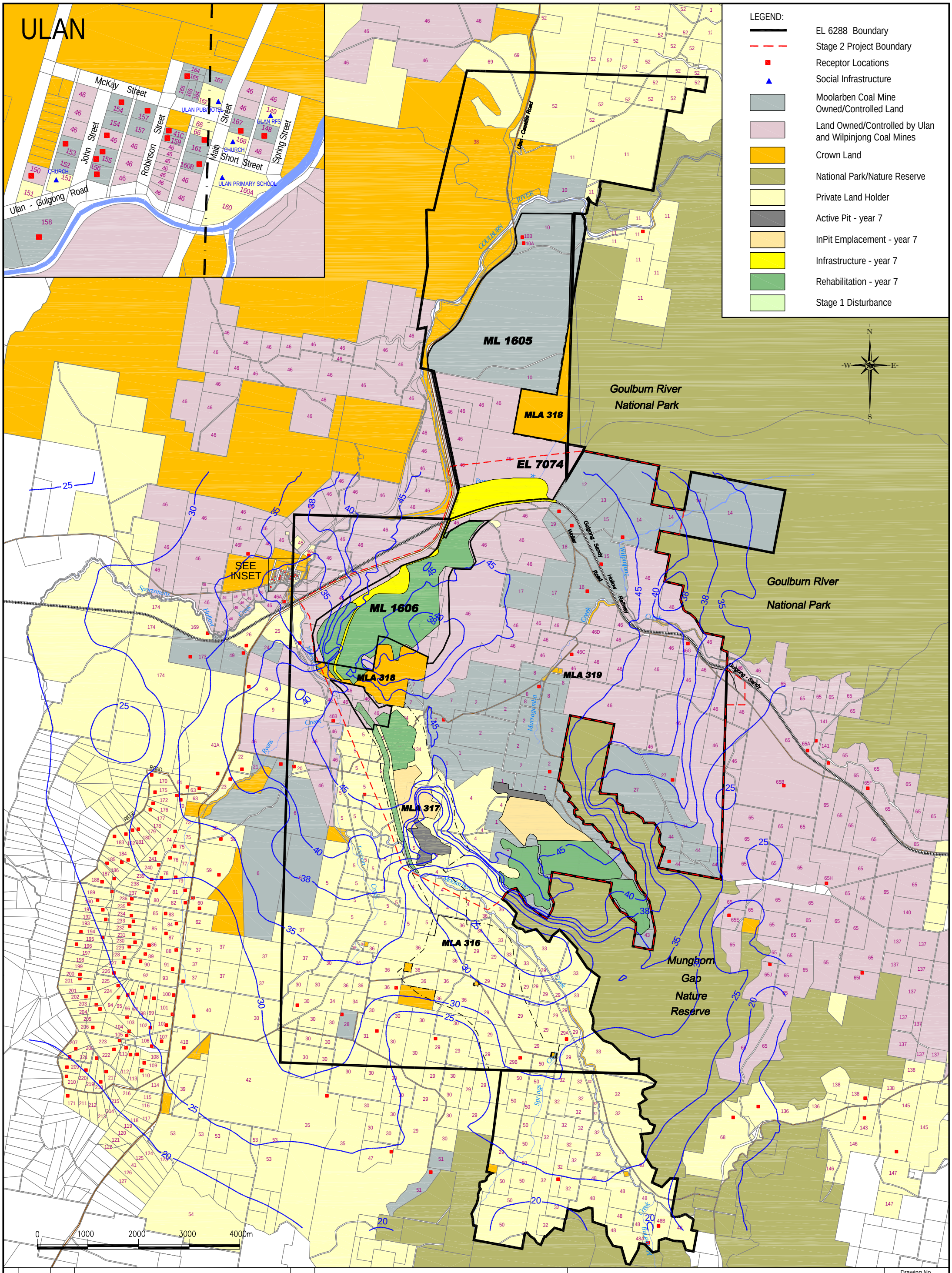
REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 2 Operational Noise Contours
LAeq(15minute) SW Wind - Figure C4

Date	Scale:	Drawn	Checked	Approved	Drawing No.	Revision No.	Sheet Size
28.08.08	NTS	CP	CS	JB	03273	C	A3



REVISIONS

DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

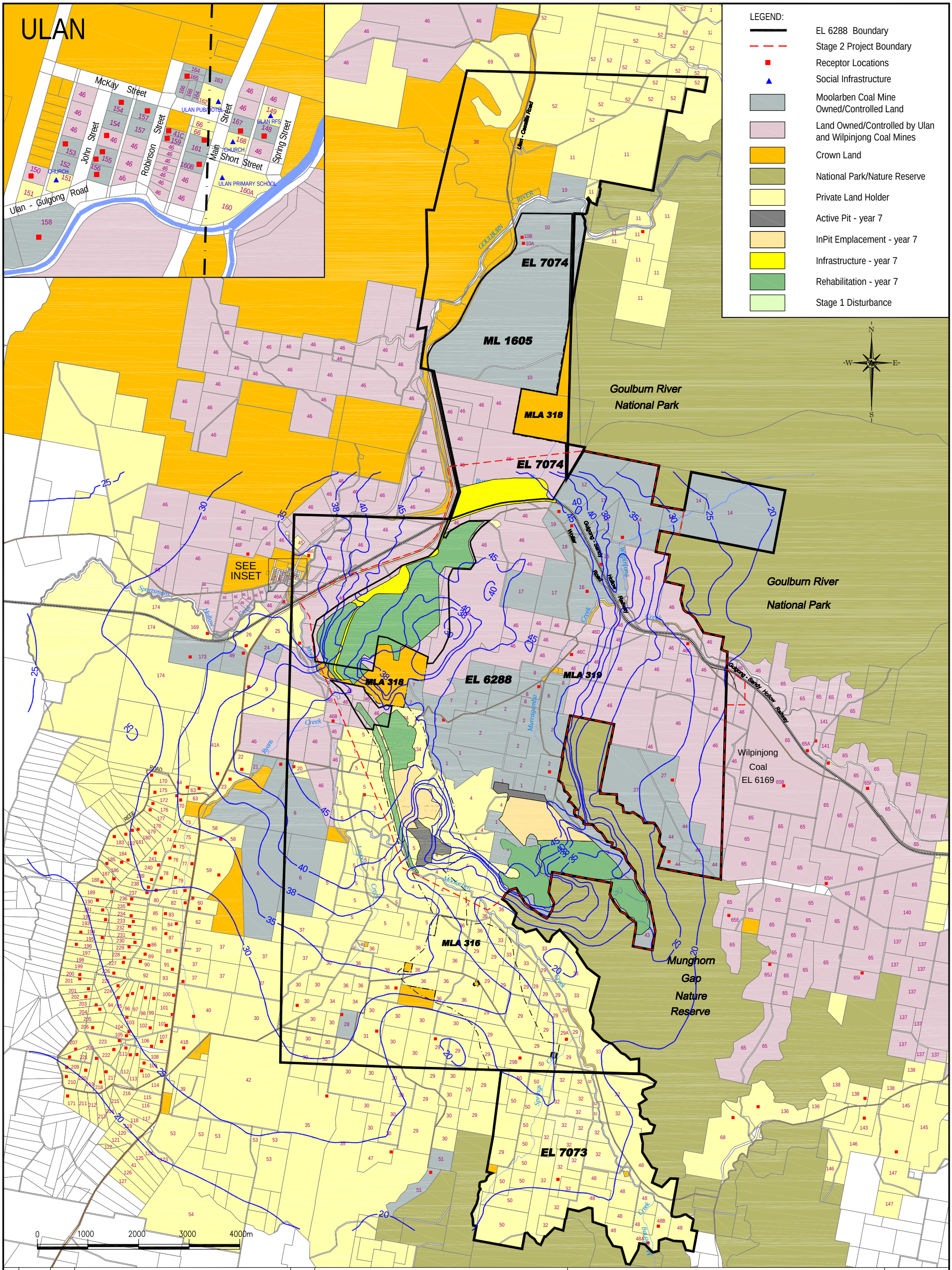
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 7 Operational Noise Contours
LAeq(15minute) Temperature Inversion - C5

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3

Drawing No. 03274

Revision No. D



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street North Sydney NSW 2060

