BENGALLA Mining Company

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Acoustic Impact Assessment

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BENGALLA MINING COMPANY PTY LTD

ACOUSTIC IMPACT ASSESSMENT

BENGALLA CONTINUATION OF MINING PROJECT ENVIRONMENTAL IMPACT STATEMENT

REPORT J0130-40-R2
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GLOSSARY

The following acoustical terms are used in this report:

Sound Pressure	Small air pressure variations above and below normal atmospheric pressure that are perceived by human ears as sound.
Sound Power	Sound energy emitted by a source, measured in watts (W) or expressed on a decibel scale with 0 dB representing 1 picowatt (1 pW) of sound power. While both sound pressure (in pascals) and sound power (in watts) can be expressed on a decibel scale, they are not interchangeable or directly comparable. Sound power levels are most commonly expressed as unweighted decibels (dBL), particularly when referring to sound power levels in frequency bands, but can be expressed as A-weighted decibels (dBA).
Frequency	The rate of sound pressure or sound power fluctuations per second, expressed as cycles per second or hertz (Hz). Human ears in good condition can typically detect sound pressure in the frequency range 20 Hz to 20,000 Hz (20 kHz), depending on the sound level.
Decibels, dB	A noise level unit based on a logarithmic scale of Pascals of sound pressure above and below atmospheric pressure, or watts of sound power. Expressing a sound level in decibels implies root-mean-squared (RMS) unless explicitly stated otherwise. Human ears in good condition can typically detect sound pressures from the threshold of perception at 0 dB (20 uPa) to the approximate threshold of pain at 140 dB (200 Pa). An increase of 10 dB is perceived as an approximate doubling of sound level by an average human ear.
dBL	Linear decibels, the same as dB but used to explicitly define a decibel scale in the absence of any weighting within the audible range.
dBA	A-weighted decibels, where the A weighting means frequencies below 500Hz and above 10kHz are artificially reduced to approximate the frequency response of an average human ear. Most sound monitoring instruments include an A-weighting option, enabling direct measurement of noise levels in dBA.
LA90	The A-weighted noise level exceeded 90% of the time (which can be thought of as the quietest 10% of the time) over a defined measurement period, usually 15 minutes or one hour, and widely accepted as the background noise level.
LAeq	The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location.

1 INTRODUCTION

Bridges Acoustics was commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Bengalla Mining Company Pty Limited (BMC) to complete an Acoustics Impact Assessment for the Bengalla Continuation of Mining Project (the Project). The purpose of this assessment is to form part of an Environmental Impact Statement (EIS) being prepared by Hansen Bailey to support an application for a State Significant Development Consent under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the continuation of open cut coal mining largely within current mining authorities for a further 24 years.

The assessment includes the following components:

- A desktop review of background noise monitoring data collected at representative receiver locations;
- Assessment of prevailing weather conditions that may affect noise propagation to receivers in the vicinity of the Project, based on data from Bengalla's weather station and temperature inversion monitoring tower;
- Development of a software-based noise model of the Project to predict received noise levels during representative operating years;
- Assessment of environmental noise levels associated with proposed construction work to potentially affected receivers;
- Assessment of noise from road and rail traffic associated with the Project;
- Assessment of blasting noise and vibration levels;
- Assessment of the potential for sleep disturbance to nearest receivers;
- Recommendation of feasible and reasonable noise and vibration mitigation and management measures where appropriate, and assessment of the effectiveness of recommended measures; and
- Identification of receivers that may remain affected by noise or vibration from the Project after all feasible and reasonable measures have been implemented, and the magnitude and extent of remaining impacts.

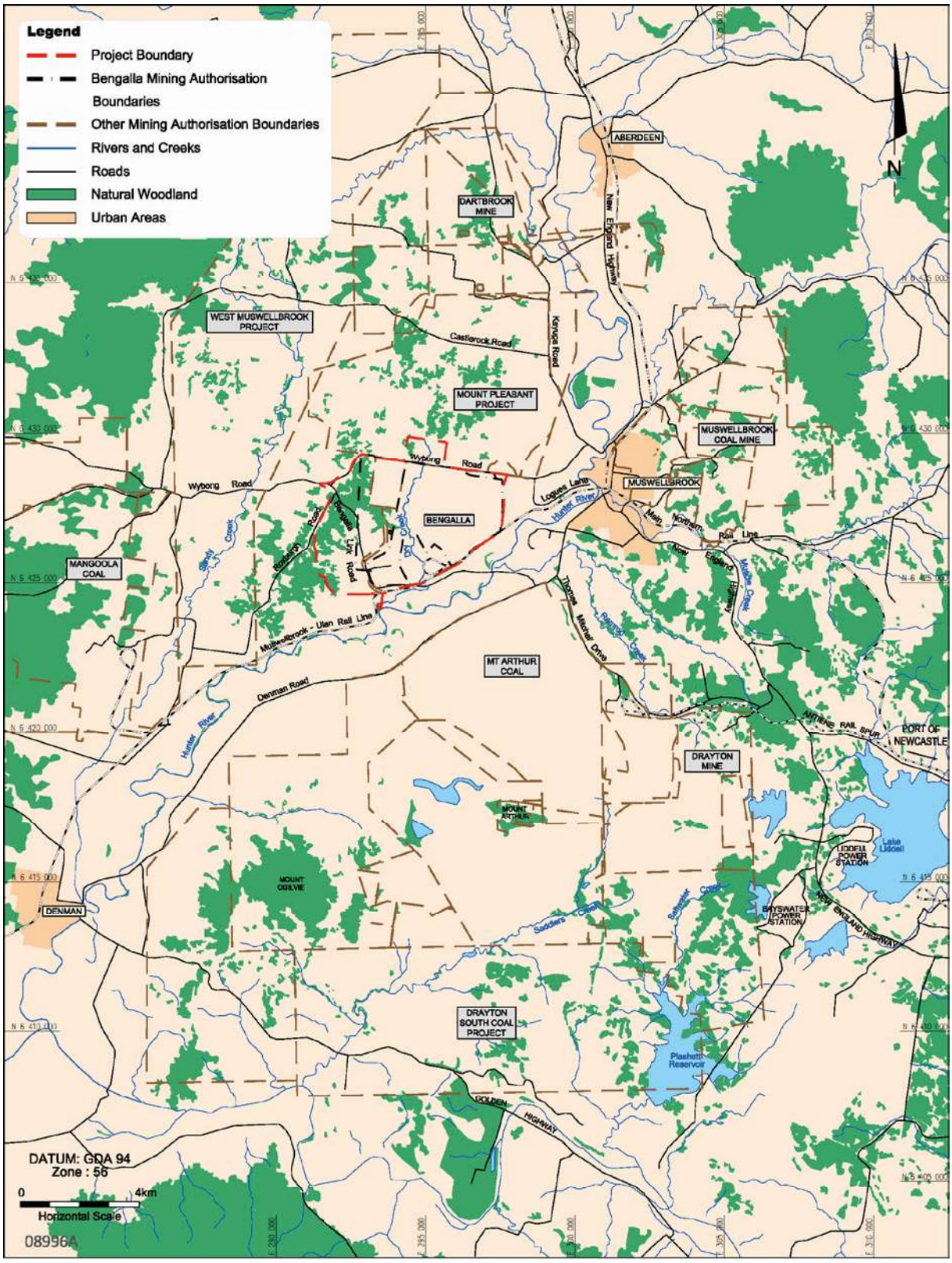
1.1 Background

BMC operates Bengalla Mine (Bengalla) located in the Upper Hunter Valley of NSW, approximately 130 km north-west of Newcastle and 4 km west of Muswellbrook. Bengalla is an open cut, strip-mining operation where mining advances generally to the west based on dragline strips approximately 60 m in width. Pre-stripped overburden is removed by loader and/or excavator and trucks, in advance of the dragline operation and subsequent coaling. Mining is conducted by an equipment fleet consisting of a dragline, loading units, trucks, various other ancillary equipment and approximately 440 full time employees.

BMC was initially granted DA 211/93 for Bengalla under the EP&A Act for the '*Construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and associated facilities'* on 7 August 1995.

Figure 1 illustrates the regional locality of the Project in relation to the nearest town centres and other coal mines, while the Project Application Boundary (Project Boundary) is shown in Figure 2.

Figure 1: Regional Locality.

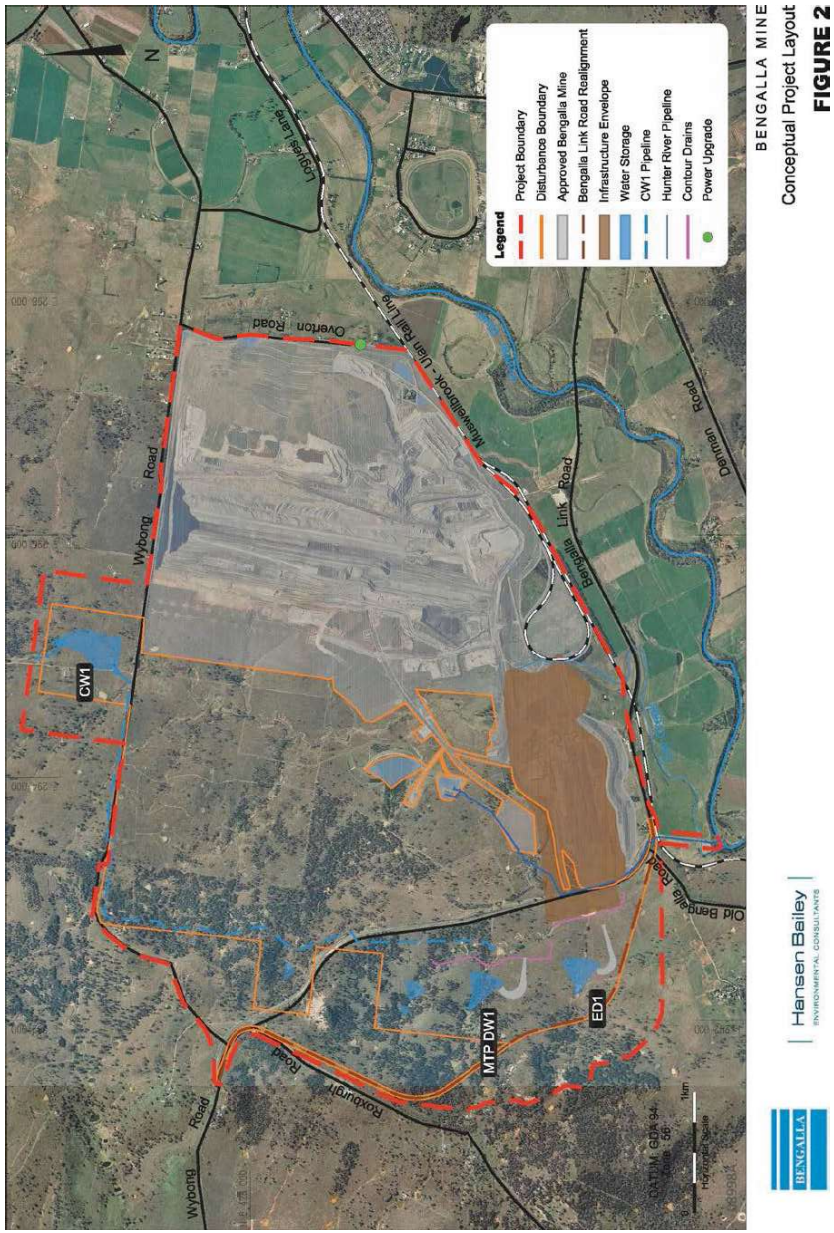


BENGALLA MINE

Regional Locality

FIGURE 1

Figure 2: Conceptual Project Layout.



Bengalla was approved to operate for a 21 year period from 1996 (i.e. until 2017) and to produce up to 8.7 Million tonnes per annum (Mtpa) of ROM coal. Approval was granted for the extraction of a total coal resource of approximately 146 Million tonnes (Mt) of ROM coal within a defined area. Additional coal reserves have always been known to exist further to the west of the 21 year coal extraction boundary. BMC has been granted four modifications to DA 211/93 which have facilitated the following:

- Increasing the Overburden Emplacement Area (OEA) height by 30 m to Reduced Level (RL) 270 m;
- Upgrade of the Coal Handling and Preparation Plant (CHPP) to allow two staged washing;
- The construction of temporary tailings drying areas;
- Increasing maximum allowable production levels to 10.7 Mtpa ROM coal;
- The relocation of the overland conveyor and associated ROM coal dump hopper;
- Extension of mining operations into an additional 32 hectare area (Wantana Extension) to recover an addition 7.5 Mt of ROM coal over a period of approximately 5 years;
- Modifications to the approved infrastructure to enable efficiencies across the operation;
- Construction of the Bengalla Link Road Stage 2 on an alternate alignment to that originally approved;
- Acceleration of mining operations in the Wantana Extension to align these with existing operations in the remainder of Bengalla; and
- Implementation of an overburden emplacement strategy to resolve the overburden emplacement capacity issues experienced at Bengalla.

1.2 Project Description

BMC is seeking Development Consent under Part 4, Division 4.1 of the EP&A Act to facilitate the continuation of open cut coal mining at Bengalla for a further 24 years. The Project is generally comprised of:

- Open cut mining towards the west at a rate of up to 15 Mtpa ROM coal for 24 years, extracting a total of 316 Mt;
- Continued use of the existing dragline, truck fleet and excavator fleet, with progressive replacement as required;
- An out of pit OEA to the west of Dry Creek which may be utilised for excess spoil material until it is intercepted by mining;
- Continued use, extension or relocation of existing infrastructure including administration and parking facilities, in-pit facilities including dragline shut down and erection pad, helipad, tyre laydown area, explosives and reload storage facility, core shed, workshop, roads, reject bin, ROM hopper, water management infrastructure, power and auxiliary infrastructure;
- Construction and use of various items of new infrastructure including a radio tower, extensions to the Main Infrastructure Area (MIA), MTP Staged Discharge Dam and associated water reticulation infrastructure, additional CHPP stockpile and ROM coal stockpile and ssociated conveyors;

- Processing, handling and transportation of coal via the upgraded CHPP and rail loop for export and domestic sale;
- Continued rejects and tailings co-disposal in the Eastern OEA and temporary in-pit reject emplacement;
- Relocation of a 3 km section of the Bengalla Link Road in approximately Year 15 to facilitate coal extraction;
- The diversion of Dry Creek via dams and pipework with a later permanent alignment of Dry Creek through rehabilitated areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams including the Staged Discharge Dam and raw water dam; and
- A workforce of approximately 900 full time equivalent personnel at peak production.

1.3 Receivers

Bengalla adjoins rural and residential receivers on all sides, with other operating and approved coal mines located south east and north of Bengalla. Some of the closest rural properties have previously been purchased by BMC to provide land for the mine or a noise and/or air quality buffer around the mine.

A number of properties not owned by BMC have been purchased by owners of the approved but currently undeveloped Mt Pleasant Mine located to the north or the operating Mt Arthur Coal Mine located to the south east. Properties and residences owned by BMC or other mining companies are not considered to be noise-sensitive receivers and are not specifically assessed in this report.

2 REGULATORY FRAMEWORK

This assessment investigates noise and blasting impacts associated with the Project in accordance with current NSW Environment Protection Authority (EPA) guidelines and policies:

- The NSW Industrial Noise Policy (INP) prepared by the Environment Protection Authority (EPA) in 2000 is intended to guide noise investigations from existing or proposed industrial developments including coal mines. The INP recommends procedures to determine:
  - background noise levels at receiver properties;
  - existing noise levels from an industrial site;
  - recommended, not mandatory, noise criteria for existing and proposed operations;
  - predicted noise levels from proposed developments; and
  - negotiation options if recommended noise criteria are not or may not be met.
- *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) provides criteria, recommended hours and methods for assessing noise from construction work;
- The *NSW Road Noise Policy* (RNP) (DECCW, 2011) provides recommended noise criteria and assessment procedures for road traffic noise, including Project-related traffic, from public roads but excludes noise produced by vehicle movements within the Project Boundary.
- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (Interim Rail Noise Guideline) (DECC, 2007) provides criteria and methods to assess noise from train movements on publicly owned rail lines;

- *Draft Rail Infrastructure Noise Guideline* (Draft RING) (Office of Environment & Heritage (OEH), 2012) provides criteria and methods to assess noise from train movements on publicly owned rail lines. While this document is only a draft for public comment, it is anticipated the final version issued in the future would be similar to the current draft;
- The *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (Blasting Guideline) (Australian and New Zealand Environment and Conservation Council (ANZECC), 1990) recommends residential ground vibration and overpressure limits and time restrictions for blasting;
- *Assessing Vibration – a Technical Guide* (Vibration Guideline) (DEC, 2006) provides recommended criteria and methods for assessing vibration, primarily from construction activities such as pile driving but excluding vibration associated with blasting; and
- *DIN 4150 Part 3 – Structural Vibration: effects of vibration on structures* (DIN 4150) (ISO, 1999).