Phone: 02 9922 3777 Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

D

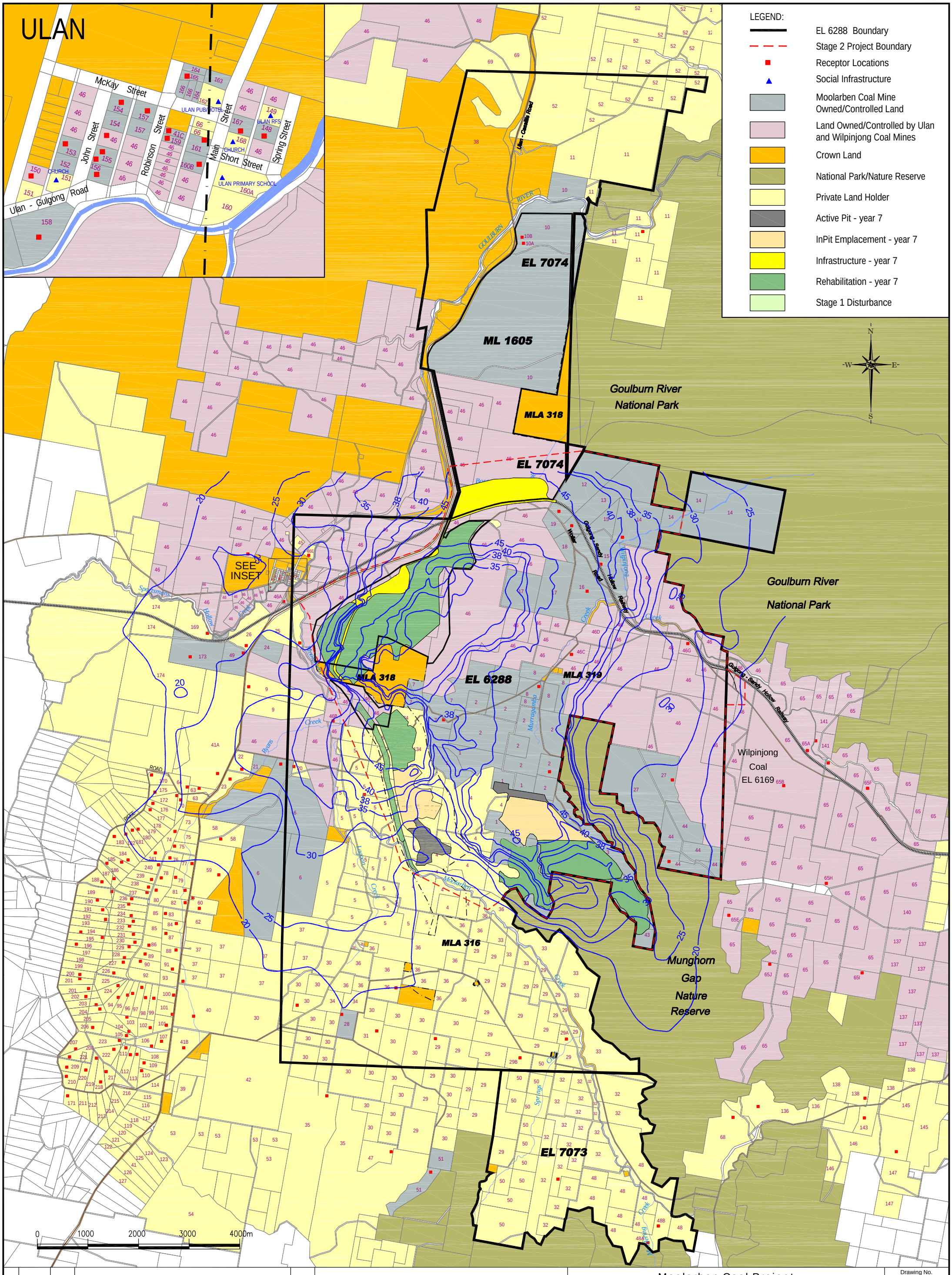
Year 7 Operational Noise Contours

LAeq(15minute) ENE Wind - C6

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3

Drawing No. 03275

Revision No. C



REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 7 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - C7

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3

Drawing No. 03276

Revision No. D

ULAN

LEGEND:

- EL 6288 Boundary
- Stage 2 Project Boundary
- Receptor Locations
- Social Infrastructure
- Moolarben Coal Mine Owned/Controlled Land
- Land Owned/Controlled by Ulan and Wilpinjong Coal Mines
- Crown Land
- National Park/Nature Reserve
- Private Land Holder
- Active Pit - year 7
- InPit Emplacement - year 7
- Infrastructure - year 7
- Rehabilitation - year 7
- Stage 1 Disturbance

EL 7074
ML 1605
MLA 318
EL 7074
SEE INSET
MLA 318
EL 6288
MLA 319
MLA 316
EL 7073
Goulburn River National Park
Goulburn River National Park
Munghorn Gap Nature Reserve
Wilpinjong Coal EL 6169
Ulan - Gulgong Road
Ulan - Cassilis Road
Gulgong - Sandy Hollow Railway
McKay Street
John Street
Robinson Street
Main Street
Short Street
Spring Street
ULAN PUB/HOTEL
ULAN RFS
CHURCH
ULAN PRIMARY SCHOOL
RIVER
COULBURN
Sportsmans Creek
Hollow Creek
Byrnes Creek
Murragamba Creek
Moolarben Creek
Wilpinjong Creek
Springs Creek
RIDGE ROAD
N
S
E
W
0 1000 2000 3000 4000m

REVISIONS			
DATE	BY	DESCRIPTION	CHK.

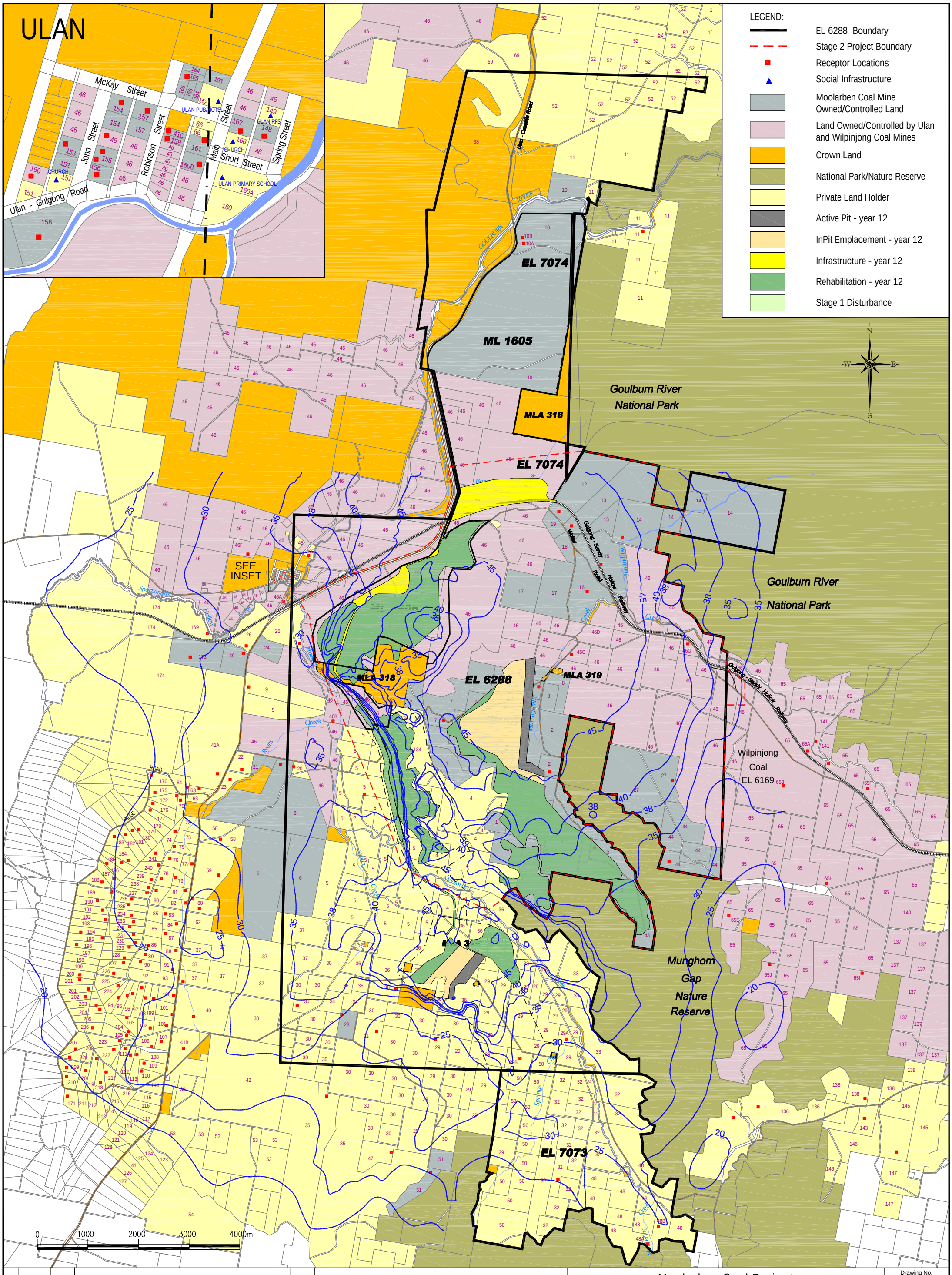
Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 7 Operational Noise Contours
LAeq(15minute) SW Wind - C8

Drawing No.	Revision No.
03277	D

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3



REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

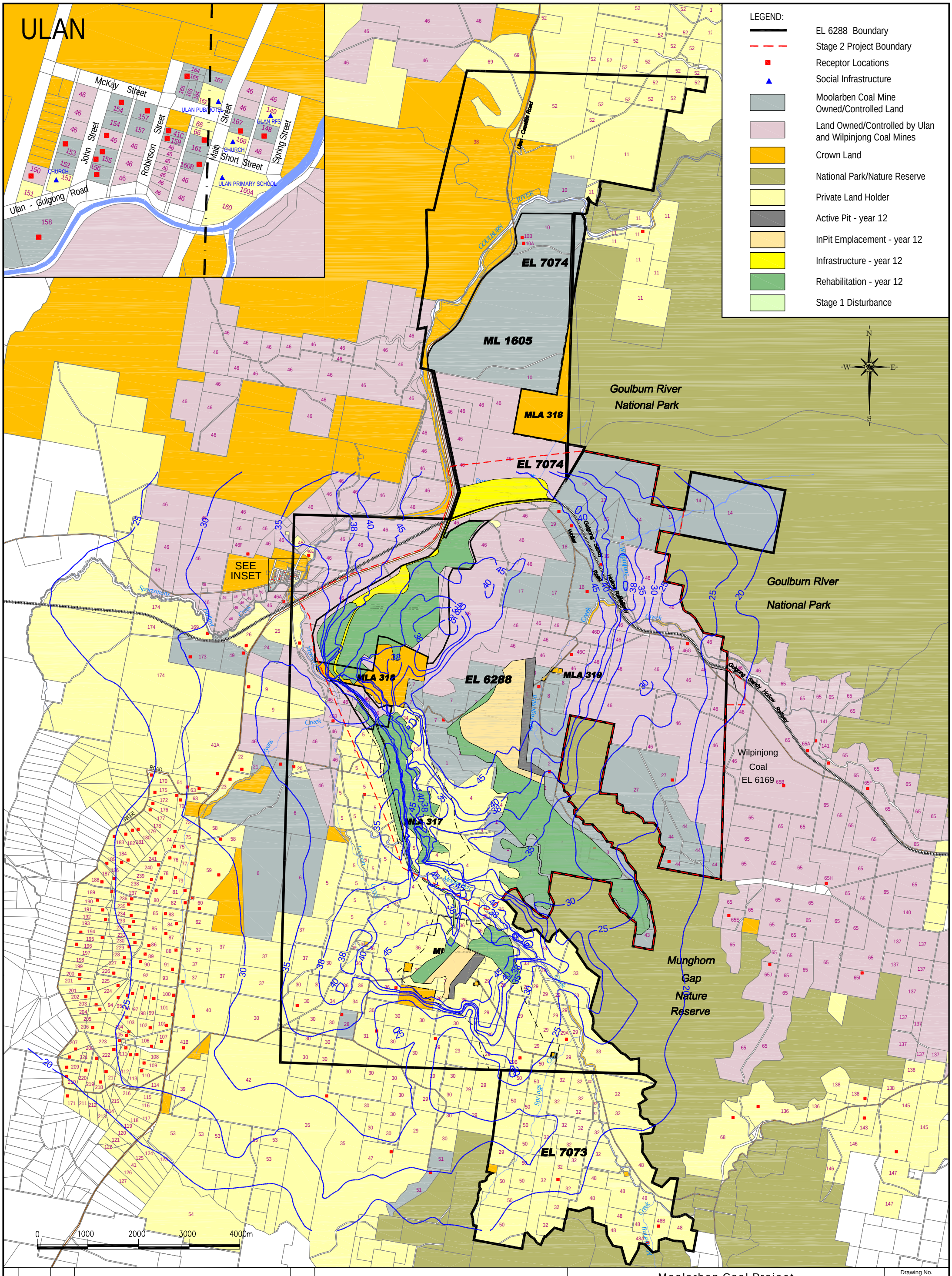
Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 12 Operational Noise Contours
LAeq(15minute) Temperature Inversion - C9

Drawing No.	Revision No.
03278	D

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

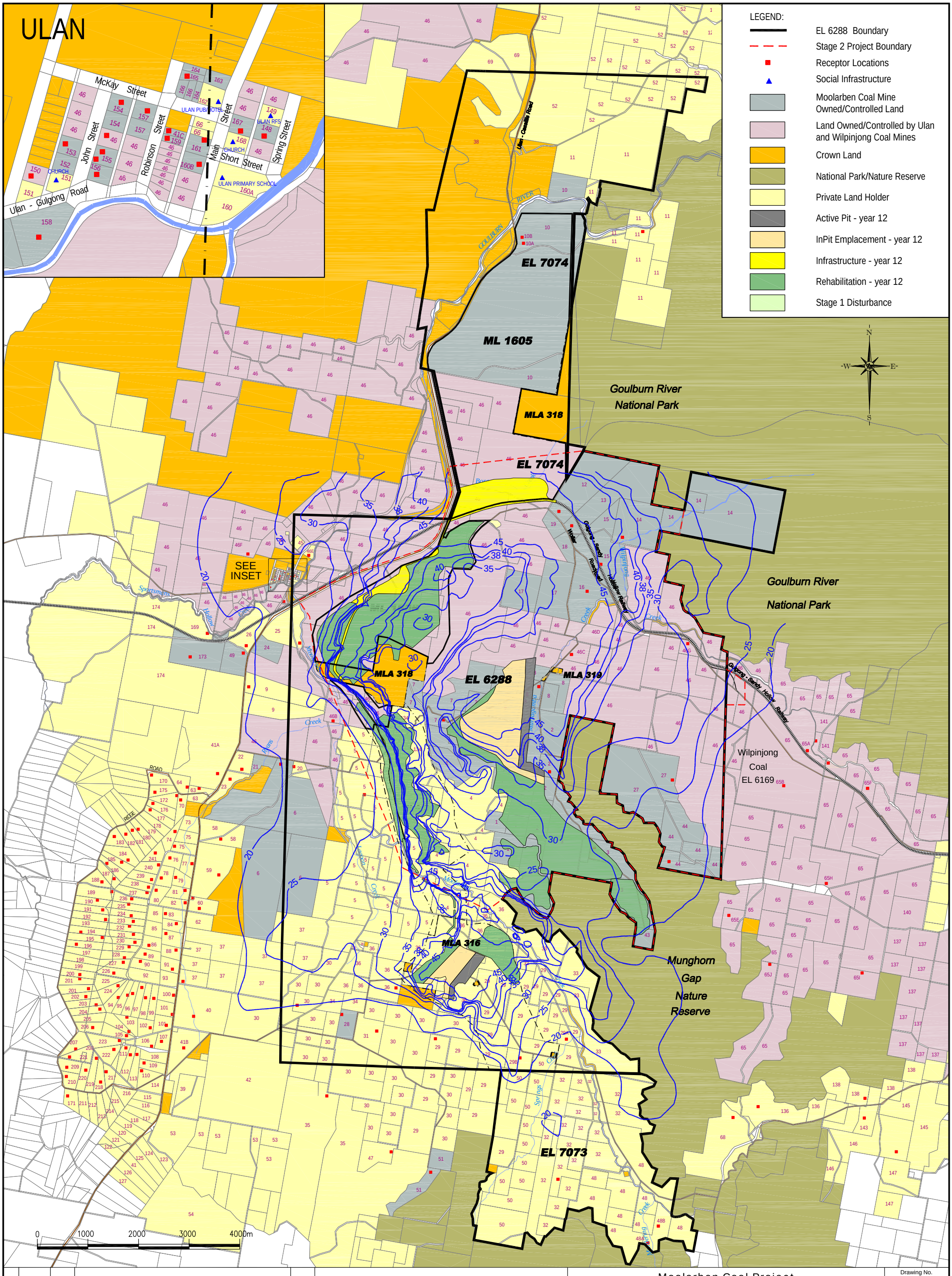
Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 12 Operational Noise Contours
LAeq(15minute) ENE Wind - C10

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03279	D	15.10.08	NTS	CP	CS	JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