2.1 Director-General's Requirements

This Acoustic Impact Assessment has been prepared in accordance with the Director-General's Environmental Assessment Requirements (DGRs) for the EIS as issued by the NSW Department of Planning & Infrastructure (DP&I) on 19 April 2012. Table 1 shows the DGRs that are relevant to this assessment and the sections in this report where the DGRs are addressed, while Table 2 shows relevant agency requirements and the sections in this report where the requirements are addressed.

Table 1: Director-General's Requirements

Requirement – Noise, Vibration and Blasting	Relevant Report Section
Construction, operational and off-site transport noise impacts	Construction – Section 7 Operations – Section 6 Transport – Sections 8 and 9
Blasting impacts on people, livestock and property	Section 11
Reasonable and feasible mitigation measures (including assessment of restricted night time operations) including evidence that there are no such measures available other than those proposed; and	Sections 5.3, 5.7
Monitoring and management measures, in particular real time, attended noise monitoring and predictive meteorological forecasting	Section 5.5.3

Table 2: Agency Comments to DGRs

Agency	Requirement	Relevant Report Section
EPA	Construction noise associated with the proposed development should be assessed using the *Interim Construction Noise Guideline* (OEH, 2009). Note that in general the construction noise guideline does not apply to coal mining developments.	Section 7
EPA	Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the *Assessing Vibration: a technical guideline* (EPA, 2006).	N/A

Agency	Requirement	Relevant Report Section
EPA	If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in *Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC, 1990)	Section 11
EPA	Operational noise from all industrial activities (including private haul roads and private railway lines) to be undertaken on the premises should be assessed using the guidelines contained in the *NSW Industrial Noise Policy* (EPA, 2000) and *Industrial Noise Policy Application Notes*.	Section 5
EPA	Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the *Environmental Criteria for Road Traffic Noise* (EPA, 1999)	Section 8
EPA	Noise from new or upgraded public roads should be assessed using the *Environmental Criteria for Road Traffic Noise* (EPA, 1999)	Section 8
EPA	Noise from increased rail traffic on the NSW Rail Network resulting from rail traffic generating development (e.g. an extractive industry) should be assessed using the environmental assessment requirements for rail traffic-generating developments available at http://www.environment.nsw.gov.au/noise/railnoise.htm	Section 9

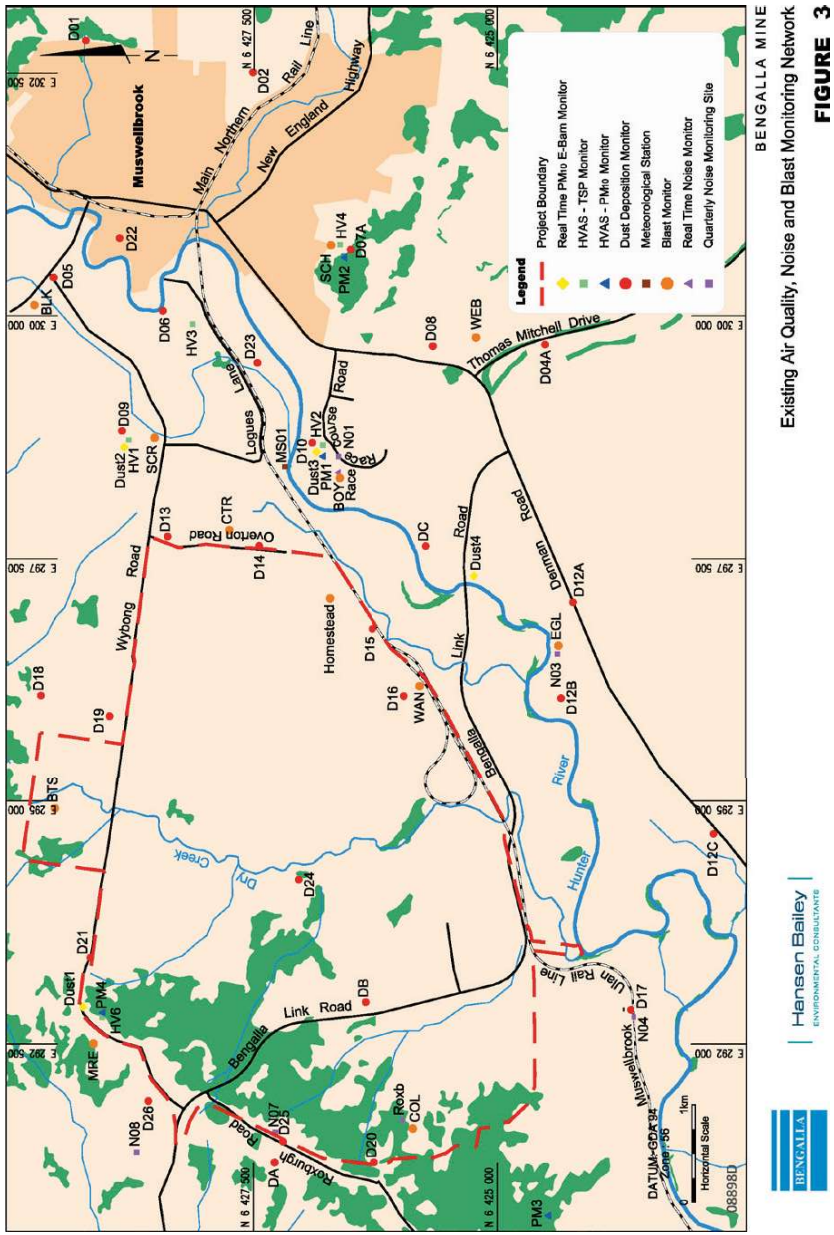
3 EXISTING ENVIRONMENT

3.1 Noise Monitoring Program

Five representative residential locations have been chosen by BMC in consultation with the EPA to carry out regular quarterly noise monitoring to confirm the mine is meeting current noise criteria or to identify periods of noise over the criteria and the primary causes of noise at these times. A plan showing noise monitoring locations is shown in Figure 3 (Hansen Bailey, 2012). The five locations are:

- Residences in Racecourse Road represented by a permanent real-time noise monitoring site on land owned by BMC;
- Residences near Denman Road represented by a monitoring location adjacent to the Edinglassie property. Edinglassie and other nearby residential properties are now owned by Hunter Valley Energy Coal (HVEC), the operator of Mt Arthur Coal Mine;
- Residences south west of the Coal Handling and Preparation Plant (CHPP) represented by a monitoring location at 1100 Denman Road. This monitoring location was previously at the end of Old Bengalla Road adjacent to the Muswellbrook to Ulan Rail Line, however it was relocated when a property near the previous location was acquired by BMC;

Figure 3: Existing Air Quality, Noise and Blast Monitoring Network.



- Residences near Roxburgh Road west of the Project represented by a monitoring location in front of the Hamilton residence (Property 158); and
- Residences to the north-west represented by a monitoring location near the Moore residence (Property 166).

Global Acoustics have carried out all recent quarterly environmental noise surveys on behalf of BMC. Noise surveys typically include operator attended noise measurements over 15 minute periods during the day and night at each of the five monitoring locations. Reported results include measured noise levels and an indication of audible sounds noted by monitoring personnel at each location.

Previous Bengalla noise assessments have assessed background noise levels at four representative monitoring locations, based on a combination of long term unattended and short term attended noise surveys. Quarterly noise monitoring data since the most recent noise assessment have been reviewed for the five monitoring locations to determine existing background and ambient noise levels, background levels in the absence of existing Bengalla operations and the mine's current noise contribution. Given the extensive database of noise monitoring results available for receiver locations near the Project, no additional noise surveys have been carried out for this assessment.

3.2 Background Noise Levels

Table 3 shows background noise levels adopted in recent Bengalla environmental assessments, including the most recent *Bengalla Mining Company Development Consent Modification Environmental Assessment* (Bengalla EA 2010) (Hansen Bailey, December 2010) which was based on a review of background noise data for the years 2000 to 2009. Background noise data were measured using instruments and methods that are consistent with the INP, as any data potentially affected by noise from Bengalla were excluded.

Table 3: Adopted Background Noise Levels, LA90,15min, 2000-2009.

Receiver Area	Background Level, LA90,15min		
	Day	Evening	Night
East (Racecourse Road)	33	32	31
South (Edinglassie) [1]	33	34	34
Others (Chudyk [2], Denman Road, Hamilton)	30	30	30

1 All residences to the south are now owned by a mining company (HVEC)

2 The Chudyk residence is now owned by BMC.

Environmental noise monitoring reports prepared by Global Acoustics for the 2010 and 2011 calendar years have also been reviewed to ensure the previously adopted background noise levels in Table 3 remain relevant. Data from the monitoring reports, for the day and night periods as the evening period is not included in the noise surveys, is presented in Table 4. Entries in bold font indicate measured noise levels in the absence of audible noise from Bengalla as required by the INP, or where estimated Bengalla noise levels were at least 10 dBA below the measured background level and therefore did not affect measured background levels, as indicated in the monitoring reports.

Background noise levels listed in Table 4 vary from one measurement period to the next but are generally consistent with, and higher than, the adopted levels in Table 3. Noise criteria based on Table 3 data, as adopted in previous Bengalla assessments, are therefore considered conservative and appropriate for this assessment.

Table 4: Measured Background Noise Levels, LA90,15min, 2010-2011.

Receiver Area	Measured Background Level, LA90,15min	
	Day	Night
East (Racecourse Road)	32, **35**, 36, **39**, **39**, **43**, 38, **38**	**32**, **32**, 32, 29, 35, 38, **36**, **38**
South (Edinglassie)	42, 37, 44, **39**, **44**, **44**, 38, **38**	37, 37, 42, 38, 40, 38, 40, **43**
South West (Denman Road)	**33**, **36**, 37, **35**, **33**, **42**, **41**, **38**	**34**, **30**, 34, **47**, **36**, 30, **32**, **39**
West (Hamilton)	**34**, 29, 27, 31, 27, 32, **32**, **31**	33, 38, 23, 38, 31, **26**, 33, 36
North West (Moore)	**28**, **30**, **28**, 29, **28**, **42**, **39**, **31**	32, 33, 22, **39**, 45, **25**, 30, **39**

As background noise levels in Table 3 and levels shown in bold font in Table 4 were measured using instruments and methods that are consistent with the INP, resulting background levels are therefore considered appropriate for this assessment.

Background noise levels at receivers to the east are influenced by noise from the Muswellbrook urban area, with traffic as the primary source. Mt Arthur Coal Mine would provide an intermittent influence on background noise levels, however is not consistent enough to affect the adopted background level as shown by the results reported in Table 4.

Background noise levels to the south west and west were previously influenced by traffic on Denman road and other local roads with some insect and bird noise, however in recent years may be intermittently influenced by noise from Mangoola Mine or Mt Arthur Coal Mine depending on weather conditions. With an occasional and inconsistent influence from nearby mining developments as shown in the results reported in Table 4, the previous conservative background levels continue to apply to these receivers.

4 CRITERIA

The INP contains two sets of noise criteria for residential receivers. Intrusive criteria are designed to limit the relative audibility of Bengalla operations, while the amenity criteria are designed to limit the total or cumulative level of industrial noise from all industrial sources in the area.

4.1 Intrusive Mining Noise Criteria

Intrusive criteria are set 5 dBA above the Rating Background Level (RBL) in each time period. These criteria can be adjusted by one or more 'modifying factors' such as tonality or impulsiveness described in Section 4 of the INP, or alternatively the source noise levels can be adjusted to consider any modifying factors applicable to those sources. In this assessment the source noise levels have been adjusted where required to consider any modifying factors. Existing and proposed noise criteria are shown in Table 5.

Intrusive criteria in Table 5 have been set 5 dBA above the background noise levels shown in Table 3, while existing noise impact assessment criteria which depend on currently achievable noise levels are specified in Schedule 3, Condition 1 of the modified Bengalla Development Consent (DA 211/93 M4). All properties are subject to sleep disturbance criteria set 10 dBA above the night intrusive criteria (or 15 dBA above the night background noise level).

Table 5: Intrusive and Consent Noise Criteria, LAeq,15min

Receiver	Receiver ID listed in the Consent	Noise Criteria Intrusive/Consent			
		Day (7 am to 6 pm) [1] and Evening (6 pm to 10 pm)		Night (10 pm to 7 am) [1]	
		Intrusive	Consent	Intrusive	Consent
65 (HVEC)	90 Webber (25%)	38 Day 37 Evening	38	36	40
N/A (HVEC)	9 Englebrecht				39
43	5 Barnett		37		38
44	6 McGoldrick				
29	68 Jabetin				37
41	3 Almond		36		
42	4 Englebrecht				
49	22 Sweeney				
48	23 Dobie				
47	24 Robinson				
50	25 Smith				
51	26 Barby				
64	11 Drake (residence)		35		
66	13 Scriven (resid.)				
60	16 Englebrecht				
59	17 Cridland				
58	18 Cridland				
57	19 Good				
55	20 Keevers				
54	21 Gleeson				
52	27 Andrews				
53	28 Solway				
63	14 Drake				36
155	44 Lane	35	38	35	38
158	38 Hamilton				37
156	40 Ellis				
152	41 Peel M		36		36
154	42 Moore				
118	47 Rankin		35		40
116 (HVEC)	50 Zahra				38
119	80 Rankin				
120	45 Roots				37
112	69 Latham				
117	81 Rankin				
168	34 Moore				36
114	72 Halloran				
115 (HVEC)	73 Zahra				
113	82 Latham				
46	10 Race Club	40	40	40	40
Other private land		-	35	-	35

1 Night ends, and day begins, at 8am on Sundays and public holidays.

4.2 Cumulative Noise Criteria

Amenity limits recommended in the INP depend on existing industrial noise levels, in the absence of existing Bengalla noise, and the nature of the receiver area. Amenity criteria are set to the amenity limits in cases where limited industrial noise is currently received, or to lower levels to ensure the cumulative impact of existing and proposed noise sources does not exceed the amenity limit for each time period. Noise amenity criteria recommended in the INP, for rural receivers, are shown in Table 6.

Table 6: Noise Amenity (Cumulative Noise) Criteria.

Noise Criteria	Noise Criteria by Time Period		
	Day	Evening	Night
Amenity limit LAeq,period (INP, rural)	50	45	40

The noise amenity criteria can be reduced, as described in Table 2.2 of the INP, to determine the amenity criteria applied to the Project alone. Alternatively the cumulative noise level produced by all industrial noise sources can be assessed and compared to the amenity limits, as discussed in Section 10 of this report.

4.3 Construction Noise

Construction noise levels produced during establishment of most industrial developments are normally assessed to the ICNG. Section 1.2 of the ICNG states it does not apply to construction associated with quarrying and mining and suggests this activity should be assessed under the INP. Section 1.3 of the INP, however, specifically excludes construction noise.

A future revision of the INP is expected to address this gap. As the ICNG is the most recent policy document, noise criteria applied to proposed construction work associated with mining (ie, on-site construction works in Years 1 to 3) are sourced from the INP and are therefore identical to mine operational criteria as shown in Table 5, although potential exceedances of the noise criteria for relatively short term construction activities are not expected to be as significant as longer term operation noise impacts.

Realignment of the Bengalla Link Road in approximately Year 15 is not a construction activity related to mining, as the Bengalla Link Road is a public road. Noise associated with the Bengalla Link Road realignment works is therefore assessed to the ICNG which recommends:

- A ‘noise affected’ level of 10 dBA above the background noise level which represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq,15min level is greater than the ‘noise affected’ level, all feasible and reasonable noise control measures should be applied in an effort to meet the ‘noise affected’ level; and
- A ‘highly noise affected’ level which represents the point above which there may be a strong community reaction to noise. Additional mitigation measures such as reduced working hours or respite periods should be considered in consultation with the relevant authority and the community.