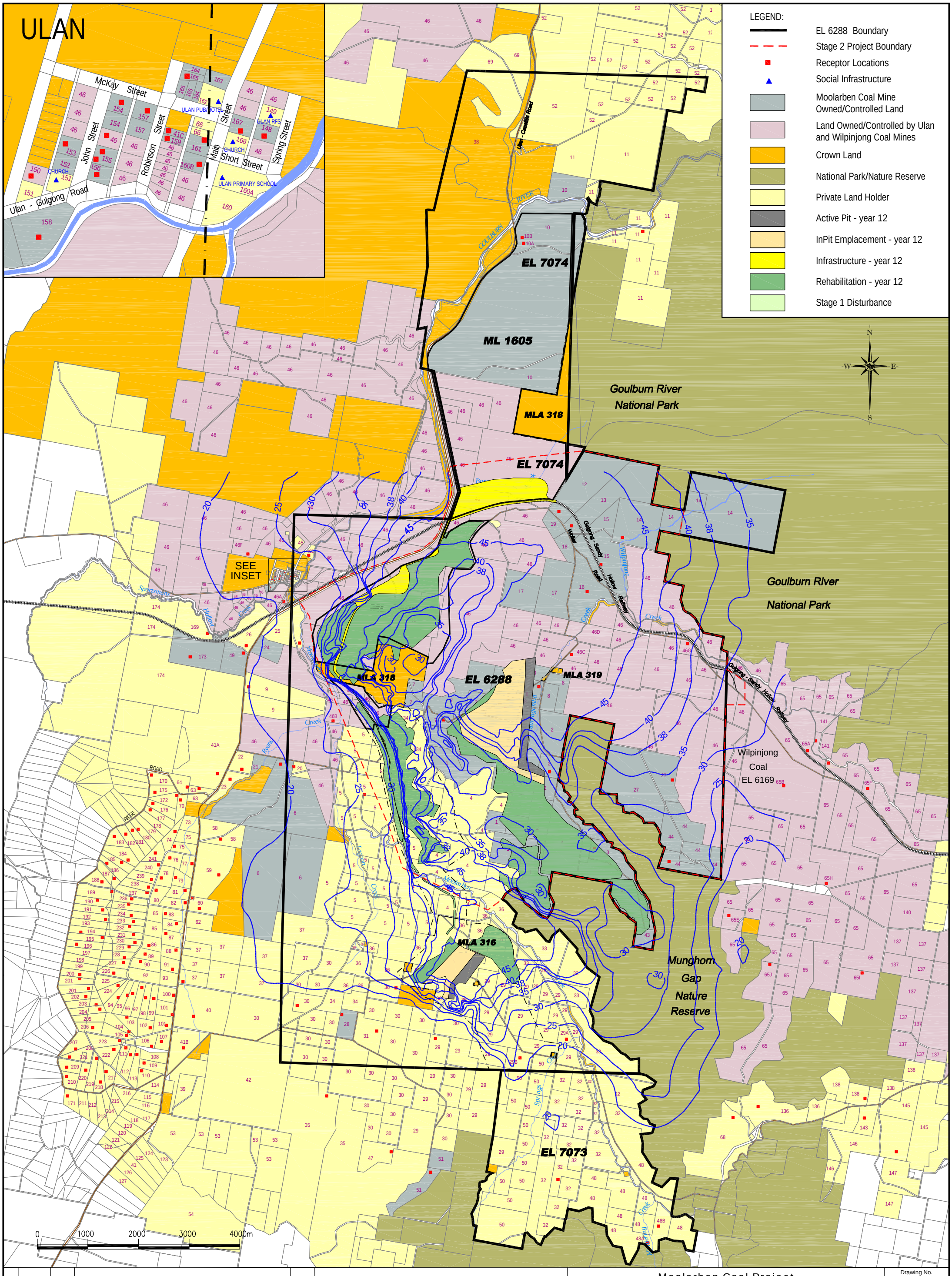
Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 12 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - C11

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03280	D	15.10.08	NTS	CP	CS	JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

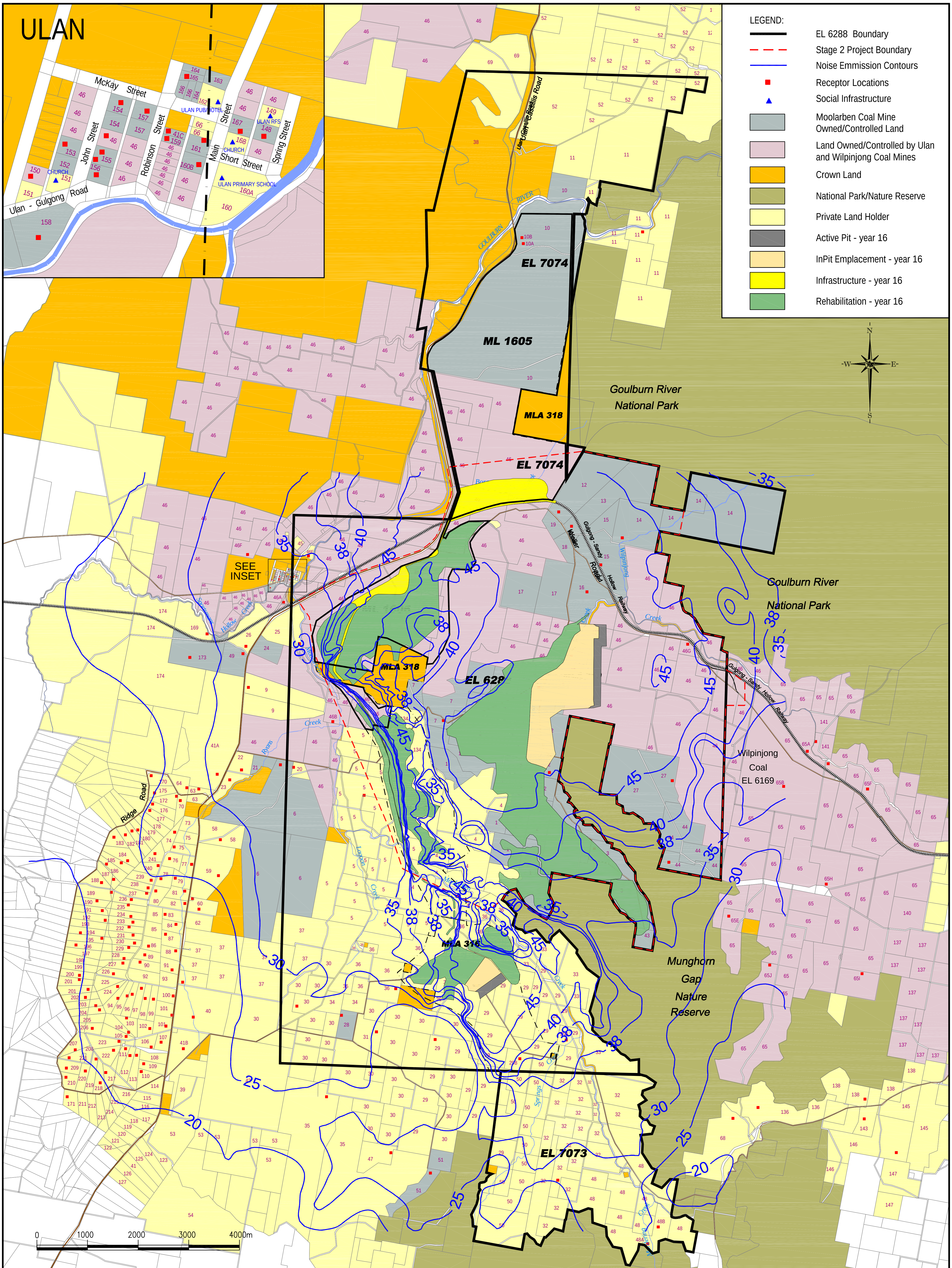
Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 12 Operational Noise Contours
LAeq(15minute) SW Wind - C12

Drawing No.	Revision No.
03281	D

Date	Scale:	Drawn	Checked	Approved	Sheet Size
15.10.08	NTS	CP	CS	JB	A3



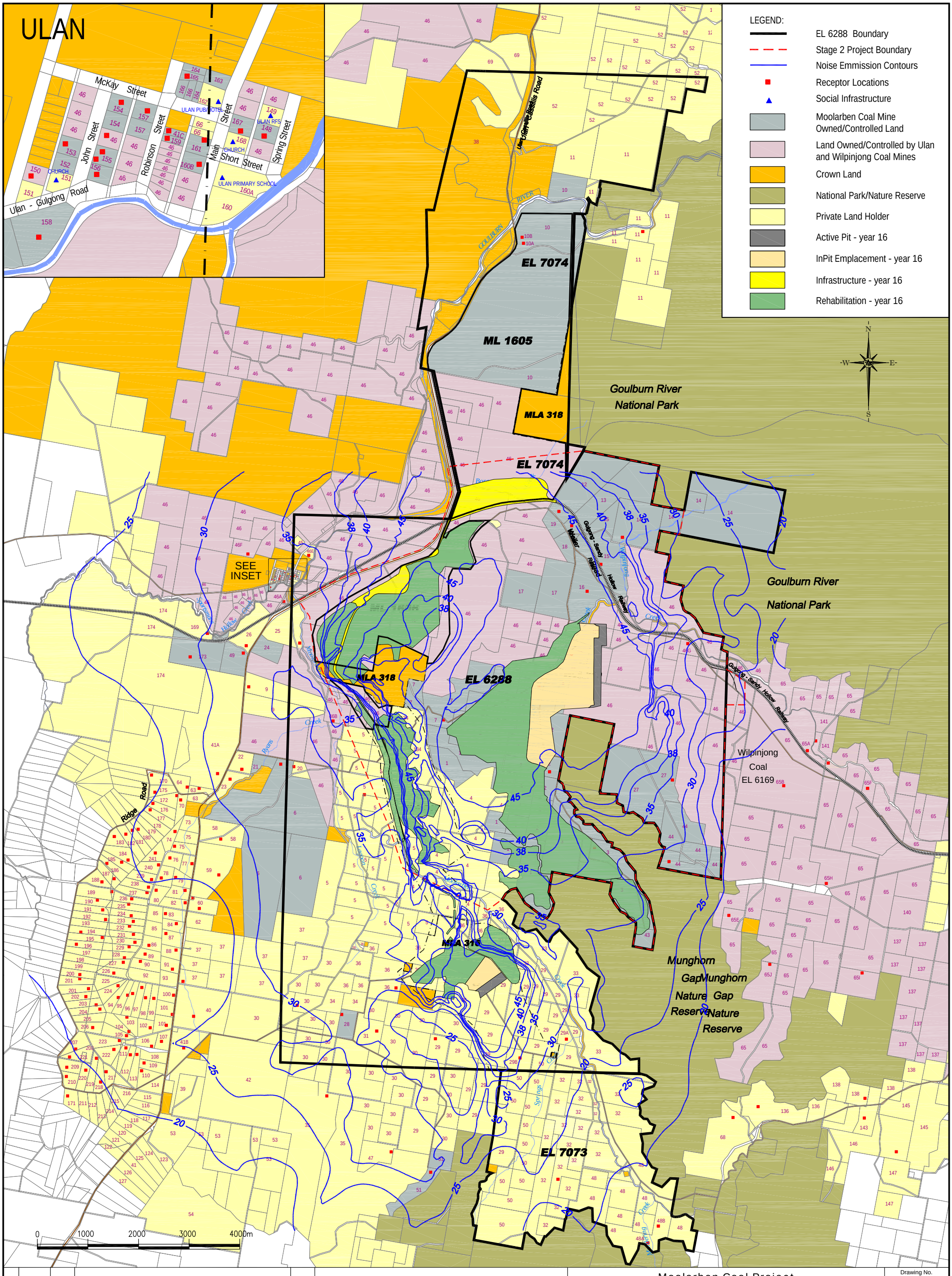
REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 16 Operational Noise Contours
LAeq(15minute) Temperature Inversion - Figure C13

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03282	F	22.12.08	NTS	CS		JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

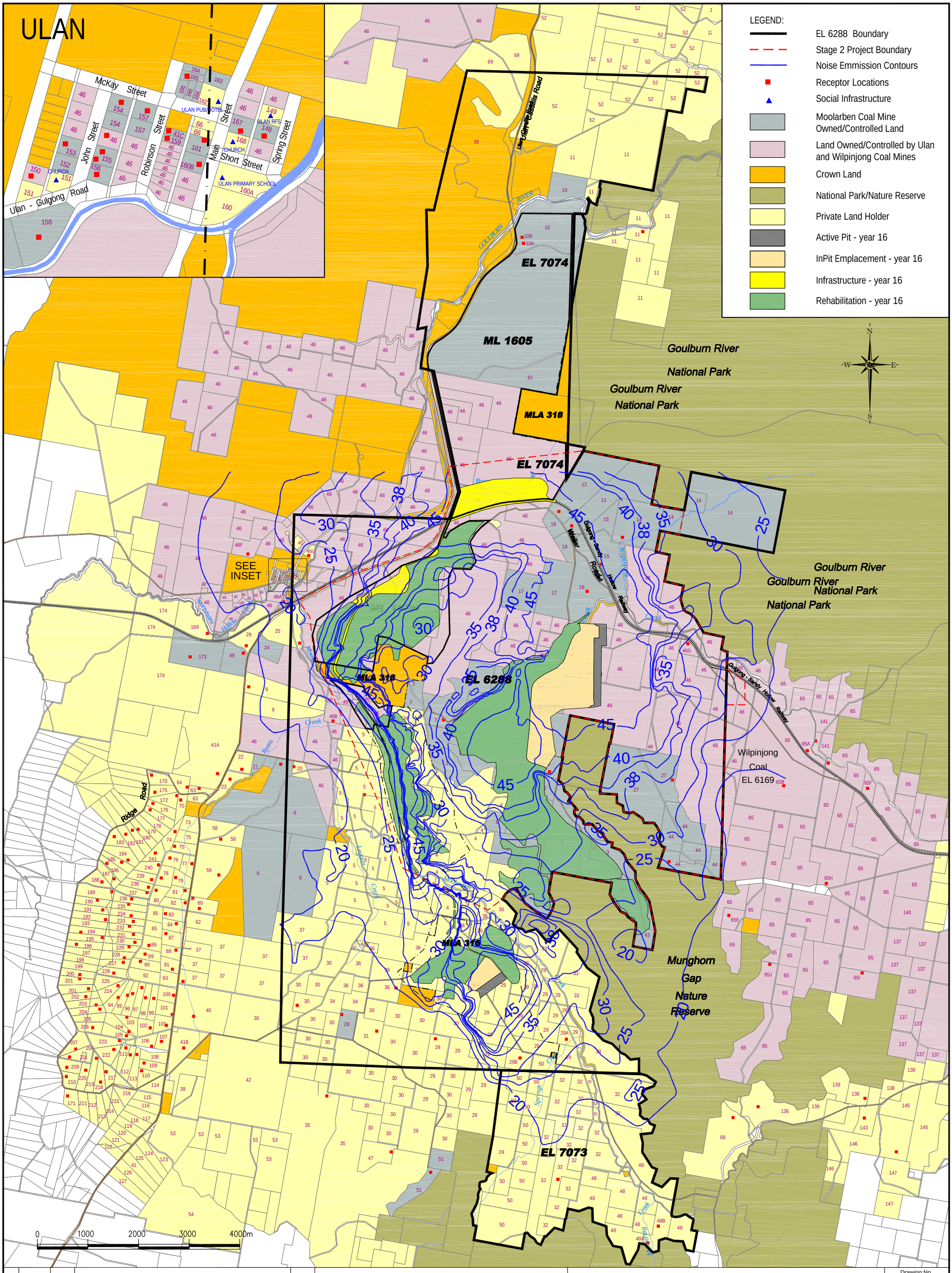
Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 16 Operational Noise Contours
LAeq(15minute) ENE Wind - Figure C14

Drawing No.	Revision No.
03283	F

Date	Scale:	Drawn	Checked	Approved	Sheet Size
22.12.08	NTS	CS		JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

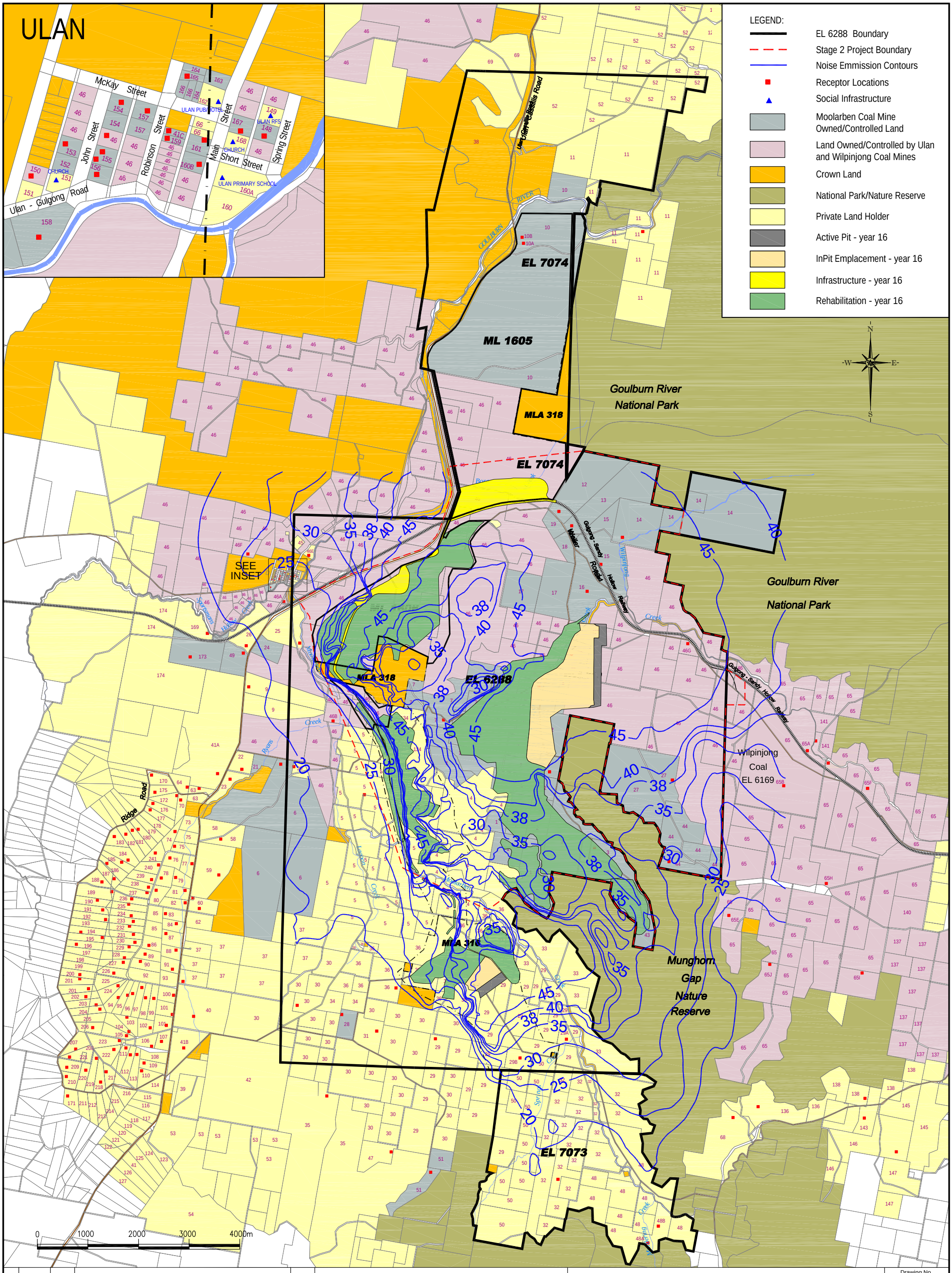
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 16 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - Figure C15