4.4 Sleep Disturbance

Sleep disturbance can be caused by a short, sharp sound that is noticeably louder than the typical or usual noise level within a bedroom. Historically, sleep disturbance criteria were sourced from the *Environmental Noise Control Manual* (EPA, 1985) and the INP Application Notes suggest the historical noise criterion of 15 dBA above the night background noise level should continue to be used in the absence of research to suggest an alternative. The INP Application Notes also point to the RNP for guidance on noise-induced sleep disturbance effects.

The RNP acknowledges the effects of noise on sleep disturbance have not yet been conclusively determined. Nevertheless, Section 5.4 of the RNP states:

"From the research on sleep disturbance to date it can be concluded that:

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

The suggested awakening criteria of 50-55 dBA inside a bedroom are approximately equivalent to an external noise level of 60-65 dBA assuming bedroom windows remain partly open for ventilation. Similarly, the suggested health criteria of 65-70 dBA inside a bedroom are approximately equivalent to an external noise level of 75-80 dBA assuming bedroom windows remain partly open for ventilation.

Table 7 shows relevant sleep disturbance criteria, including the historical criteria and more recent guidance in the RNP. Sleep disturbance criteria apply during the night period 10 pm to 7 am, at a point 1 m outside a potentially affected bedroom window.

Table 7: Sleep Disturbance Criteria, Night, LA1,1min.

Steps to Determine Noise Criteria	Noise Criteria LA1,1min, 10pm to 7am		
	Eastern Receivers	Southern Receivers	All Other Receivers
Background level LA90,15min (Section 3)	31	34	30
Historical Criteria LA1,1min (LA90 + 15)	46	49	45
RNP Awakening Criteria	60 - 65		
RNP Health Criteria	75 - 80		

Noise levels within the historical criteria are considered unlikely to cause sleep disturbance, while noise levels less than 60 LA1,1min are unlikely to cause awakening reactions according to the RNP. Where noise levels are predicted to exceed the historical criterion, The RNP suggests further information regarding maximum noise levels such as time of night and number of events is required to assess the potential effect of noise on sleep.

4.5 Road Traffic Noise

The Project would generate traffic on Denman Road, Bengalla Link Road and other local roads during the construction and operational phases. Traffic noise criteria primarily apply to operational traffic, as construction related traffic only occur for a relatively brief period compared to the life of the Project.

Relevant road traffic noise criteria are listed in Table 3 in the RNP and are reproduced in Table 8.

The LAeq,15hr and LAeq,9hr criteria for arterial roads refers to the average traffic noise level over an entire 15 hour day or 9 hour night. The LAeq,1hr criteria for local roads refers to the average traffic noise level over a worst case, or peak, hour during the day or night. Recommended noise criteria apply to all traffic including vehicles associated with the Project and other vehicles on the road.

Table 8: Road Traffic Noise Criteria, LAeq.

Roads	Noise Criteria LAeq	
	Day and Evening	Night
Arterial Roads (Denman Road, Bengalla Link Road)	60 LAeq,15hr	55 LAeq,9hr
Local Roads (all other roads)	55 LAeq,1hr	50 LAeq,1hr

4.6 Rail Traffic Noise

Rail noise criteria in this section apply to train movements on publicly owned rail lines such as the Main Northern Railway Line, while noise from the proposed rail spur is assessed in conjunction with mining noise and is therefore excluded from this section.

Noise criteria are sourced from the Interim Rail Noise Guideline which recommends trigger levels of 65 LAeq,15hr during the day, 60 LAeq,9h during the night and 85 LAmax at any time. Similarly, condition L2.2 of EPL 3142 issued to the Australian Rail Track Corporation (ARTC), which regulates train movements on all railways controlled by ARTC, specifies noise level objectives of 65 LAeq,15hr day, 60 LAeq,9hr night and 85 LAmax at one metre from the façade of affected residential premises.

Table 1 in the Draft RING contains the same trigger levels as the Interim Rail Noise Guideline.

4.7 Low Frequency Noise

Section 4 of the INP recommends low frequency noise levels should be considered in the normal operational noise criteria by the addition of a 'modifying factor' to either a source sound power level or a received noise level. Any modifying factors that are relevant to the assessment, including low frequency penalties, have been applied to the adopted sound power levels for affected mining and transportation equipment and no separate assessment of low frequency noise levels is therefore required.

Relevant factors have been applied to the source sound power levels, rather than to received noise levels, to simplify the assessment of a large number of sources that do not require the same modifying factors.

4.8 Blast Noise and Vibration

Residential noise and vibration criteria associated with blasting are recommended in *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990). Noise and vibration limits recommended in the policy for occupied residences are:

- Overpressure 115 dBL, and
- Ground vibration 5mm/s Peak Particle Velocity (PPV).

The policy recognises blast effects cannot always be controlled accurately and allows higher limits of 120 dBL and 10mm/s PPV for up to 5% of the total number of blasts in a 12 month period. Identical blast criteria are specified in Schedule 3, Conditions 9 and 10 of the modified Bengalla Development Consent (DA 211/93 M4) and Condition L4 of Environment Protection License 6538.

Blast criteria for other sensitive structures, such as sensitive historical buildings, depend on the type of structure and the current condition of the structure. Fragile structures, or those in poor condition, are typically assigned lower and more conservative criteria to minimise the risk of damage. Robust structures, or those in good condition, are better able to resist vibration related damage and are typically assigned higher blast criteria.

Suggested criteria of 10 mm/s and 120 dBL have been adopted for mine-owned heritage buildings to protect them from structural and cosmetic damage. A ground vibration criterion of 50 mm/s has been adopted for more robust structures such as building foundations (house sites) and cemeteries, while these structures are not sensitive to overpressure and an overpressure criterion has therefore not been assigned.

5 ASSESSMENT

5.1 Noise Assessment Method

Noise levels from operation of the Project including mining and processing equipment, coal transportation and rail loadout, have been assessed using a comprehensive model of the site based on RTA Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receiver locations or as contours over a receiver area. It is recognised in NSW as the most appropriate choice for situations involving complex topography and a large number of individual noise sources and where a detailed assessment of the effects of atmospheric conditions on noise propagation is required.

The standard ENM package includes data input modules to allow terrain and noise source information to be entered and amended, plus an initial setup page containing terrain and source lists and modelled weather conditions for each scenario. All terrain and source files were prepared for this assessment using a combination of AutoCad and Excel based data then automatically converted to ENM format terrain and source files using specially prepared software. All outputs were obtained using software equivalent to ENM's standard sectioning and contouring algorithms and are presented on a base landownership plan supplied by Hansen Bailey. Tabulated noise levels at residences, and noise levels over 25% of contiguous property areas, have been produced by specially prepared software based on ENM's intermediate calculation files used to produce the noise contours.

Noise contour figures showing proposed noise levels associated with the Project are presented in Appendix A.

5.2 Weather Conditions

Atmospheric conditions including temperature, relative humidity, wind speed, wind direction and vertical temperature gradient can all affect noise propagation and received noise levels at some distance from a source. Previous Bengalla assessments included a comprehensive assessment of weather conditions as they apply to the area around Bengalla, based on detailed weather records from the Bengalla weather station and inversion tower.

A review of recent weather data has also been completed to confirm the previously adopted prevailing weather conditions remain valid for the Project, as discussed in the following sections.

5.2.1 Gradient Winds

Relevant weather data from Bengalla's weather station for the year 2009, as supplied by BMC and Hansen Bailey including data at 30 minute intervals for the 12 month period, have been processed by software equivalent to the *Noise Enhancement Wind Analysis* (NEWA) program (EPA, 2011), with results shown in Table 9. Values in bold font highlight significant noise enhancing winds that occur for 30 % of the time or more in any season or time period.

Table 9: Noise Enhancing Winds, Bengalla Weather Station, 2009 Data.

Wind Direction	Occurrence of Noise Enhancing Winds, % of Season and Time Period											
	Summer			Autumn			Winter			Spring		
	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night
N	6	6	8	11	10	24	12	24	24	5	6	16
NNE	7	9	9	13	11	28	11	24	30	5	6	20
NE	11	12	12	17	11	**30**	12	23	29	8	8	21
ENE	26	22	24	**33**	23	**37**	18	26	**33**	20	23	27
E	**38**	**35**	**44**	**40**	**40**	**39**	21	22	27	26	**33**	**35**
ESE	**36**	28	**51**	**32**	**40**	**37**	20	21	23	25	29	**36**
SE	**36**	24	**51**	**34**	**41**	**38**	22	24	23	27	29	**35**
SSE	**42**	27	**56**	**43**	**47**	**41**	28	25	23	**33**	**34**	**38**
S	**47**	**34**	**57**	**45**	**51**	**42**	28	23	22	**37**	**38**	**39**
SSW	29	22	**39**	25	**31**	**32**	22	24	17	25	23	29
SW	17	10	20	19	18	21	22	20	15	19	14	16
WSW	11	8	12	14	14	15	19	15	12	14	10	12
W	6	6	7	9	10	9	13	14	10	9	8	9
WNW	3	5	4	5	6	5	7	11	6	5	5	5
NW	3	4	4	5	4	4	7	10	7	4	4	5
NNW	5	5	6	9	7	17	10	21	16	5	6	12

Table 9 shows significant winds occurred from the south east during the day and evening in 2009, which is consistent with historical data. The 2009 data show similar south east winds occur during the night which reflects the location of the weather station on the elevated Overton Ridge, while closest receivers to the east and to the south west are on lower ground within the Hunter River valley which experiences significant north easterly cold air drainage flows which run generally downhill within the valley towards the Pacific Ocean. As south easterly winds are considered in the day and evening periods, the noise model includes the expected east-north-easterly drainage flows for the night period to ensure weather-related noise enhancement is adequately assessed to receivers located south west of the Project.

As prevailing wind directions in the day and evening are very similar, these two periods have been combined for this assessment.

5.2.2 Temperature Inversions

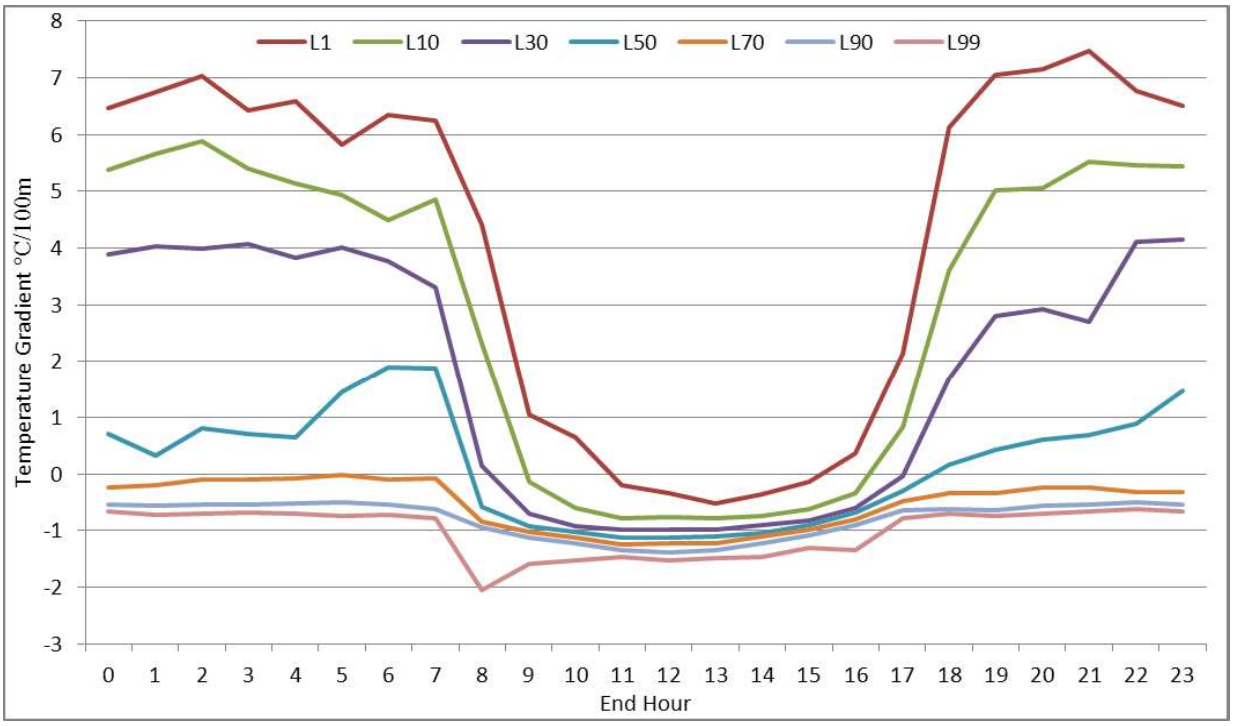
Bengalla's inversion tower is a 90 m mast located south east of the mining area on the Hunter River floodplain. The tower is fitted with 6 temperature sensors and 4 wind speed and direction sensors from near ground level to 90 m above the ground which allows direct measurement of temperature inversion strength and associated wind conditions.

Inversion tower data for the 2010 calendar year, as supplied by BMC and Hansen Bailey, were analysed to determine the typical range of temperature inversions that occur in the area. Valid data were processed to determine the occurrence and typical strength of temperature inversions, based on the following procedure:

- Separate the data by season, remove invalid data and continue with only valid winter data;
- Calculate the temperature difference reported by the 10 m and 90 m temperature sensors for each 10 minute period;
- Separate the data by hour; and
- For each hour, calculate representative percentiles of the temperature difference for further review.

Figure 4 shows percentiles from L1 (the highest 1%) to L99 (the lowest 1%) of temperature inversions, by hour, for the winter period. The L30 percentile indicates temperature inversions stronger than 4 °/100m occur less than 30 % of the time, while the L1 percentile shows temperature inversions reach 7 °/100m less than 1 % of the time. Figure 4 shows the vertical temperature gradient during the day is typically -1 °C/100m.

Figure 4: Temperature Inversions from Inversion Tower Data, Winter 2010 Data.



Further analysis of the weather data was completed to determine prevailing winds associated with temperature inversions, based on the following procedure:

- Select valid winter data;
- Sort the data by temperature inversion strength and separate the data into 1 °C/100m ranges; and
- Calculate the median and L30 percentile wind speed associated with each temperature inversion range.

The results indicate the median and L30 wind speed do not significantly change with inversion strength, with all inversion strength ranges from 1 °C/100m to above 7 °C/100m showing a median wind speed from 0.85 to 1.0 m/s and an L30 wind speed from 1.2 to 1.4 m/s. Dominant winds associated with inversions blow from the east-north-east, resulting in the selection of an east-north-east wind to represent prevailing conditions for this assessment. Analysis of wind direction associated with various inversion strengths indicates the wind direction remains more consistent when stronger inversions occur, with more variation in wind direction as inversions weaken. Stronger inversions are associated with the dominant east-north-east wind over 80 % of the time while weaker inversions tend to cause this dominant wind direction for 60 % to 70 % of the time.

The worst case 30 % of the time during winter nights therefore includes a 4 °C/100m inversion combined with a 1.4 m/s drainage flow from the east-north-east, which is equivalent to the INP default 3 °/100m inversion plus a 2 m/s wind.

5.2.3 Adopted Weather Parameters

Results from the analysis of recent weather data are consistent with the weather conditions adopted in previous Bengalla assessments as shown in Table 10. The equivalent inversion strength shown in Table 10 is calculated by Equation 1, which is the method used by the noise model software to combine the effect of temperature inversions and gradient winds to determine the total radius of curvature of sound rays and level of noise enhancement:

Equivalent Inversion °/100m = Inversion °/100m + 2.5 x Wind speed m/s. *Equation 1.*

Table 10: Modelled Weather Conditions.

Atmospheric Parameter	Day Neutral	Day and Evening Prevailing		Night Prevailing	
Temperature, °C	20			10	
Relative Humidity, %	70			90	
Wind Speed, m/s	0	3		0	2
Wind Direction	-	SE	SSW	-	ENE
Temp Gradient, °C/100m	-1			3	
Equivalent Inversion	-1	6.5	6.5	3	8

Analysis of available weather data indicates periods of irregular vertical temperature profile or differences in wind direction with height tend to occur, however such events do not necessarily cause increased noise enhancement and noise levels during these periods cannot be reliably predicted with currently available noise assessment methods. Potentially higher noise levels during times of more extreme noise enhancement would continue to be actively identified and managed by BMC, as discussed in Section 5.2.3, to minimise the potential for excessive noise at receivers.