Date	Scale:	Drawn	Checked	Approved	Sheet Size
22.12.08	NTS	CS		JB	A3

Drawing No. 03284

Revision No. F



REVISIONS

DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

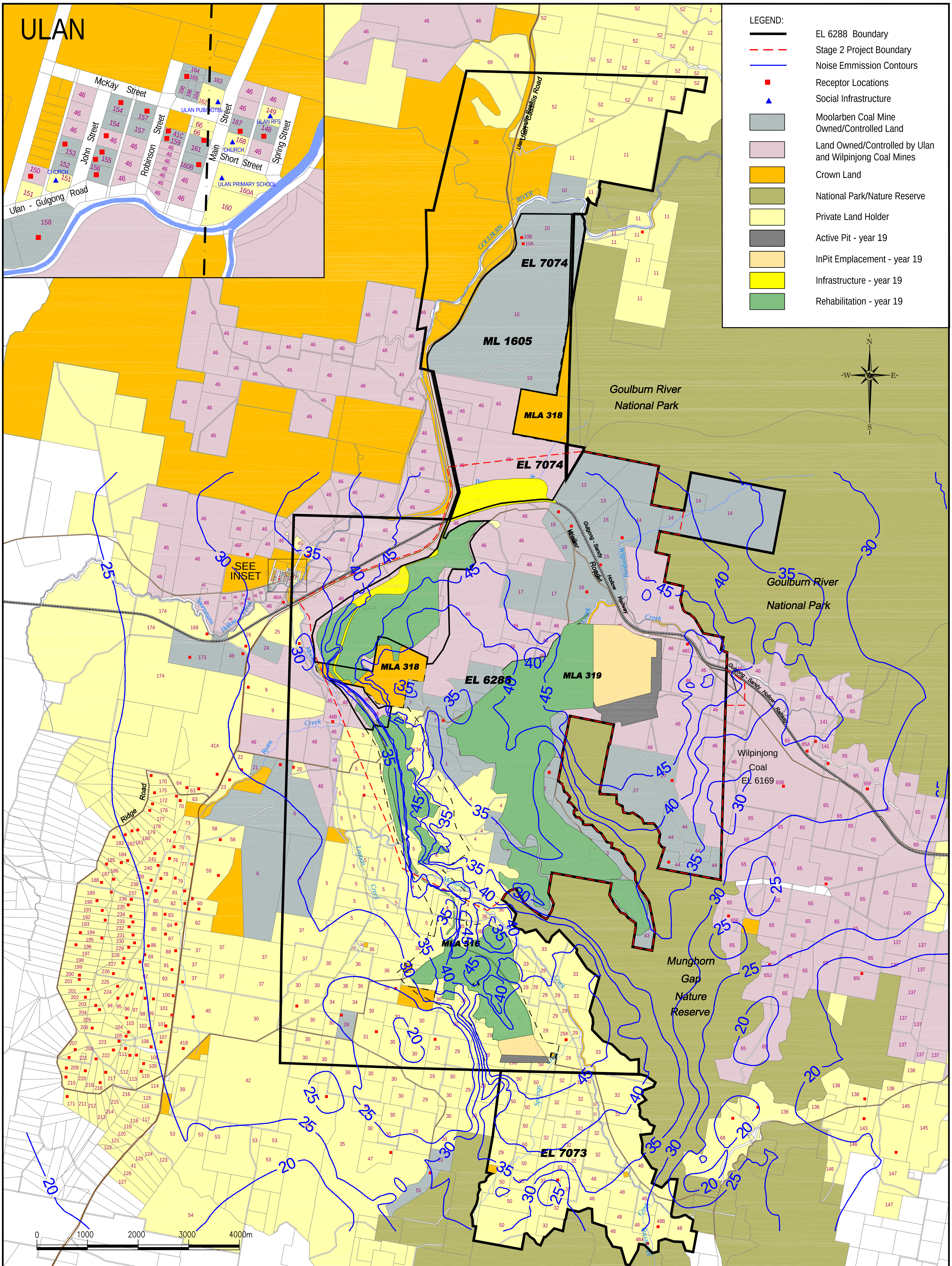
Level 14 213 Miller Street North Sydney NSW 2060

Phone: 02 9922 3777 Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 16 Operational Noise Contours
LAeq(15minute) SW Wind - Figure C16

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03285	F	22.12.08	NTS	CS		JB	A3



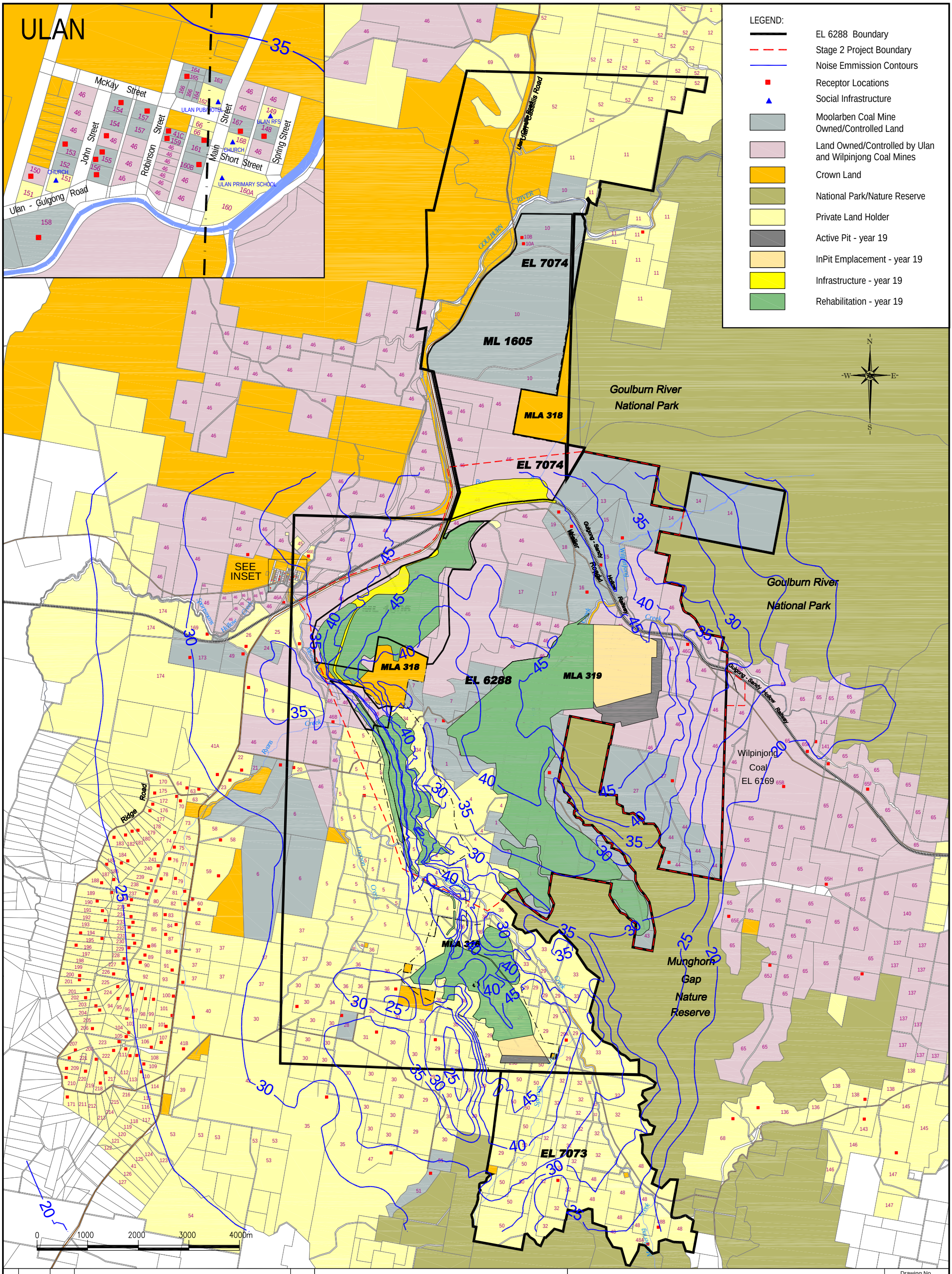
REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 19 Operational Noise Contours
LAeq(15minute) Temperature Inversion - Figure C17

Date	Scale:	Drawn	Checked	Approved	Sheet Size	Drawing No.	Revision No.
23.12.08	NTS	CS		JB	A3	03578	C