5.3 Noise Control Strategies

Since operations commenced at Bengalla in 1998, BMC has invested significant resources into achieving all reasonable and feasible noise mitigation measures in an effort to minimise operational noise levels. BMC has a long history of working with equipment manufacturers to achieve the lowest possible equipment sound levels, particularly with regard to the haul truck fleet. Section 5.3.1 describes current feasible and reasonable best practice equipment modifications, a combination of which will continue to be employed for the Project.

Over the past four years in particular, BMC has worked with its suppliers to achieve continuous improvement of acoustic performance and best practice noise attenuation on its haul trucks. In order to achieve lower noise levels, BMC and its supplier developed a retrofit of the haul truck's noise countermeasure kit. Further work at BMC's supplier's proving ground has also been undertaken including mobilising Australian sound testing service providers to establish "like for like" testing during further development of the countermeasure kit. Additionally, BMC has expended over $8 Million in the last four years in sound attenuation its new and existing equipment.

BMC remains committed to a best practice achievable noise attenuated fleet through ongoing and continual improvement. The sound power levels adopted for the Project noise model are practically achievable and represent all reasonable and feasible noise mitigation available at the present time to minimise mining noise.

5.3.1 Engineering Controls for Mobile Equipment

All feasible and reasonable equipment modifications, to result in the lowest mobile plant sound power levels that can consistently be achieved, would continue to be implemented as part of the Project.

- Excavators would produce an average sound power level of 115 dBA which may include the following best practice modifications, or equivalent:
  - appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres;
  - cooling air inlet plenums or louvres; and
  - covers over various ventilation and other openings not fitted with louvres.
- Trucks and water carts would produce a sound power level of 115 dBA which may include the following best practice modifications, or equivalent:
  - appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres;
  - engine bay side and belly plates;
  - gridbox attenuators (for electric drive trucks) or gearbox cover plates (for mechanical drive trucks); and
  - helical hub gears rather than noisy straight-cut gears.
- Drills would produce a sound power level of 114 dBA which may include the following best practice modifications, or equivalent:
  - appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres; and
  - acoustically lined engine and compressor covers including belly plates.
- Front end loaders and wheel dozers would produce an average sound power level of 113 dBA which may include the following best practice modifications, or equivalent:
  - Appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature based fan speed control;
  - radiator acoustic louvres; and
  - engine bay side cover plates and air inlet louvres to enclose the engine.

- Dozers would produce a sound power level of 114 dBA which may include the following best practice modifications and management measures, or equivalent:
  - appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres;
  - engine bay side covers;
  - track modifications to reduce impact noise as practical modifications are developed;
  - operator training and careful control of machine speed to avoid track noise during the night or when track noise is likely to be excessive at any sensitive receiver; and
  - use wheel dozers rather than track dozers on acoustically exposed sections of the OEA, particularly during the sensitive night period.
- Graders would produce a sound power level of 108 dBA which may include the following best practice modifications, or equivalent:
  - appropriate exhaust silencers;
  - aerodynamic radiator fan blades and temperature-based fan speed control; and
  - engine bay side covers.

5.3.2 Engineering Controls for CHPP Equipment

Feasible and reasonable noise mitigation measures have been incorporated into the existing CHPP and would be continued in all proposed modifications and additional equipment, including the following measures:

- The existing ROM hopper has been designed and constructed with the following best practice modifications:
  - the hopper is located within a boxcut to maximise shielding to sensitive receivers;
  - a hood has been fitted to control noise emitted from the inside surface of the hopper; and
  - the hopper is constructed with a double steel skin, with the space between the skins filled with sand to dampen vibration in the hopper walls. Reduced wall vibration results in less noise produced by the walls as material is deposited in the hopper, particularly when the hopper is almost empty.
- The proposed relocated ROM hopper would include an equivalent level of noise control to the existing hopper;
- Coal Preparation Plant (CPP) building currently produces a sound power level of 115 dBA due to the following best practice modifications:
  - the coal washing process has been designed with the minimum number of noisy machines such as vibrating screens and centrifuges;
  - the building's structure has been designed to minimise floor, wall and roof vibration to minimise noise generated by these surfaces;
  - the building has been clad with steel sheeting on all sides, to the ground in the previously most sensitive directions and to approximately 4 m above the ground in the previously least sensitive directions. Ventilation fans were installed in lieu of large openings for natural ventilation and a minimum of translucent sheeting was installed; and
  - elevated conveyors entering the building have been fully enclosed and flashing installed to seal the conveyor enclosures to the building cladding.

- Conveyors would continue to produce a sound power level of no more than 76 dBA per metre for sections of conveyor that cannot be enclosed, based on the following measures:
  - conveyor frames have been designed to minimise structural vibration;
  - sections of elevated conveyor have been enclosed where possible;
  - idler surfaces have been machined after assembly to minimise belt vibration; and
  - conveyor condition is regularly monitored and noisy bearings or other defects are repaired to maintain the required conveyor sound power level.
- Stackers and reclaimers have been constructed with the following modifications to minimise noise:
  - transfer chutes have been constructed to optimize material flow paths to avoid impact noise; and
  - reclaimers have been constructed with optimum chain sprocket profiles and bucket guides to minimise impact noise.
- The rail loadout facility currently includes the following noise control measures:
  - The rail loop has been constructed with optimum gradients to control locomotive power while a train is loading and to avoid wagon coupling noise;
  - The train loading system has been enclosed and a noise controlled tunnel has been constructed to control noise from the wagon being loaded;
  - rails have been continuously welded rather than jointed;
  - points and crossovers have been constructed to minimise wheel impact noise; and
  - large radius bends have been used to minimise wheel and flange noise.

5.3.3 Acoustic Shielding

A number of noise control bunds have previously been constructed to minimise noise transmission to receivers. A bund approximately 8 m high was originally constructed at the eastern side of the OEA to shield initial mining areas from receivers to the east. The bund is no longer required since the ROM hopper and associated haul roads have been relocated to a new position near the CHPP and the bulk of the OEA forms a more effective noise barrier for receivers to the east.

A large bund approximately 24 m high has been constructed along the southern boundary of the CHPP area. This bund forms an effective noise barrier for receivers east and south of the Project in conjunction with a natural ridge along the eastern boundary of the CHPP. The proposed stockpile extensions would result in a cutting face forming an effective extension of the bund around the southern and western side of the extensions.

The north-south alignment of the main pit results in some acoustic shielding for receivers located east and west of the Project, with receivers to the east shielded by the OEA and receivers to the west shielded from some equipment operating in deeper mining areas. Where possible, mobile equipment operates between parallel rows of dragline spoil within the OEA to provide some shielding to receivers west of the Project, particularly during the most sensitive night period.

Closest receivers to the west are generally located on ground that is elevated approximately 100 m above the CHPP and an average of 50 m above mining areas. The elevated location of receivers generally precludes the use of additional noise barriers within the Project Boundary, as the height of any barrier must be increased substantially to interrupt an elevated direct line of sight from noise generating equipment to receivers.

An active noise management strategy has also been implemented, including the following management measures:

- Mobile machines including trucks, dozers, graders and water carts generally operate on elevated and exposed sections of the OEA during the day and early evening and on lower and more shielded sections of the OEA during the sensitive night period;
- Mining machines generally work below the surface during the sensitive night period. Surface work including clearing, topsoil stripping, stockpiling and rehabilitation is completed during the day;
- Drilling and drill pad preparation generally occurs at least 6 m below the natural surface during the evening and night;
- A continuous data link from the weather monitoring station was established to allow informed decisions to be made regarding appropriate equipment operating locations; and
- A real time noise monitoring system was established to provide feedback regarding Bengalla's acoustic performance and to allow equipment operating locations to be fine-tuned to avoid excessive noise at receivers.

Existing noise control and management measures would be continued as part of the Project.

5.4 Operational Noise Sources

5.4.1 Existing Noise Sources

BMC currently relies on a number of items of fixed and mobile equipment to uncover, extract, process and transport coal. Average sound power levels for existing equipment are listed in Table 11.

Table 11: Existing Noise Sources and Sound Power Levels.

Noise Source,		Sound Power Level, dBL re 1pW *									Total	
Height Above Ground, m		31.5	63	125	250	500	1000	2000	4000	8000	Lin	A
Mobile Equipment												
Dragline 9020	15	124	121	119	109	111	108	104	99	90	127	113
Excavator EX3600	6	117	118	121	115	112	109	107	102	94	125	115
Excavator EX5500	6	117	118	121	115	112	109	107	102	94	125	115
Loader L1800	3	106	109	114	111	109	108	106	104	101	119	113
Truck 830E	3	116	121	120	115	113	109	106	102	97	125	115
Tracked Dozer D11	2	108	106	116	107	111	109	107	99	93	119	114
Wheel Dozer 854	3	106	109	114	111	109	108	106	104	101	119	113
Water Cart R90	3	107	108	117	116	111	110	108	103	96	121	115
Drill SK50	2	110	115	120	117	112	107	102	95	95	123	114
Grader 16M, 24M	2	97	99	109	105	103	104	102	96	88	113	108
Coal Processing and Transportation Equipment												
Sizing station ST103	15	112	108	108	104	101	100	95	84	73	115	104
Transfer ST104	10	101	103	108	105	102	99	97	94	86	112	105
Transfer ST105	8	101	103	108	105	102	99	97	94	86	112	105
Yard conveyor /200m	1	105	100	101	101	97	93	91	88	81	109	100
Raw stacker SK101	8	96	98	103	100	97	94	92	89	81	107	100
Raw reclaimer RC301	3	115	111	109	106	101	96	94	90	80	118	104
Transfer ST301	8	98	102	104	102	100	97	95	91	84	109	103
Surge bin BN301	20	89	94	92	93	94	96	95	93	87	103	101
CPP ST401	15	126	122	120	117	112	107	105	101	91	129	115

Noise Source, Height Above Ground, m		Sound Power Level, dBL re 1pW *									Total	
		31.5	63	125	250	500	1000	2000	4000	8000	Lin	A
CPP Second Stage	15	120	116	114	111	106	101	99	95	85	123	109
Reject transfer ST701	8	117	109	105	102	107	106	105	99	89	119	111
Reject bin BN701	20	111	107	105	102	97	92	90	86	76	114	100
Transfer ST801	12	104	106	111	108	105	102	100	97	89	115	108
Sampling station ST802	12	96	98	103	100	97	94	92	89	81	107	100
Stackers SK801, 802	8	96	98	103	100	97	94	92	89	81	107	100
Reclaimer RC801, 802	3	115	111	109	106	101	96	94	90	80	118	104
Transfers ST803, 804	8	96	98	103	100	97	94	92	89	81	107	100
Train conveyor /200m	1	107	102	103	103	99	95	93	90	83	111	102
Train bin BN801	15	96	98	103	100	97	94	92	89	81	107	100
Locomotive (on loop)	3	109	109	102	101	105	104	100	94	88	114	108

* dBL means unweighted, as opposed to A-weighted, noise levels. Total dBL and dBA sound power levels are shown in the last two columns.

Sound power levels in Table 11 are derived from recent on-site noise measurements completed by Global Acoustics and current best practice noise control modifications available from mobile equipment suppliers. Minor items of equipment that are unlikely to be audible at any receiver under any weather conditions, such as pumps located in the pit or conveyor drives within the coal handling area, have been shown by preliminary noise modelling to have no appreciable effect on received noise levels and have been omitted from the assessment.

5.4.2 Proposed Noise Sources

The Project primarily involves continuation of the existing Bengalla mine, using the existing equipment fleet and CHPP. Additional and replacement mobile equipment would be required as a result of the proposed production increase, with the additional machines assumed to produce the same sound power level per unit as the existing machines.

Extensions to the CHPP would be required to enable two stage washing of raw coal and to increase the stockpile capacity. Modifications to enable two stage washing are relatively minor and would result in a CPP sound power level increase of less than 1 dBA. Additional and extended conveyors required to achieve the increase in stockpile capacity would produce a similar sound power level per unit length as the existing stockyard conveyors, while additional stockpile machines would produce the same sound power level as the existing stockpile machines.

The sound power levels listed in Table 11 would therefore continue to apply to the Project, although an expanded mobile machine fleet has been considered as shown in Table 12, consistent with the proposed increase in annual production.

Table 12: Proposed Mobile Equipment Fleet.

Machine Type	dBA	Utilisation Rate, %	Assessed Project Year									
			1	4	8	15	24	1	4	8	15	24
			Equipment Fleet					Total Sound Power, dBA				
Dragline	113	100	1	1	1	1	1	113	113	113	113	113
Excavator	115	100	6	6	7	7	8	123	123	123	123	124
Loader	113	100	1	1	1	1	1	113	113	113	113	113
Truck	115	90	27	36	40	41	48	129	131	131	131	132
Tracked Dozer	114	90	11	11	11	13	14	124	124	124	125	125
Wheel Dozer	113	75	1	2	2	2	2	113	116	116	116	116
Water Cart	115	75	3.5	3.5	3.5	4.5	5.5	120	120	120	122	122
Drill	114	100	4	5	5	6	7	120	121	121	122	122
Grader	108	90	2.5	3.5	3.5	4.5	5.5	112	113	113	115	115
Total Fleet			57	69	74	80	92	132	133	133	134	134

5.5 Predicted Mining Noise Levels

Noise levels from Bengalla have been modelled for representative operating scenarios, time periods and weather conditions. Noise contour figures showing predicted noise levels under prevailing weather conditions have been produced for years 1, 4, 8, 15 and 24 under neutral and prevailing weather conditions.

Table 13 summarises predicted worse case noise levels from the Project based on the detailed noise level tables presented in Appendix C. Shading in Table 13 indicates residences or properties that would be potentially affected by noise from the Project, based on a comparison with the noise criteria. Residences and properties that are owned by a mining company or the Crown, or that are subject to a private agreement with BMC, have been excluded from the table. A dash (-) indicates a residence does not exist on the property.

Residences or properties predicted to receive less than the criteria have generally been excluded from Table 13. Where more than one residence or property is owned by one landowner, and one or more of those residences or properties are expected to receive a noise level over the criterion, all residences and properties owned by that landowner have been included in the table. Noise levels at assessed residences or properties that have been excluded from the table, and noise levels for each assessed year, are shown in the more detailed tables in Appendix C.