REVISIONS

DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

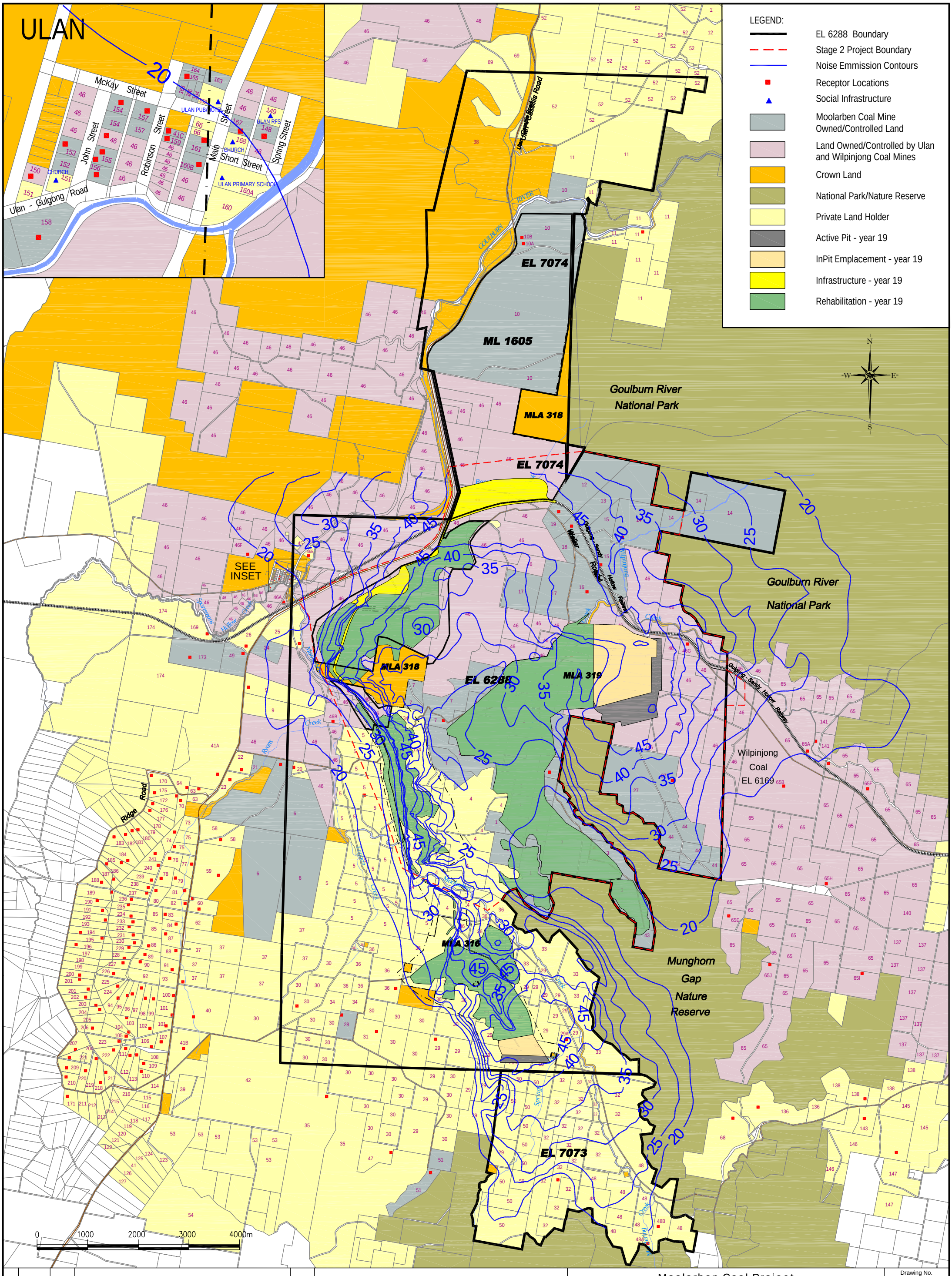
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 19 Operational Noise Contours
LAeq(15minute) ENE Wind - Figure C18

Date	Scale:	Drawn	Checked	Approved	Sheet Size
23.12.08	NTS	CS		JB	A3

Drawing No. 03579

Revision No. C



REVISIONS

DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

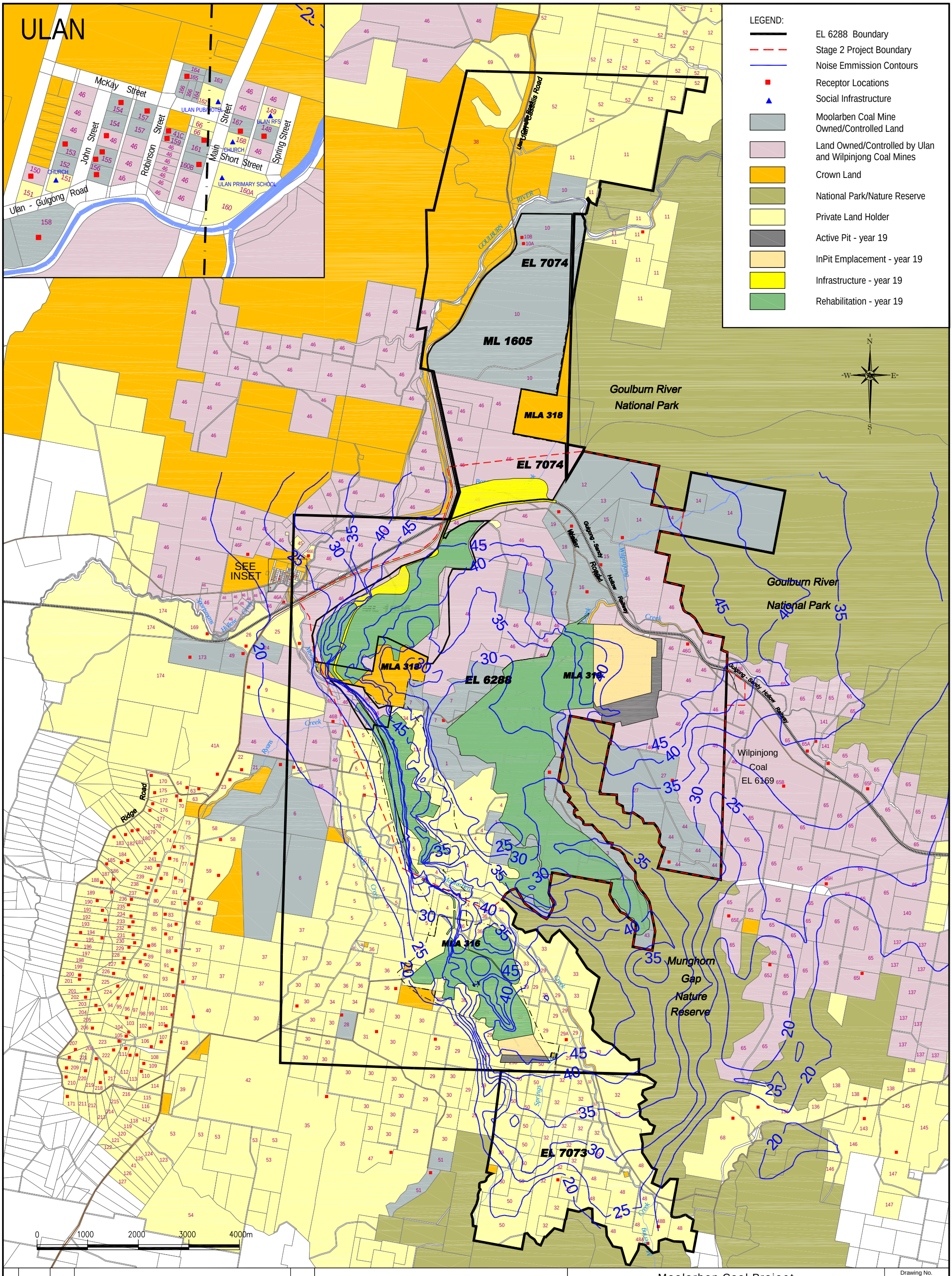
Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 19 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - Figure C19