Table 13: Predicted Operational Noise Levels, LAeq,15min

Owner ID	Residences				25% of Property Areas			
	Block ID	Day	Day/ Evening	Night	Block ID	Day	Day/ Evening	Night
		Neutral	Prevailing			Neutral	Prevailing	
Eastern receivers subject to 38 day / 37 evening / 36 night LAeq,15min noise criteria								
10	19	24.7	37.0	33.8	19-21,25,26	24.5	37.2	33.8
	25	24.6	37.6	34.0				
11	22	24.9	37.5	34.0	22	24.9	37.6	34.0
12	23	25.0	37.8	34.1	23	25.0	37.9	34.1
13	24	25.0	37.9	34.1	24	25.1	37.9	34.1
14	27E	24.4	36.9	33.6	27,28	25.2	38.6	34.4
	27W	25.2	38.7	34.3				
15	29	30.6	37.6	34.5	29	30.6	37.5	34.5
25	43	32.1	37.6	35.2	43	31.9	37.6	35.1
26	44	32.3	37.9	35.2	44	32.2	38.4	35.2
44	64	32.3	33.1	35.7	64	35.3	36.4	37.1
46	66	31.6	32.0	35.7	66	36.1	36.5	38.3
Other receivers subject to 35 day / 35 evening / 35 night LAeq,15min noise criteria								
70	-	-	-	-	99,100	20.4	21.2	35.2
71	-	-	-	-	101	20.4	21.8	35.7
72	102	21.7	21.7	36.4	102	21.1	21.9	36.4
74	105	23.1	23.1	37.9	104,105	24.6	24.6	38.2
75	106	24.9	24.9	39.4	106,108	25.7	25.7	39.2
	108	23.7	23.7	39.0				
76	-	-	-	-	109	24.5	24.5	39.8
77	110N	23.1	23.5	40.2	110,111	23.8	23.8	40.3
	110S	24.3	24.3	39.9				
78	112N	24.3	24.8	41.7	112,113	25.5	25.5	41.9
	112S	25.7	25.7	40.4				
	113	26.0	26.0	41.0				
79	114	26.7	26.7	41.7	114	26.5	26.5	43.0
81	117	28.5	28.5	42.1	117	29.1	29.1	44.4
82	118	29.7	29.7	44.4	118,119	30.3	30.3	45.1
	119	29.9	29.9	42.7				
83	120	25.7	27.5	41.2	120,122,147,148	25.5	29.7	40.0
84	-	-	-	-	121,125	23.4	27.1	38.3
86	126N	21.2	25.6	37.6	126	21.1	25.1	37.7
	126C	20.6	24.5	36.6				
	126S	19.9	23.8	35.9				
87	130	19.3	22.8	35.7	127,130	20.2	22.8	36.7

Owner ID	Residences				25% of Property Areas			
	Block ID	Day	Day/ Evening	Night	Block ID	Day	Day/ Evening	Night
		Neutral	Prevailing			Neutral	Prevailing	
91	145	21.4	26.6	36.3	145	21.5	26.7	36.4
92	146	21.5	26.5	37.4	146	22.6	28.7	36.8
95	152	35.7	44.5	44.6	152	28.3	36.9	37.8
96	153	30.8	39.8	42.1	153	29.1	36.3	39.6
97	154	33.4	41.9	42.6	154	32.1	40.8	42.4
98	155	37.8	44.9	45.4	155	31.7	36.6	40.7
99	156E	40.1	47.3	46.7	156,157	35.0	44.3	43.9
	156C	36.6	45.2	45.0				
	156W	28.2	39.7	39.4				
101	161	26.0	39.6	34.1	159-165,186,187,190,191	25.7	38.7	35.3
	186N	21.0	37.2	35.2				
	186S	20.9	35.5	34.1				
102	166	30.8	41.3	37.6	166	29.6	40.5	36.8
103	-	-	-	-	167	24.7	38.7	34.8
104	168	40.0	48.1	45.7	168-170,174,175	27.6	39.9	35.7
	169	27.8	39.5	34.8				
105	171	29.6	42.9	39.8	171-173,217	23.8	36.7	33.5
106	180	21.4	37.3	34.4	176-182,185	22.6	38.4	35.9
107	184	21.3	37.8	35.7	183,184,188	21.7	38.1	35.8
108	189	20.8	35.8	34.7	189,193	20.6	35.4	34.4
122	-	-	-	-	211	23.5	25.5	40.2
Contour Figure		A16	A17	A18	-	A16	A17	A18
Total Affected Residences/ Properties [1]		1	5	6	Significant	0	3	4
		0	6	8	Moderate	0	4	7
		2	7	7	Mild	0	8	10

Orange shading – a significant noise impact of more than 5 dBA above the 35 LAeq,15min intrusive criteria;
Blue shading – a moderate noise impact of 2 to 5 dBA above the 35 LAeq,15min intrusive criteria;
Green shading – a mild noise impact of 2 dBA or less above the 35 LAeq,15min intrusive criteria; and
Grey Shading – the property is currently subject to acquisition by a mining company upon request by the landowner.

1 The totals exclude affected residences and properties that are currently subject to acquisition by a mining company.

Results in Table 13 indicate seven residences (110 North, 152, 153, 154, 156 East, 156 Centre and 166) and one small unoccupied property (211), owned by seven landowners, would be significantly affected by noise levels more than 5 dBA above the intrusive criteria during reasonable worst case operating and weather conditions, excluding residences and properties that are currently subject to acquisition by another mining company. Owners of significantly affected residences also own two moderately affected residences (110 South and 156 West).

An additional nine residences (105, 106, 108, 126 North, 146, 161, 180, 184 and 186 North) and three properties (109, 121 and 125, 167), owned by ten landowners, would be moderately affected by noise levels 2 to 5 dBA above the intrusive noise criteria during reasonable worst case operating and weather conditions, excluding residences and properties that are currently subject to acquisition by another mining company. Owners of moderately affected residences also own three mildly affected residences (126 Central, 126 South and 186 South).

An additional nine residences (22, 23, 24, 25, 29, 102, 108, 130, 145) and two unoccupied properties (99 and 100, 101), owned by eleven landowners, would be mildly affected by noise levels up to 2 dBA above the intrusive noise criteria during reasonable worst case operating and weather conditions, excluding residences and properties that are currently subject to acquisition by another mining company.

Detailed review of the results in Table 13 indicates some receivers are more affected by prevailing weather conditions than others. For example, receivers located generally to the south west of the Project would remain substantially unaffected by the prevailing south easterly wind during the day/evening period but would receive significantly enhanced noise during the night due to the combined temperature inversion and ENE drainage flow. Noise levels would therefore change substantially from the day to the night as temperature inversions begin to form and drainage flows develop. Day noise levels under prevailing weather conditions are therefore similar to noise levels under neutral weather conditions to receivers located generally to the south west.

In contrast, receivers located generally to the north west of the Project would receive significant noise enhancement due to the prevailing south easterly winds during the day and evening and a similar level of noise enhancement from a temperature inversion during the night. Depending on weather conditions from time to time, receivers in this area would not experience a large difference in noise level from day to night.

Noise levels at residences owned by mining companies have also been calculated and are shown in Table C3 in Appendix C.

5.6 Noise Levels to Livestock

Noise levels from the Project would be audible over areas of grazing land owned by BMC and private landowners. Predicted noise levels experienced by livestock would vary from time to time depending on the location of the livestock within each grazing property, however the noise levels over 25 % of each property area listed in Table 13 provide an indication of typical noise levels that would be experienced by livestock. In general, livestock located in an area of a property closest to the Project would experience slightly higher noise levels than shown in Table 13, while livestock in more remote areas of a property would experience noise levels lower than the levels shown in the table.

BMC has operated dairy farms and grazed other livestock on land adjacent to the existing Bengalla mine since purchasing the land up to 18 years ago. Based on BMC's previous experience, livestock on privately owned grazing properties are unlikely to be affected by noise from the Project.

5.7 Additional Noise Control Options

A significant focus of this assessment has been to identify noise control options, including current noise control practices, that have the potential to offer lower noise levels at receiver properties. Adopted noise control and management options are discussed in Section 5.3. Additional noise control options, beyond the recommended and proposed options listed in Section 5.3, were considered but have not been adopted due primarily to the technical limitations of each option.

- Further noise control measures for mobile mining equipment may be possible with future technology, however the proposed noise control measures represent current best practice. Further noise reductions from mobile equipment are not considered technically feasible with current technology; and
- Additional noise bunds around the mining area would not be acoustically effective due to the elevated location of nearest receivers west of the mining area. In addition, as mining progresses to the west, any bunds constructed west of the mining area to shield closest receivers would be consumed by active mining in a relatively short time. Additional noise associated with construction of the bunds is unlikely to be offset by any minor and short term reductions in operating noise levels, therefore noise bunds are technically impractical for this Project.

This discussion shows all feasible noise control and management measures, in the absence of additional promising noise control strategies that may be developed in the future, have been considered and implemented for the Project.

6 SLEEP DISTURBANCE

6.1 Noise Sources

The Project includes continuation of an existing coal mine, involving a number of diesel powered machines operating to remove overburden and extract coal. Most machines, such as trucks, have very little potential to produce a noise character that is likely to disturb sleep. Other machines such as draglines and dozers can produce intermittent louder noise depending on working conditions, machine condition and operator actions. Other sources of potential sleep disturbance include raw coal being deposited from an excavator or loader bucket into a truck, from a truck or loader into the ROM hopper and CHPP equipment start alarms.

The dragline can produce significant impact noise if the spreader bar and drag chains impact the bucket while discharging material. The chance of such an event occurring can be minimised by suitable operator training, however some impact noise may nevertheless occur occasionally.

Tracked dozers generally work in the forward direction, either pushing material with the blade or ripping hard ground with the rear-mounted ripping tines. Forward operation, particularly under load, tends to produce noise from the engine and exhaust but very little noise from the tracks. As a dozer reverses, however, lack of tension in the rear section of the tracks tends to cause them to impact idlers between the drive sprocket and the rear wheel. All existing dozers have had the fastest reverse gear disabled to minimise track noise, which makes second gear the fastest reverse gear available.

The original ROM hopper was located at the eastern boundary of the mining area. This hopper was a conventional single skin steel lined vessel which tended to produce significant impact noise when material was deposited from a truck into the nearly empty bin. Noise from the hopper was minimised when required, typically during the sensitive night period, by ensuring the bin remained at least half full to reduce the material fall distance and dampen vibration in the hopper walls.

BMC constructed a new ROM hopper adjacent to the CHPP in 2008-2009 then decommissioned and removed the original hopper. The new hopper is constructed with double skin steel walls and the void between the skins has been filled with sand to dampen vibration in the hopper walls. According to noise and vibration measurements for both hoppers reported in *Bengalla Mining Company ROM Hopper Noise and Vibration Assessment* (Global Acoustics, 2009), the double skin construction of the new hopper resulted in a reduction of approximately 20 dBA in maximum noise level compared to the original hopper. The proposed relocated ROM hopper to be constructed in approximately Year 4 would include a similar level of noise control as the existing hopper.

CHPP start alarms, or audible warnings that are generated approximately 30 seconds before equipment such as sizers or conveyors are operated, are required to reduce the risk of operator injury and equipment damage due to unsupervised or automatic equipment control. The equipment alarms have been designed and constructed to minimise environmental noise levels, by installing a larger number of quieter alarms at smaller intervals along the conveyors, and are currently generally inaudible or at worst barely audible at any receiver. Alarms installed on new CHPP equipment would be similar to the existing alarms.

The rail loop was designed to maintain some tension in the train wagon couplings during the loading cycle, which normally avoids coupling noise as train speeds change. The rail loadout system has also been designed to load the train continuously, with no starting and stopping required. It is nevertheless possible that a train must stop and start on the loop and train wagon coupling noise or train bunching has been included as a possible source of sleep disturbance. The following maximum sound power levels have therefore been adopted for the sleep disturbance model:

Dragline bucket impacts	130 dBA at a height of 25 m above the ground;
Material into an empty truck body	120 dBA at a height of 5 m;
Dozer tracks in reverse (second gear)	122 dBA at a height of 1 m;
ROM hopper raw coal impacts	110 dBA at the top of the ROM bin;
CHPP start alarms	115 dBA at 2m above the ground; and
Train wagon bunching	127 dBA at 1m above the rail loop.

This discussion indicates a number of noise sources can produce potentially audible maximum noise levels, despite continuation of existing management measures to avoid many of these sources. A theoretical worst case sleep disturbance assessment has been completed based on the following strategy:

- Include all potential noise sources, at representative locations, in the noise model, which represents a theoretical worst case assessment given the existing management measures in place to avoid or minimise many of these sources;
- Calculate the maximum noise level produced by any source, rather than the sum of all sources; and
- Add the calculated maximum noise level to predicted LAeq,15min noise levels from Figure A15, on the basis that any maximum noise level events would occur in conjunction with normal operation of the Project.

6.2 Maximum Noise Levels – No Mitigation

Sleep disturbance noise contours produced by the adopted assessment strategy are shown in Figure A25 in Appendix A. A maximum noise level of 45 LA1,1min or slightly higher is predicted at Residence 156, with slightly lower noise levels predicted at Residences 118 and 155. All of these residences are also expected to receive significant operational noise impacts, as discussed in Section 5.5 and shown in Table 13. All other privately owned residences are expected to receive noise levels within the sleep disturbance criteria.

Maximum noise levels of just over 55 LA1,1min are also predicted at one residence owned by Coal & Allied Operations Pty Limited for the Mount Pleasant Project and noise levels in the range 45 to 51 LA1,1min are predicted at a number of residences owned by HVEC near Denman Road. Consultation with the owners of these residences is recommended to resolve any issues.

Noise management plans for mining and coal processing would continue to include best practise management measures to avoid or minimise potential sources of sleep disturbance impacts. The predicted maximum noise levels in Figure A25 should therefore occur rarely.

7 CONSTRUCTION NOISE

7.1 Proposed Construction Activities

The Project includes a number of modifications and additions to existing infrastructure. Construction activities with the potential to produce audible noise include:

- An additional ROM coal stockpile located generally east of the existing ROM hopper, assumed to occur in Year 1;
- An additional raw coal stockpile located generally north of the existing raw coal stockpile, to be constructed in Years 1 and 2;
- Various additions to the stores, administration, bathhouse and workshop buildings and carpark in Years 1 and 2;
- Relocation of the reject bin and associated conveyors and transfer stations in Years 1 and 2;
- A series of clean water dams to the north and west of the mining area as and when required, including a temporary pumping station and pipeline to carry diverted water from Dry Creek in Years 1 and 2;
- Extensions to the coal preparation plant in Year 2;
- Modifications to the rail loadout conveyors, assumed to occur in Year 2;
- Relocation of the existing ROM hopper and construction of associated conveyors, sizing station and transfer station in Year 3;
- Realignment of a section of the Bengalla Link Road in approximately Year 15 to avoid the proposed mining area; and
- Reinstatement of Dry Creek in approximately Year 17.

7.2 Construction Noise Sources

The earthmoving phase of the construction program is expected to require a number of diesel powered machines such as excavators, trucks, dozers, rollers and graders. This assessment assumes the same earthmoving fleet would move from one construction activity to the next, rather than multiple fleets operating in all activity areas simultaneously, with some machines not required to work in areas requiring a relatively minor amount of earthworks.

Certain construction activities, such as upgrading the rail loadout conveyors, are not expected to require significant earthworks. Additional noise sources have been included in the construction noise model in the vicinity of the proposed product stockpile, the preparation plant extension and the train loadout conveyors, to represent the CHPP upgrade projects that do not include a significant earthmoving component.

Table 14 shows the proposed earthworks and installation fleets, assuming all machines in each fleet operate continuously at full power to present a worst case assessment.

Normal operation of the Project includes rehabilitation of earlier sections of the OEA. Reinstatement of Dry Creek, through the approximate centre of the Project, would be undertaken primarily using mine rehabilitation equipment and processes to form the new creek channel. Minor additional work may be required to correctly shape or line the new creek bed, however such work is unlikely to require additional equipment or produce a greater noise level than the typical rehabilitation fleet. Considering the proposed Dry Creek alignment does not run close to any sensitive receiver compared to the active mining area in later years, reinstatement of Dry Creek has not been specifically included in the construction noise model.

Table 14: Proposed Construction Fleets and Sound Power Levels.

Indicative Construction Fleet		Sound Power Level, LAeq	
Machine	Number in Fleet	Per Machine Type	Total
Large Earthworks Fleet			
Articulated truck	4	116	127
Scraper	2	119	
Grader	2	112	
Excavator	2	117	
Backhoe	2	106	
Roller	2	110	
Flat bed truck	1	106	
Fuel truck	1	106	
Water cart	2	106	
Small Earthworks Fleet			
Articulated truck	2	116	122
Grader	1	112	
Excavator	1	117	
Backhoe	1	106	
Roller	1	110	
Water cart	1	106	
Pipeline Installation Fleet			
Small excavator	1	112	115
Backhoe	1	106	
Water cart	1	106	
Truck	2	106	
CHPP Upgrade, Installation Fleet			
Mobile crane	2	108	121
Flat bed or concrete truck	4	106	
Compressors, welders	4	108	
Grinders, impact wrenches	2	115	

7.3 Construction Noise Assessment

Noise levels for this worst case construction scenario have been calculated using the Project noise model for years 1, 4 and 15, as shown in Table 15.

Table 15: Modelled Construction Noise Sources

Model Year	Construction Year	Construction Activity	Modelled Construction Fleet (Source code)
1	1	ROM stockpile	Large earthmoving (LE)
	1 and 2	Raw stockpile	Large earthmoving (LE)
	1 and 2	Various buildings	Upgrade/Installation (UI)
	1 and 2	Reject system	Upgrade/Installation (UI)
	1 and 2	Various dams	Small earthmoving (SE)
	1 and 2	Dry Creek diversion	Pipeline Fleet (PL)
	2	CHPP extension	Upgrade/Installation (UI)
	2	Rail loadout system	Upgrade/Installation (UI)
4	3	ROM hopper	Large earthmoving (LE)
15	15	Bengalla Link Road realignment	Large earthmoving (LE)

Modelled noise source locations are shown in Figures B6 to B8 in Appendix B for years 1, 4 and 15 respectively. As multiple mining related construction activities are not expected to occur concurrently, maximum construction noise levels from the loudest activity have been adopted for years 1 and 4 rather than the sum of noise levels from all modelled activities in each year. Construction work associated with the Bengalla Link Road would tend to occur in a number of areas simultaneously. The construction fleet has therefore been distributed along the road alignment and the noise contours represent the sum of all construction sources.

Resulting construction noise levels were then added to the Year 1, 4 and 15 day neutral and day prevailing noise levels, as normal mining activity is expected to continue during all construction periods.

The final construction noise contours are shown in Figures A19 to A24 in Appendix A, while predicted construction noise levels are shown in Table 16. Residences omitted from Table 16 are predicted to receive construction noise levels below 36 LAeq,15min (for eastern residences) or 35 LAeq,15min (for south western and western residences).

Table 16: Predicted Worst Case Construction Noise Levels to Residences, LAeq,15min

Owner ID	Residence	Predicted Daytime Noise Level, LAeq,15min					
		Mine-Related Construction				Bengalla Link Road Realignment Year 15	
		Years 1 and 2		Year 3			
		Neutral	Prevailing	Neutral	Prevailing	Neutral	Prevailing
1	2	25.8	37.6	19.9	36.2	18.3	33.1
	3	25.4	37.3	20.0	36.2	18.3	33.1
8	17	24.9	37.1	20.4	36.3	18.2	33.3
10	19	25.1	37.5	20.7	36.7	18.4	33.4
	25	25.1	38.1	21.4	37.1	18.6	33.5
11	22	25.4	38.0	21.1	37.1	18.5	33.5
12	23	25.5	38.3	21.2	37.2	18.6	33.6
13	24	25.5	38.3	21.3	37.2	18.6	33.6
14	27E	25.0	37.5	22.5	36.7	18.3	32.6
	27W	25.8	39.2	22.4	38.1	18.8	33.3
15	29	30.9	39.7	28.4	37.6	19.9	32.4
21	39	30.5	37.4	27.3	35.5	20.7	31.3
22	40	31.3	38.3	28.0	36.3	20.9	31.9
23	41	32.1	38.9	28.8	36.8	21.4	32.3
24	42	32.2	39.2	28.9	37.1	21.3	32.4
25	43	32.5	40.1	29.8	37.9	21.5	32.9
26	44	32.7	40.3	30.0	38.1	21.6	33.0
29	47	32.4	39.1	29.1	36.9	21.7	32.4
30	49	32.4	38.9	29.0	36.7	21.7	32.3
31	50	32.5	39.0	29.1	36.8	21.8	32.4
32	51	32.6	39.0	29.2	36.7	21.9	32.3
33	52	32.7	38.9	29.2	36.5	22.1	32.3
34	53	32.8	38.8	29.3	36.5	22.2	32.3
35	54	32.3	38.7	28.9	36.5	21.7	32.2
36	55	32.4	38.7	28.9	36.5	21.8	32.2
38	57	32.7	38.7	29.1	36.4	22.1	32.2
39	58	32.8	38.6	29.2	36.3	22.2	32.1
40	59	32.9	38.4	29.3	36.3	22.4	32.2
41	60	32.9	38.2	29.4	36.2	22.5	32.2

Owner ID	Residence	Predicted Daytime Noise Level, LAeq,15min					
		Mine-Related Construction				Bengalla Link Road Realignment Year 15	
		Years 1 and 2		Year 3			
		Neutral	Prevailing	Neutral	Prevailing	Neutral	Prevailing
120	48	32.4	39.0	29.0	36.8	21.7	32.3
93	149N	23.3	35.5	21.6	31.1	26.4	31.4
	149C	23.0	34.2	21.4	30.9	26.3	31.5
	149S	23.6	33.0	22.6	31.0	27.4	31.5
95	152	33.9	46.4	33.2	42.2	46.3	51.5
96	153	33.8	43.6	30.7	42.7	38.4	45.5
97	154	32.6	46.7	31.8	41.7	40.9	47.5
98	155	35.6	48.4	34.7	42.1	49.1	51.0
99	156E	39.2	49.7	35.9	44.9	54.7	57.4
	156C	36.7	46.6	34.1	42.4	49.5	53.4
	156W	27.5	43.7	26.6	36.8	35.7	43.9
101	161	24.5	41.6	23.1	36.3	35.1	44.8
	186N	18.0	38.9	16.9	33.4	30.0	42.0
	186S	17.7	36.7	16.6	32.4	29.4	41.3
102	166	29.9	41.4	25.2	37.8	49.6	54.9
104	168	33.9	43.8	30.7	41.5	39.5	50.5
	169	25.3	40.7	22.9	36.8	43.4	53.2
105	171	26.8	41.4	23.5	38.7	38.6	46.2
106	180	18.7	38.6	17.7	34.9	30.4	42.9
107	184	18.6	37.9	17.3	35.4	29.7	42.2
108	189	18.0	35.7	17.0	32.8	29.0	39.8
109	192	17.9	35.9	16.4	30.7	25.5	36.0
Noise Contour Figure		A19	A20	A21	A22	A23	A24
Noise Criteria		On-Site Construction Work, Subject to Operational Criterion 35 LAeq,15min				Off-site Construction Work Subject to 'Noise Affected' Construction Criterion, 40 LAeq,15min	

Orange shading – a significant construction noise impact of more than 10 dBA above the operational criteria;
Blue shading – a moderate construction noise impact of 5 to 10 dBA above the operational criteria;
Green shading – a mild construction noise impact of 5 dBA or less above the operational criteria;
Yellow shading - an exceedance of the 'noise affected' construction noise criterion in Year 15;
Grey Shading – the property is currently subject to acquisition by another mining company upon request by the landowner; and
Pink Shading – the property is predicted to be significantly affected by operational noise from the Project as shown in Table 13.

7.3.1 Construction in Years 1 and 2

Results in Table 16 for mine-related construction activity in Years 1 and 2 indicate 19 residences in the vicinity of Racecourse Road and an additional 2 residences located generally west of the Project would receive mild noise impacts from combined operational and construction noise, excluding residences predicted to receive operational noise impacts and residences subject to acquisition by a mining company.

The dominant source of construction noise to the majority of affected receivers would be works associated with the clean water dams and Dry Creek diversion pipeline near the Project Boundary.

7.3.2 Construction in Year 3

Results in Table 16 for mine-related construction activity in Year 3 indicate one residence (24) would receive combined operational and construction noise levels to an insignificant 0.1 dBA above the intrusive criterion, excluding residences predicted to receive operational noise impacts and residences subject to acquisition by a mining company.

7.3.3 Construction in Year 15

Results in Table 16 for Bengalla Link Road Realignment work in Year 15 indicate 16 residences would receive construction noise levels above the 'noise affected' criterion recommended by the ICNG under prevailing weather conditions. All 16 residences are also predicted to be impacted by operational noise from the Project or are subject to acquisition from a mining company, therefore no additional residences are predicted to be affected by construction noise in Year 15.

The ICNG recommends all feasible and reasonable noise mitigation and management measures be implemented to minimise construction noise levels at affected residences.

7.4 Construction Noise Control Recommendations

Predicted construction noise levels have been calculated in the absence of noise mitigation measures to identify potentially affected receivers and dominant construction activities. The assessment indicates the majority of residences that are potentially affected by construction noise are also either potentially affected by operational noise or are already subject to acquisition by another mining company. Predicted construction noise levels are therefore considered generally acceptable, however it would be appropriate to consider all feasible and reasonable construction noise management measures as part of the revised BMC Noise Management Plan.

The following noise management measures should be considered to minimise construction noise levels, particularly during prevailing weather conditions:

- The revised Noise Management Plan should describe the proposed construction activities, including proposed construction hours for each activity. Particular emphasis should be placed on any evening and night construction work, should such work be required. The plan should outline procedures to identify machines and activities that could produce audible noise at any privately owned residence and, where possible, to avoid or reduce noise levels from those machines or processes to result in the lowest practical noise levels at receivers;
- Time restrictions may be required, and should be considered in the Noise Management Plan, for particularly noisy activities such as rock hammering or concrete cutting that may occasionally be required; and
- Communication protocols and response protocols should be developed to minimise the potential for ongoing exceedances of the noise criterion. Existing real time noise monitoring equipment is expected to provide valuable noise data during the construction period.

8 ROAD TRAFFIC NOISE

Noise levels from vehicles travelling within the Project are included in the noise model, while noise from Project-related vehicles travelling on public roads such as Denman Road is assessed in this section.

8.1 Operational Traffic Noise Assessment

Data regarding existing and proposed traffic flows on public roads in the vicinity of the Project are available in the *EIS Traffic and Transport Impact Assessment* (DC Traffic Engineering, 2012). Additional data have been sourced from *Traffic Impact Assessment of Bengalla Link Road Stage 2* (2007 Traffic Assessment), (Parsons Brinckerhoff, October 2007) which was included as Appendix F of *Bengalla Mine Development Consent Modification Environmental Assessment* (Hansen Bailey, March 2008).

Data regarding existing traffic flows, including existing Bengalla traffic, and proposed additional traffic flows due to the Project, are shown in Table 17.

Table 17: Existing and Proposed Daily Traffic Flows, 2013 and 2028

Assessed Road	Traffic Flows, Vehicles per Day, by Year				
	Existing		Project Additional	Proposed Totals	
	2013	2028	2013 and 2028	2013	2028
Denman Road North	6700	11830	185	6885	12015
Denman Road South	1500	2640	25	1525	2665
Bengalla Link Road East	830	2240	330	1160	2570
Bengalla Link Road West	280	1240	130	410	1370
Wybong Road West	1000	1250	130	1130	1380

Calculated traffic noise levels associated with the existing and proposed traffic flows are shown in Table 18 compared to the 60 LAeq,15hr day and 55 LAeq,9hr night criteria.

Table 18: Existing and Proposed Operational Traffic Noise Levels, LAeq

Closest Receivers	Assessed Road	Distance, m	Scenario	Traffic Flows		Noise Levels	
				2013	2028	2013	2028
Various in Muswellbrook	Denman Rd Nth	15	Existing	6700	11830	63.4	65.8
			Project	185	185	47.8	47.8
			Proposed	6885	12015	63.5	65.9
240 Denman Road (Residence 62)	Denman Rd Nth	45	Existing	6700	11830	57.3	59.8
			Project	185	185	41.7	41.7
			Proposed	6885	12015	57.4	59.8
405 Denman Road (Residence 66)	Denman Rd Nth	40	Existing	6700	11830	57.9	60.4
			Project	185	185	42.4	42.4
			Proposed	6885	12015	58.1	60.5
532 Denman Road (HVEC)	Denman Rd Sth	30	Existing	1500	2640	54.9	57.3
			Project	25	25	37.1	37.1
			Proposed	1525	2665	54.9	57.3

Closest Receivers	Assessed Road	Distance, m	Scenario	Traffic Flows		Noise Levels	
				2013	2028	2013	2028
532 Denman Road (HVEC)	Bengalla Link Rd East	660	Existing	830	2240	30.9	35.2
			Project	330	330	26.9	26.9
			Proposed	1160	2570	32.4	35.8
120 Roxburgh Road (Residence 158)	Bengalla Link Rd West	790	Existing	280	1240	24.2	30.7
			Proposed	130	130	20.9	20.9
				410	1370	25.9	31.1
1319 Wybong Road (Residence 166)	Wybong Rd West	60	Existing	1000	1250	61.0	62.0
			Project	130	130	52.2	52.2
			Proposed	1130	1380	61.6	62.4
1550 Wybong Road (Residence 184)	Wybong Rd West	70	Existing	1000	1250	60.2	61.1
			Project	130	130	51.3	51.3
			Proposed	1130	1380	60.7	61.6

Red shading – calculated traffic noise level exceeds the day criterion.

Green shading - calculated traffic noise level exceeds the night criterion.

Purple Shading – the property is currently subject to acquisition by another mining company upon request by the landowner.

Calculated traffic noise levels listed in Table 18 indicate Project-related traffic is expected to contribute 1.5 dBA or less to total traffic noise levels at all residences. Closest Muswellbrook residences to Denman Road would continue to receive traffic noise levels over the criteria during the day and night, while closest rural residences to Denman Road would receive traffic noise levels close to or marginally over the day noise criterion and up to 5.5 dBA over the night noise criterion.

Traffic noise levels from Bengalla Link Road would be within relevant noise criteria, while Wybong Road traffic noise levels would exceed the day and night noise criteria at closest residences to the road.

8.2 Construction Traffic Assessment

Up to 325 construction staff are expected to be required in Year 2, with the majority of staff travelling via private car. A worst case assessment is based on 200 car movements to the Project during the 6 am to 7 am morning peak and 200 car movements from the Project during the period 4 pm to 6 pm. An average of 20 construction related truck movements per day are also assumed to occur, with 6 of the 20 movements assumed to occur in the morning peak.

Calculated traffic flows and traffic noise levels associated with the construction period are shown in Table 19, with all truck traffic and the majority of construction related car traffic assumed to travel via Denman Road and Bengalla Link Road.

Calculated construction traffic noise levels listed in Table 19 indicate a maximum increase of 2.9 dBA should be expected at any receiver as a result of construction related traffic. Given the relatively short term nature of construction traffic, the predicted noise level increases are not expected to be significant.

Table 19: Existing and Proposed Construction Traffic Noise Levels, LAeq

Closest Receivers	Assessed Road	Distance, m	Scenario	Traffic Flows	Noise Levels
				2013	2013
Various in Muswellbrook	Denman Road Nth	15	Existing	6700	63.4
			Project	370	53.7
			Proposed	7070	63.8
240 Denman Road (Residence 62)	Denman Rd Nth	45	Existing	6700	57.3
			Project	370	47.6
			Proposed	7070	57.7
405 Denman Road (Residence 66)	Denman Rd Nth	40	Existing	6700	57.9
			Project	370	48.3
			Proposed	7070	58.4
532 Denman Road (HVEC)	Denman Rd Sth	30	Existing	1500	54.9
			Project	40	42.1
			Proposed	1540	55.1
532 Denman Road (HVEC)	Bengalla Link Rd East	660	Existing	830	30.9
			Project	410	30.7
			Proposed	1240	33.8
120 Roxburgh Road (Residence 158)	Bengalla Link Rd West	790	Existing	280	24.2
			Project	10	28.8
			Proposed	290	30.1
1319 Wybong Road (Residence 166)	Wybong Rd West	60	Existing	1000	61.0
			Project	10	44.1
			Proposed	1010	61.6
1550 Wybong Road (Residence 184)	Wybong Rd West	70	Existing	1000	60.2
			Project	10	43.2
			Proposed	1010	60.7

Red shading – calculated traffic noise level exceeds the day criterion.

Green shading - calculated traffic noise level exceeds the night criterion.

Purple Shading – the property is currently subject to acquisition by another mining company upon request by the landowner.

8.3 Traffic Noise Control

The operational traffic noise assessment, based on predicted traffic flows in 2013 and 2028, indicate traffic noise levels are likely to exceed relevant noise criteria at closest suburban and rural residences to Denman Road north of Bengalla Link Road. Traffic associated with the Project represents approximately 21 % of all traffic on Denman Road in that area which is a significant but not a dominant influence.

Minor exceedances of the criteria are also predicted at a small number of other rural residences, although in most cases these residences are also significantly affected by mining noise from one or more coal mines in the region.

It is not considered appropriate to require a mining company to address calculated exceedances of the road traffic noise criteria at Denman Road residences, given the relatively low Project-related contribution to total noise levels experienced by these residents. BMC would, however, willingly contribute to an investigation and action by a relevant authority such as Roads and Maritime Services or Muswellbrook Shire Council in conjunction with other mining companies in the region and in proportion to each company's contribution to traffic flows on Denman Road.

9 RAIL TRAFFIC NOISE

Noise levels from train movements on the Ulan Line and the Main Northern Line are subject to the criteria described in Section 4.6 and are assessed separate to noise from train movements on the rail loading loop.

9.1 Ulan Line

A detailed assessment of noise from train movements on the Ulan Line requires data regarding the average and maximum number of train movements per day that currently occur on the railway and the location of all potentially affected residences along the route. The *2012-2021 Hunter Valley Corridor Capacity Strategy* (Australian Rail Track Corporation (ARTC), 2012) includes the following data regarding train movements on the eastern end of the Ulan Line from the Project to Muswellbrook:

- One or two country ore and grain trains per day;
- Occasional interstate freight trains bypassing Sydney during track maintenance periods;
- 27 Mtpa of coal, equivalent to 9.3 trains or an average of 19 coal train movements per day at an average capacity of 7921 tonnes of coal per train, from Bylong to Mangoola; and
- 5 Mtpa of coal from the existing Bengalla Mine, equivalent to 1.8 trains or an average of 3.5 coal train movements per day at an average capacity of 7700 tonnes of coal per train,

A total of 23 coal train movements and 2 other train movements are therefore considered on the existing Ulan Line. The Project would require approximately 1540 trains per year, or an average of 8.3 train movements per day, to transport approximately 12 Mtpa of product coal to the Port of Newcastle. Subtracting existing Bengalla train movements results in the Project generating an average of 5 additional train movements per day, based on an average of 7700 tonnes of coal per train.