Drawing No.	Revision No.
03580	C

Date	Scale:	Drawn	Checked	Approved	Sheet Size
23.12.08	NTS	CS		JB	A3



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

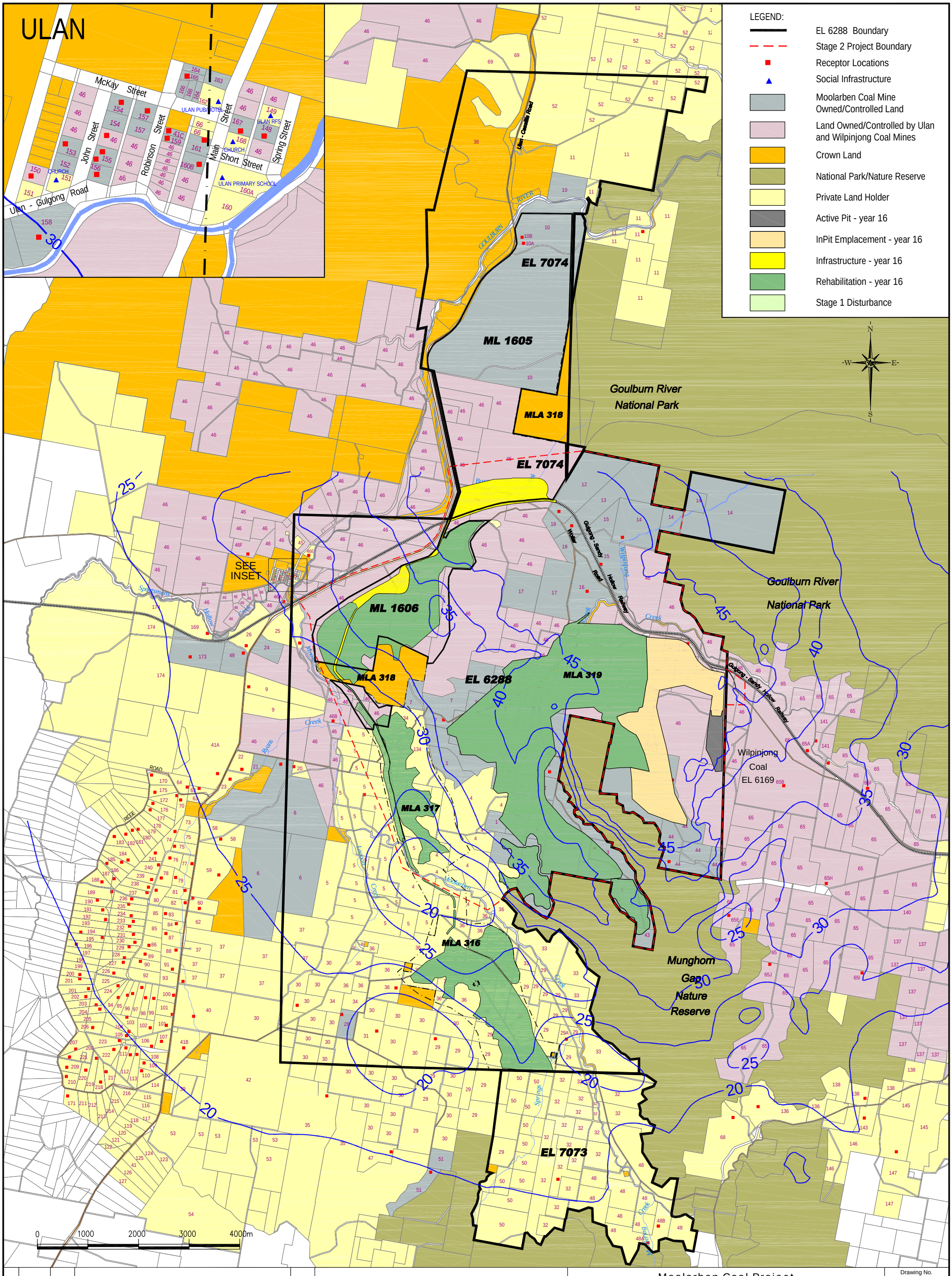
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 19 Operational Noise Contours
LAeq(15minute) SW Wind - Figure C20

Date	Scale:	Drawn	Checked	Approved	Sheet Size
23.12.08	NTS	CS		JB	A3

Drawing No. 03582

Revision No. C



REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 24 Operational Noise Contours
LAeq(15minute) Temperature Inversion - C21

Date	Scale:	Drawn	Checked	Approved	Sheet Size
03.12.08	NTS	CS		JB	A3

Drawing No. 03427

Revision No. A

ULAN

LEGEND:

- EL 6288 Boundary
- Stage 2 Project Boundary
- Receptor Locations
- Social Infrastructure
- Moolarben Coal Mine Owned/Controlled Land
- Land Owned/Controlled by Ulan and Wilpinjong Coal Mines
- Crown Land
- National Park/Nature Reserve
- Private Land Holder
- Active Pit - year 16
- InPit Emplacement - year 16
- Infrastructure - year 16
- Rehabilitation - year 16
- Stage 1 Disturbance

EL 7074
ML 1605
MLA 318
Goulburn River National Park
SEE INSET
ML 1606
MLA 319
EL 6288
MLA 317
MLA 316
Wilpinjong Coal EL 6169
Munghorn Gap Nature Reserve
EL 7073

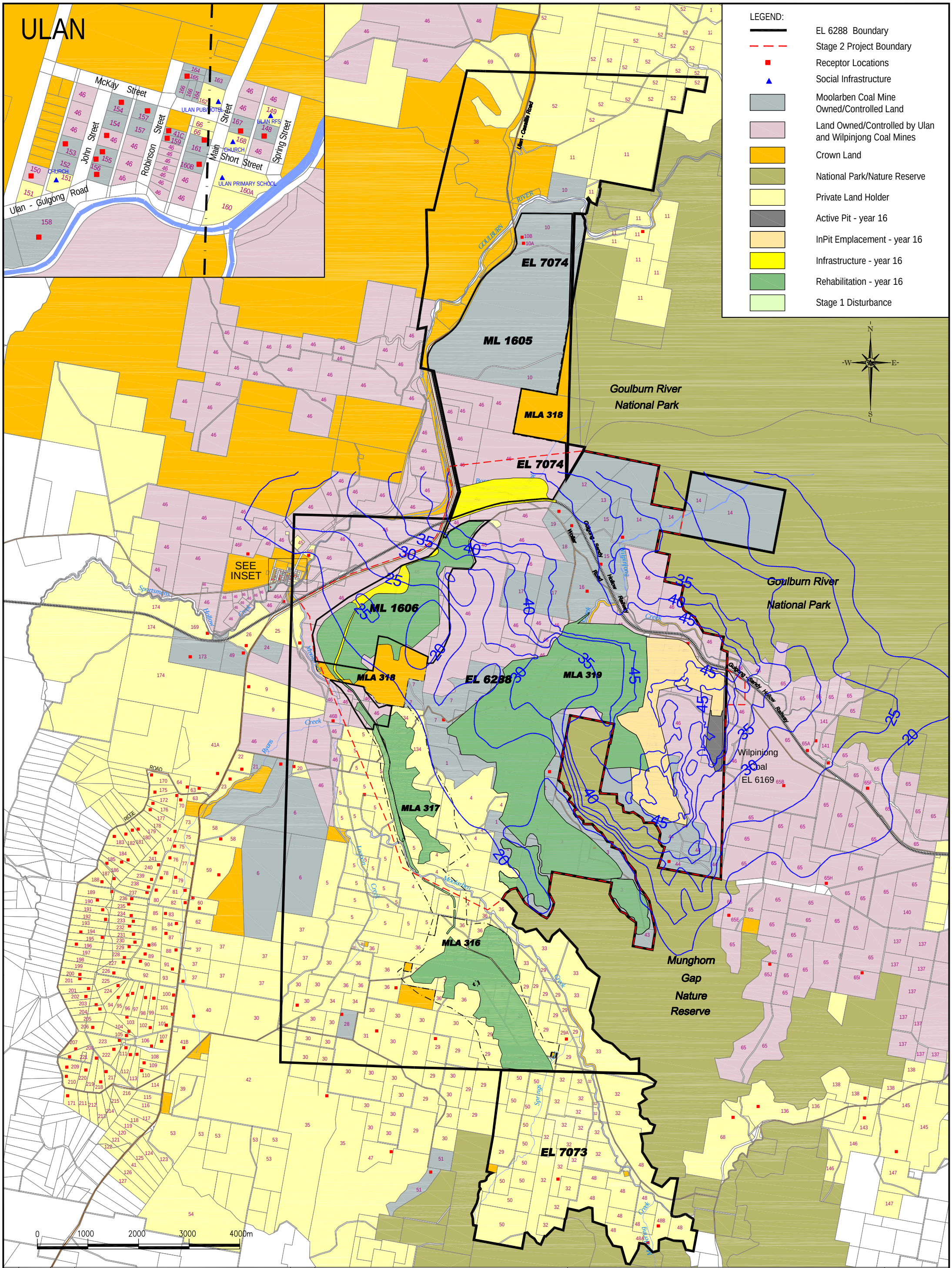
0 1000 2000 3000 4000m

REVISIONS				
DATE	BY	DESCRIPTION	CHK.	

Moolarben Coal Mines Pty Limited
Level 14 213 Miller Street Phone: 02 9922 3777
North Sydney NSW 2060 Fax: 02 9923 2427
Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 24 Operational Noise Contours
LAeq(15minute) ENE Wind - C22

Drawing No.	Revision No.	Date	Scale:	Drawn	Checked	Approved	Sheet Size
03409	A	13.11.08	NTS	JD	CS	JB	A3



REVISIONS

DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060

Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 24 Operational Noise Contours
LAeq(15minute) Neutral Atmosphere - C23

Date	Scale:	Drawn	Checked	Approved	Sheet Size
13.11.08	NTS	JD	CS	JB	A3

Drawing No. 03426

Revision No. A

ULAN

LEGEND:

- EL 6288 Boundary
- Stage 2 Project Boundary
- Receptor Locations
- Social Infrastructure
- Moolarben Coal Mine Owned/Controlled Land
- Land Owned/Controlled by Ulan and Wilpinjong Coal Mines
- Crown Land
- National Park/Nature Reserve
- Private Land Holder
- Active Pit - year 16
- InPit Emplacement - year 16
- Infrastructure - year 16
- Rehabilitation - year 16
- Stage 1 Disturbance

EL 7074
ML 1605
MLA 318
Goulburn River National Park
EL 7074
ML 1606
MLA 318
EL 6288
MLA 319
MLA 317
MLA 316
Munghorn Gap Nature Reserve
EL 7073
Wilpinjong Coal EL 6169
SEE INSET

0 1000 2000 3000 4000m

REVISIONS			
DATE	BY	DESCRIPTION	CHK.

Moolarben Coal Mines Pty Limited

Level 14 213 Miller Street
North Sydney NSW 2060
Phone: 02 9922 3777
Fax: 02 9923 2427

Prepared by Pegasus Technical Ph: 02 65 718888

Moolarben Coal Project
Year 24 Operational Noise Contours
LAeq(15minute) SW Wind - C24

Date	Scale:	Drawn	Checked	Approved	Sheet Size
03.12.08	NTS	CS		JB	A3

Drawing No. 03428
Revision No. A