The Project would result in a 17 % increase from 25 to 30 trains per day which is approximately equivalent to an average noise level increase of 0.7 LAeq,24hr at receivers from the Project to Muswellbrook.

9.2 Main Northern Railway

The Main Northern Railway from Muswellbrook to Newcastle carries rail traffic from both the Ulan Line and the remainder of the Main Northern Railway from Werris Creek to Muswellbrook. According to ARTC data, the Main Northern Railway north of Muswellbrook carries the following daily train movements:

- Cityrail passenger services to and from Scone, although these small passenger trains do not contribute significant noise compared to longer and heavier freight and coal trains;

- Countrylink services to and from Moree and Armidale, for a total of 4 train movements per day through Muswellbrook;
- Up to 10 grain, cotton and flour train movements per day, although these train movements only occur for a small proportion of the year; and
- 10 Mtpa of coal, equivalent to 5 trains or an average of 10 coal train movements per day at an average capacity of 5600 tonnes of coal per train, from Werris Creek to Scone.

A total of 14 regular train movements plus seasonal grain, cotton and flour train movements currently occurs on the Main Northern Railway north of Muswellbrook. The Main Northern Railway south east of Muswellbrook therefore currently carries 39 regular train movements from the combined Ulan Line and Main Northern Railway north of Muswellbrook. The Project would result in an 11 % increase from 39 to 44 regular train movements per day which is approximately equivalent to an insignificant noise level increase of just under 0.5 LAeq,24hr at receivers from Muswellbrook to Newcastle.

9.3 Future Train Movements

A number of other coal mine projects have been proposed or have recently received development approval. According to available data (ARTC, 2012), coal volumes are expected to:

- Increase from 27 Mtpa in 2012 to 60 Mtpa by 2022 on the Bylong to Mangoola section of the Ulan Line which would require 42 train movements per day at an average capacity of 7730 tonnes per train;
- Increase from 10 Mtpa in 2012 to 54 Mtpa by 2022 on the Werris Creek to Scone section of the Main Northern Railway which would require 51 train movements per day at an average capacity of 5825 tonnes per train; and
- Increase from 39 train movements to 104 movements per day south east of Muswellbrook, including 5 train movements per day associated with the Project and assuming no increase in grain, ore, freight and passenger trains in the same time period.

Additional train movements associated with projected coal volumes considered by the ARTC have been included in this rail noise assessment, although future train movements associated with other Projects do not represent Project-related noise impacts.

9.4 Predicted Rail Noise Levels

There are a number of residences between the Project and Muswellbrook located at various distances from the Ulan Line and the Main Northern Railway, excluding residences owned by or subject to acquisition by a mining company:

Project to Muswellbrook	Receiver 29 (154 Logues Lane) approximately 45 m south of the Ulan Line;
Within Muswellbrook	Closest cabin within the Riverside Cabin and Van Park, Mill Street Muswellbrook, approximately 13 m south of the Ulan Line; 8 Mill Street, approximately 185 m south of the Ulan Line; 2 Bridge Street, approximately 45 m south of the Ulan Line; Various Victoria Street residences, approximately 60 m north of the Main Northern Railway south east of the Ulan Line junction; and Closest cabin within the Pinaroo Leisure Park, New England Highway Muswellbrook, approximately 140 m south of the Main Northern Railway south east of the Ulan Line junction.

Calculated noise levels produced by existing train movements, existing plus Project related train movements and future plus Project related train movements are shown in Table 20 for comparison with the 65 LAeq,15hr day, 60 LAeq,9h night and 85 LAmax noise criteria.

Table 20 indicates the closest cabin within the Riverside Cabin and Van Park currently receives train noise levels over the average and maximum noise level criteria. All other residential receivers currently experience train noise levels within the day noise criteria and would continue to do so with proposed Project related rail traffic. Additional train movements associated with the Project would result in a train noise increase of approximately 0.7 LAeq,24hr at residences near the Ulan Line between the Project and Muswellbrook, and an increase of just under 0.5 LAeq,24hr at residences near the Main Northern Railway south east of the Ulan Line junction.

Table 20: Calculated Rail Traffic Noise Levels to Closest Receivers.

Receiver Area	Receiver, Distance	Predicted Noise Level					
		Existing 2012		Existing 2012 + Project		Future 2022 + Project	
		LAeq	LAmax	LAeq	LAmax	LAeq	LAmax
Project to Muswellbrook	154 Logues Lane, 45 m	58	79	59	79	61	79
Muswellbrook (Ulan Line)	Riverside Park Mill Street, 13 m	63	90	64	90	66	90
	8 Mill Street, 185 m	52	67	53	67	55	67
	2 Bridge Street, 45 m	58	79	59	79	61	79
Muswellbrook (Main Northern Railway)	Various Victoria Street, 60 m	59	76	59	76	63	76
	Pinaroo Leisure Park, 140 m	55	69	56	69	59	69

Red shading – calculated traffic noise level exceeds the day criterion.
Green shading - calculated traffic noise level exceeds the night criterion.

Future rail traffic, including additional train movements associated with other mining projects transporting coal via the Ulan Line and Main Northern Railway north of Muswellbrook, would result in exceedances of the current night noise criterion at the closest Logues Lane and Bridge Street residences and at approximately 15 of the closest Victoria Street residences. As future noise levels on or above the criterion would occur with or without additional rail traffic associated with the Project, it is not appropriate to require BMC to take specific action to mitigate noise levels at these receivers.

Maximum passby noise levels would not change as a result of the Project, as coal trains associated with the Project are assumed to produce the same maximum noise level as existing coal trains.

10 CUMULATIVE NOISE LEVELS

Noise levels from existing industrial sources including coal mines, operating in conjunction with the Project, have been assessed to potentially affected receiver properties and compared to the noise amenity criteria shown in Table 6. Other industrial developments with the potential to produce significant environmental noise include:

- Mount Pleasant Project to the north;
- Mangoola Coal Mine to the south west;
- Mt Arthur Coal Mine to the south;

- Muswellbrook Coal Mine to the east; and
- Dartbrook Underground Coal Mine (currently in care and maintenance) to the north east.

Project noise levels calculated in this assessment are LAeq,15min levels, which means the average noise level in a representative worst case 15 minute period including significant noise enhancement during the evening and night. As weather conditions tend to vary from time to time and would not remain strongly noise enhancing for an entire night, the average noise level over a night is lower than the LAeq,15min noise level.

A conservative correction factor of -3 dBA has been adopted to estimate LAeq,night noise levels from the reported LAeq,15min levels for all industrial noise sources including the Project. This correction factor acknowledges reasonable worst case LAeq,15min noise levels shown in Table 13, which are due to combined worst case operating and weather conditions, are unlikely to persist for an entire night.

10.1 Project Noise Levels

Noise levels from the Project have been determined from the predicted noise levels in Table 13, with a -3 dBA correction factor to determine LAeq,night noise levels.

10.2 Mount Pleasant Project

Noise levels from the Mount Pleasant Project were determined from the *Mt Pleasant Project Modification Environmental Assessment Report* (EMGA Mitchell McLennan, October 2010). Noise levels have been determined from Table 6.4 of the EMGA Report which contains predicted noise levels at potentially affected receivers under various weather conditions, including night prevailing conditions. A -3 dBA correction factor has been added to convert the reported LAeq,15min noise levels in the EMGA Report to LAeq,9hr amenity levels.

10.3 Mangoola Mine

Noise levels from operation of Mangoola Mine have been determined from *Modifications to Mangoola Coal Mine Plans and Relocation of 500 kV Electricity Transmission Line Environmental Assessment* (Umwelt Australia Pty Limited, December 2010) which includes *Mangoola Mine Modifications Noise and Vibration Assessment* (Wilkinson Murray, December 2010). Figure 2-1 in the Wilkinson Murray report shows the location of assessed receivers, while Appendix C of the Wilkinson Murray report shows calculated 10th percentile noise levels for the majority of assessed residences. Noise levels at residences not listed in the Appendix have been estimated from the noise contours in Figure 12.23 in Section 12 of the Umwelt Report. A -3 dBA correction factor has been added to convert the reported LAeq,15min noise levels to LAeq,9hr amenity levels.

10.4 Mt Arthur Coal Mine

Noise levels from Mt Arthur Coal Mine have been determined from *Mt Arthur Coal Consolidation Project Environmental Assessment* (Hansen Bailey, November 2009) including *Mt Arthur Coal Consolidation Project Noise and Blasting Impact Assessment* (Wilkinson Murray, October 2009).

Noise levels at all assessed residences except Residence 180 are listed in Appendix B to the Wilkinson Murray Report. Noise levels at Residence 180 have been extrapolated from the listed noise level for Residence 186 (Mt Arthur Coal Residence 257). A -3 dBA correction factor has been added to convert the reported LAeq,15min noise levels to LAeq,9hr amenity levels.

10.5 Muswellbrook Coal Mine

Noise levels from Muswellbrook Coal Mine have been determined from Environment Protection Licence 656 issued to Muswellbrook Coal Company Limited. Condition L2 of Licence 656 specifies the following noise criteria during the night:

- 36 to 40 LAeq,15min at receivers north of Muswellbrook Coal Mine;
- 35 LAeq,15min at closest Muswellbrook receivers; and
- 38 LAeq,15min at receivers south of Muswellbrook Coal Mine.

Noise levels from Muswellbrook Coal Mine would therefore be less than 30 LAeq,15min at the western side of Muswellbrook and less than 25 LAeq,15min (equivalent to 22 LAeq,9hr night) at receivers near the Project. Noise from Muswellbrook Coal Mine has therefore been excluded from the cumulative noise assessment.

10.6 Dartbrook Mine

Dartbrook Mine was an operating underground mine until it entered a care and maintenance phase in 2007. When operating, noise from the mine was subject to night criteria of 35 LAeq,15min at receivers near the Mine Infrastructure Area (MIA) and 41 LAeq,15min at receivers near the CHPP. The two closest receivers are located approximately 375 m and 570 m from the MIA.

As Dartbrook Mine is located over 6 kilometres from potential affected receivers near the Project, noise levels from a potentially reopened Dartbrook Mine would be less than 20 LAeq,15min, equivalent to 17 LAeq,9hr night. Noise from Dartbrook Mine has therefore been excluded from the cumulative noise assessment.

10.7 Cumulative Industrial Noise Levels

Cumulative industrial noise levels during night prevailing weather conditions, from the Project and other industrial developments, have been calculated for residences that:

- Are privately owned;
- Are predicted to receive at least 35 LAeq,15min (equivalent to 32 LAeq, 9hr night) from the Project;
- Are not predicted to be significantly affected by noise from the Project (ie shaded red in Table 13); and
- Are not currently subject to acquisition by a mining company.

Assessed residences were in some cases outside the area assessed by other mining companies, requiring noise levels at those residences to be extrapolated from available information. Extrapolated noise levels would be subject to some uncertainty, however in all cases the extrapolated noise levels were insignificant compared to noise from other coal mines and potential inaccuracies are therefore insignificant.

Table 21 shows calculated cumulative noise levels for comparison with the 40 LAeq,9hr night amenity criterion. The proportion of total cumulative noise levels contributed by the Project is shown in the last column of the table.

Table 21 shows the Project would be a major contributor to cumulative noise levels at most assessed residences, however all residences are expected to receive cumulative noise levels below the 40 LAeq,9hr night criterion. The Project would contribute typically 30% to 40%, but up to 70%, of total predicted noise levels at potentially affected residences.

Table 21: Cumulative Noise Levels, LAeq,9hr Night

Predicted Noise Level LAeq,9hr Night									Project Proportion
Project		Mount Pleasant		Mangoola		Mt Arthur		Cumulative Level	
ID	dBA	ID	dBA	ID	dBA	ID	dBA		
105	34.9	-	24 [1]	228	31	186	30	37	55 %
106	36.4	-	24 [1]	-	28 [1]	187	33	39	60 %
108	36.0	302	24	230	28	198	29	38	70 %
126N	34.6	-	28 [1]	241C	33	218N	31	38	43 %
126C	33.6	-	28 [1]	241B	33	218C	32	38	35 %
126S	32.9	-	28 [1]	241A	33	218S	32	38	32 %
130	32.7	-	24 [1]	240	32	216	31	37	38 %
146	34.4	-	26 [1]	182	33	232	31	38	43 %
161	31.1	262	32	-	28 [1]	248	27	36	32 %
186N	32.2	266	32	250	31	257	24	37	35 %
186S	31.1	266	32	250	31	257	24	36	29 %
180	31.4	267	32	248	28	-	23 [1]	36	36 %

1 Residence was not assessed by Mount Pleasant, Mangoola or Mt Arthur. Noise levels were determined from noise contour figures or required extrapolation from available data.

11 BLASTING

Blasting is proposed to occur at the rate of up to 12 blast events per week, during the currently approved hours of 7 am to 5 pm Monday to Saturday. Limited blasting is proposed between 11:00 am and 3:00 pm on Sundays when a scheduled blast is within 500 m of the infrastructure area. It is anticipated that blasting on Sundays will be undertaken at up to 1 blast event per day within 500 m of BMC infrastructure areas in accordance with Blast Management Plan to be developed in consultation with the relevant authorities and to the satisfaction of DP&I.

11.1 Existing Blast Levels

Ground vibration and overpressure levels are currently monitored at a total of 11 locations:

- Two control locations adjacent to the mining area;
- One monitoring location at the heritage listed Bengalla Homestead within the Project Boundary;
- Five monitoring locations at residences owned by BMC; and
- Three monitoring locations at privately owned residences.

Table 22 shows a summary of existing Bengalla blast monitoring results at the eight representative receiver locations for the years 2007 to 2011.

Data summarised in Table 22 indicates some exceedances of the vibration and overpressure criteria at mine owned receivers, particularly the 'Bates' monitor which is the closest location at approximately 1200 m from the active mining area. Closest blasts in Year 8 are expected to be approximately 700 m from this location which implies vibration and overpressure levels will increase above current levels at this location. The 'Bates' property is owned by Coal & Allied Operations Pty Limited.

Notes attached to the monitoring data indicate some or perhaps all of the overpressure exceedances at Property 87 may have been due to the effect of wind on the monitor's microphone, rather than actual overpressure. It is noted that, in general, the 'Scriven' monitoring location is closer to blast events than

Property 87, yet measured overpressure levels at the 'Scriven' location did not indicate any exceedances of the criteria in 2009.

Table 22: Summary of Blast Monitoring Results, 2007-2011

Location (Owner)	Year	Number of Events	Vibration Max. Level	Overpressure Max. Level	Exceedances of 5 mm/s and 115 dB
Mine Owned Residences					
'Collins' (BMC)	2007	172	0.8	114.7	0
	2008	188	0.8	115.4	1
	2009	180	1.1	116.2	1
	2010	26 [3]	0.7	109.4	0
	2011	108 [4]	0.7	114.6	0
'Boyle' (BMC)	2007	172	1.1	111.6	0
	2008	188	2.0	112.0	0
	2009	180	1.7	116.9	4
	2010	26 [3]	1.1	104.8	0
	2011	108 [4]	1.1	136.5 [2]	8
'Edinglassie' (HVEC)	2007	172	1.3	111.3	0
	2008	188	1.6	113.5	0
	2009	180	2.6	113.9	0
	2010	26 [3]	1.7	108.3	0
	2011	108 [4]	0.8	118.7	1
'Bates' (Mount Pleasant)	2007	172	3.7	123.1	11
	2008	188	6.5	122.7	13
	2009	180	6.4	120.0	21
	2010	26 [3]	2.1	120.1	6
	2011	108 [4]	5.0	128.4	15
'Scriven' (BMC)	2007	172	1.3	115.5	1
	2008	188	1.9	111.0	0
	2009	180	1.4	112.7	0
	2010	26 [3]	1.4	106.5	0
	2011	108 [4]	1.1	118.2	1
'Blake' (Mt Pleasant)	2007	172	0.8	114.2 [1]	0
	2008	188	0.7	113.1	0
	2009	180	0.6	111.5	0
	2010	26 [3]	0.4	111.0	0
	2011	108 [4]	0.4	111.3	0
Privately Owned Receiver Locations					
St James School, Skellatar Stock Route	2007	172	0.3	113.4	0
	2008	188	0.3	108.6	0
	2009	180	1.6	114.7	0
	2010	26 [3]	0.2	102.9	0
	2011	108 [4]	0.2	108.2	0

Location (Owner)	Year	Number of Events	Vibration Max. Level	Overpressure Max. Level	Exceedances of 5 mm/s and 115 dB
Property 87 (Webber)	2007	172	0.6	114.4	0
	2008	188	0.3	114.7	0
	2009	180	0.4	117.2	4
	2010	26 [3]	0.2	111.8	0
	2011	108 [4]	0.2	114.2	0

1 Excludes one event over 115 dB that was affected by wind noise on the monitor microphone.
2 Results inconsistent with other monitors, likely technical issue with this monitor.
3 Available data from 1 January to 26 Feb 2010 only.
4 Available data from 1 January to 8 August 2011 only.

The 'Edinglassie' monitoring location is approximately 1600 m from closest blast events and, with one exception in 2011, indicated ground vibration levels below 2.6 mm/s and overpressure levels below 113.9 dB. This indicates a setback distance of approximately 1470 m is appropriate to control blast effects from the Project.

11.2 Residences

All residences within 1470 m of Project mining areas are either:

- Mine owned; or
- Subject to acquisition by a mining company.

Previous blast monitoring results indicate residences at least 1470 m from blast events are unlikely to receive ground vibration levels over the 5 mm/s criterion or overpressure levels over the 115 dBL criterion. The closest remaining sensitive residence to the active mining area would be Residence 156, located approximately 1500 m from the proposed Year 24 active mining area. Exceedances of the blast criteria are unlikely to occur at Residence 156 and at other privately owned receivers located at a greater distance from the active mining area with the existing or an equivalent blast management system in place.

Existing blast monitoring locations were selected based on previous active mining areas. Two of the existing blast monitors (Property 87 'Webber' and 'Blake') are located at least 4500 m east of proposed active mining areas and should be relocated to more relevant monitoring locations generally west of the Project.

11.3 Heritage Buildings

A number of potentially sensitive heritage buildings are located in the vicinity of the Project. The EIA Heritage Assessment (AECOM, 2012) has identified the following buildings and structures:

- Overdene Homestead owned by BMC, approximately 2150 m east of the Year 1 mining area;
- Bengalla Homestead owned by BMC, approximately 1600 m east of the Year 1 mining area;
- Rous Lench owned by HVEC approximately 2100 m south east of the Year 1 mining area;
- Edinglassie Homestead owned by HVEC, approximately 1900 m south of the Year 1 mining area;
- Old Bengalla Site on land owned by BMC, approximately 1100 m south of the Year 24 mining area;

- Keys Family Cemetery on land owned by BMC, approximately 1100 m south of the Year 24 mining area; and
- House Site 3 owned by Coal & Allied Operations Pty Limited, approximately 360 m north of the Year 4 mining area.

Predicted blast impacts have been calculated based on the recommended procedure in Appendix J of Australian Standard 2187.2-2006, using typical ground coefficients of K=1140 and b=1.6.

Table 23: Predicted Blast Impacts to Heritage Structures

Building/Structure	Distance, m	MIC, kg						Criteria, mm/s, dBL
		500	1000	1500	500	1000	1500	
		Ground Vibration mm/s			Overpressure dBL			
Overdene Homestead [1]	2150	0.8	1.3	1.8	99	102	104	10, 120
Bengalla Homestead [1]	1600	1.2	2.1	3.0	103	106	108	10, 120
Rous Lench	2100	0.8	1.4	1.9	105	108	109	10, 120
Edinglassie Homestead	1900	0.9	1.6	2.3	106	109	110	10, 120
Old Bengalla Site	1100	2.2	3.9	5.4	- [2]	- [2]	- [2]	50, -
Keys Family Cemetery	1100	2.2	3.9	5.4	- [2]	- [2]	- [2]	50, -
House Site 3	360	13.4	23.3	32.2	- [2]	- [2]	- [2]	50, -

1 Overpressure levels have been reduced by 5 dBL to account for shielding provided by the OEA.

2 House sites and the cemetery are not sensitive to overpressure.

Table 23 indicates predicted blast impacts are acceptable compared to suggested criteria for each building or structure.

11.4 Communication Masts

An industrial property owned by Aliform Pty Ltd is located approximately 1200 m south of the Project and contains two communication masts. While no blast monitoring results are currently available at this location, interpolation from the Edinglassie monitoring results indicates the masts have previously received ground vibration levels typically below 5mm/s but occasionally up to 10mm/s, with overpressure levels previously reaching 128 dBL but typically less than 118 dBL. No damage to the masts has been reported as a result of blasting and, as the masts would be designed to withstand windy conditions and do not have a significant surface area, they are not expected to be sensitive to overpressure.

Active mining areas would recede from the masts, and blast effects would gradually reduce, as mining progresses. In the absence of damage or adverse effects on the masts from previous blasting, proposed blast events are not expected to affect the masts.

11.5 Muswellbrook – Ulan Rail Line

Blasting near the Muswellbrook-Ulan Rail Line poses a number of potential issues, including:

- Ground vibration affecting the tracks;
- Overpressure affecting the trains; and
- Flyrock affecting both the trains and tracks.

Previous blasts have regularly occurred approximately 250m from the Muswellbrook-Ulan Rail Line. Bengalla's existing management practices include consultation with ARTC and either temporarily

closing the rail line or delaying the blast to ensure no trains pass Bengalla when a blast is detonated within 500 m from the track. This practice would continue to minimise risks due to blasting, although blasts within 500 m of the railway line are only expected during the early years of the Project.

11.6 Public Roads

Proposed blasts would remain more than 500 m from the Bengalla Link Road as the realignment works would be completed before the active mining area approaches to within 500 m of the road. Intermittent closure of Wybong Road east of the Bengalla Link Road would continue to be required as blasts are detonated in the northern part of the active mining area within 500 m of the road. No other public roads are expected to be affected by blasting.

The revised Blast Management Plan would include management measures to protect users of Wybong Road from flyrock and other blast impacts.

11.7 Blasting Near the MIA

Proposed blasts would occur within 500 m of the MIA including the rail loadout loop, CHPP, stockpiles and administration and other buildings. While blasting near the MIA is primarily an issue affecting BMC rather than an environmental impact, the revised Blast Management Plan would include management measures to minimise the risk of personal injury and equipment damage. Management measures may include:

- Avoid loading the blastholes or otherwise delay the blast during train loading periods to minimise the risk of injury to train drivers and damage to locomotives and rolling stock;
- Detonate blasts near the MIA on a Sunday, when the administration and other buildings are not fully occupied, and evacuate the buildings and carparks before each blast if required to ensure staff safety and minimise the risk of damage to vehicles;
- Carefully control the MIC for blasts close to the MIA, by minimising the bench depth or deck loading the blastholes, to minimise the risk of overpressure damage to building walls, doors and windows;
- Shut down the CHPP during the blast event if required to minimise the risk of damage to coal storage and processing equipment; and
- Cover blastholes with mats or other materials if required to control flyrock near buildings.

The above or similar management measures are expected to provide sufficient protection to personnel and equipment as the active mining area passes the MIA. Management measures would only be required in the southern section of the mining area close to the MIA, with other blasts further from the MIA able to be detonated without many or all of the suggested management measures.

As blasts within 500 m of the MIA would be more remote from privately owned receivers, ground vibration and overpressure levels would not exceed 3 mm/s and 110 dB at the closest occupied residences (such as Edinglassie owned by HVEC) and are expected to remain below 1.5 mm/s and 105 dB at all privately owned receivers that are not subject to acquisition by a mining company. Blast events near the MIA would therefore comply with historical 'shoulder period' blast criteria of 2 mm/s and 105 dB as recommended in the Environmental Noise Control Manual (ENCM) (SPCC now EPA, 1985). While the ENCM is no longer relevant to current acoustic assessments, the existence of previous 'shoulder period' blast criteria indicates blasts can be acceptable outside the normal blasting hours provided lower criteria are met.

11.8 Blasting Near Livestock

As described in Section 11.2, all blasts would comply with human comfort criteria at all privately owned residences that are not impacted by operational noise from the Project. Ground vibration and overpressure levels experienced by livestock on privately owned land would therefore also meet human comfort criteria.

Livestock on mine-owned land would at times receive blast impacts above human comfort criteria, however BMC has been successfully keeping cattle and other livestock on land adjacent to active mining areas since Bengalla began operating approximately 15 years ago. The current situation is therefore expected to continue.

12 CONCLUSION

This assessment shows a number of privately owned receivers near the Project are expected to receive noise levels above the adopted intrusive noise criteria, after all feasible and reasonable noise mitigation measures have been applied to the Project. Consultation with potentially affected receivers is recommended.

Predicted worst case construction noise levels, in the absence of mitigation measures, are expected to be acceptable at the majority of privately owned residences that would remain unaffected by mining noise from the Project or another nearby mine. Construction of the proposed clean water dams and Dry Creek diversion pipeline, in particular, is expected to cause moderate or mild exceedances of the construction noise criteria at closest residences as the dams and pipeline are relatively close to the Project Boundary.

Realignment of the Bengalla Link Road is expected to cause exceedances of the 'noise affected' criterion in the ICNG at closest receivers, which triggers the need for all feasible and reasonable mitigation measures to be applied during the construction works. The existing Noise Management Plan would be revised to include proposed construction works and noise mitigation opportunities for construction activities to result in the lowest construction noise levels that can reasonably be achieved.

Sleep disturbance from potential impact sources associated with the Project, such as dozer track slap and train wagon bunching, is unlikely to occur at any receiver given the Project's proposed noise management measures to avoid these noise sources. However, occasional maximum noise event may occur and such events would not affect any receiver that would also remain unaffected by normal mining noise levels.

Noise from road traffic associated with construction activities and ongoing operation of the Project would be insignificant compared to existing traffic noise levels. Traffic noise levels over the criteria at closest Denman Road residences in Muswellbrook, due to existing traffic, would increase by a very minor 0.1 dBA due to additional Project-related traffic which is unlikely to be noticed by residents.

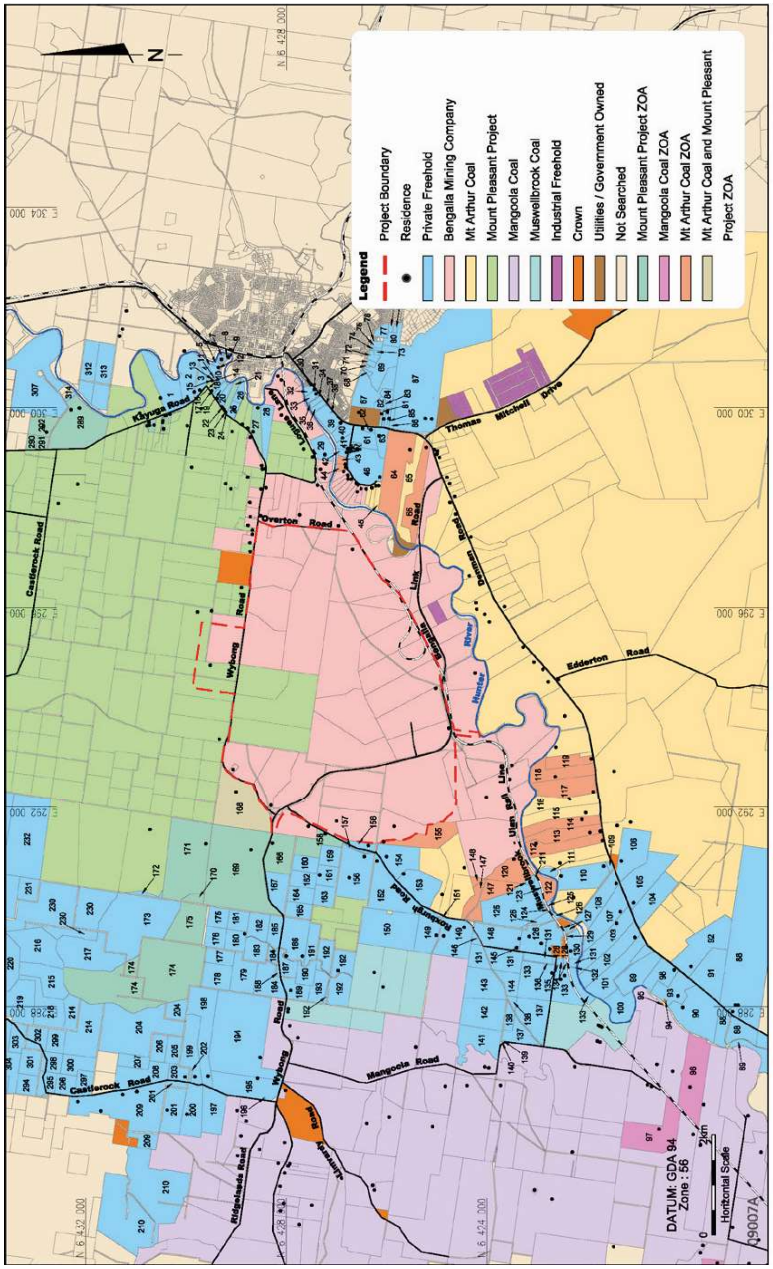
Existing background rail traffic noise levels, in the absence of the Project, currently exceed relevant noise criteria at closest cabins in the Riverside Cabin and Van Park in Mill Street Muswellbrook. Future rail traffic noise levels, including additional train movements from other mines but excluding trains associated with the Project, would also exceed relevant noise criteria at one Bridge Street residence and approximately 15 of the closest Victoria Street residences in Muswellbrook. Additional train noise levels due to the Project would increase existing noise levels by approximately 0.7 dBA at residences near the Ulan Line and by less than 0.5 dBA at residences near the Main Northern Railway east of the Ulan Line junction, which is considered insignificant.

Cumulative noise levels, with simultaneous operation of the Project and adjoining mines and Projects, are not expected to exceed relevant noise amenity criteria at any privately owned residence that is not significantly affected by at least one mine.

Blasting associated with the Project is unlikely to exceed relevant ground vibration and overpressure criteria at all privately owned residences, based on results from extensive blast monitoring around Bengalla and given the relatively large distances to nearest sensitive receivers. The existing Blast Management Plan should be reviewed and updated including management measures to control blast impacts on identified heritage buildings and structures and selection of appropriate blast monitoring locations generally west of the Project.

APPENDIX A – NOISE CONTOUR FIGURES

FIGURE	LAYOUT PLANS - LANDOWNERSHIP AND HERITAGE SITES		
L1	Landownership plan (Hansen Bailey, 2012)		
FIGURE	NOISE CONTOURS – NORMAL OPERATION		
A1	Year 1	Day	Neutral weather conditions
A2	Year 1	Day/Evening	Prevailing weather conditions
A3	Year 1	Night	Prevailing weather conditions
A4	Year 4	Day	Neutral weather conditions
A5	Year 4	Day/Evening	Prevailing weather conditions
A6	Year 4	Night	Prevailing weather conditions
A7	Year 8	Day	Neutral weather conditions
A8	Year 8	Day/Evening	Prevailing weather conditions
A9	Year 8	Night	Prevailing weather conditions
A10	Year 15	Day	Neutral weather conditions
A11	Year 15	Day/Evening	Prevailing weather conditions
A12	Year 15	Night	Prevailing weather conditions
A13	Year 24	Day	Neutral weather conditions
A14	Year 24	Day/Evening	Prevailing weather conditions
A15	Year 24	Night	Prevailing weather conditions
A16	All years	Day	Neutral weather conditions
A17	All years	Day/Evening	Prevailing weather conditions
A18	All years	Night	Prevailing weather conditions
FIGURE	NOISE CONTOURS – CONSTRUCTION		
A19	Year 1	Day	Neutral weather conditions
A20	Year 1	Day/Evening	Prevailing weather conditions
A21	Year 4	Day	Neutral weather conditions
A22	Year 4	Day/Evening	Prevailing weather conditions
A23	Year 15	Day	Neutral weather conditions
A24	Year 15	Day/Evening	Prevailing weather conditions
FIGURE	NOISE CONTOURS – SLEEP DISTURBANCE		
A25	All years	Night	Prevailing weather conditions



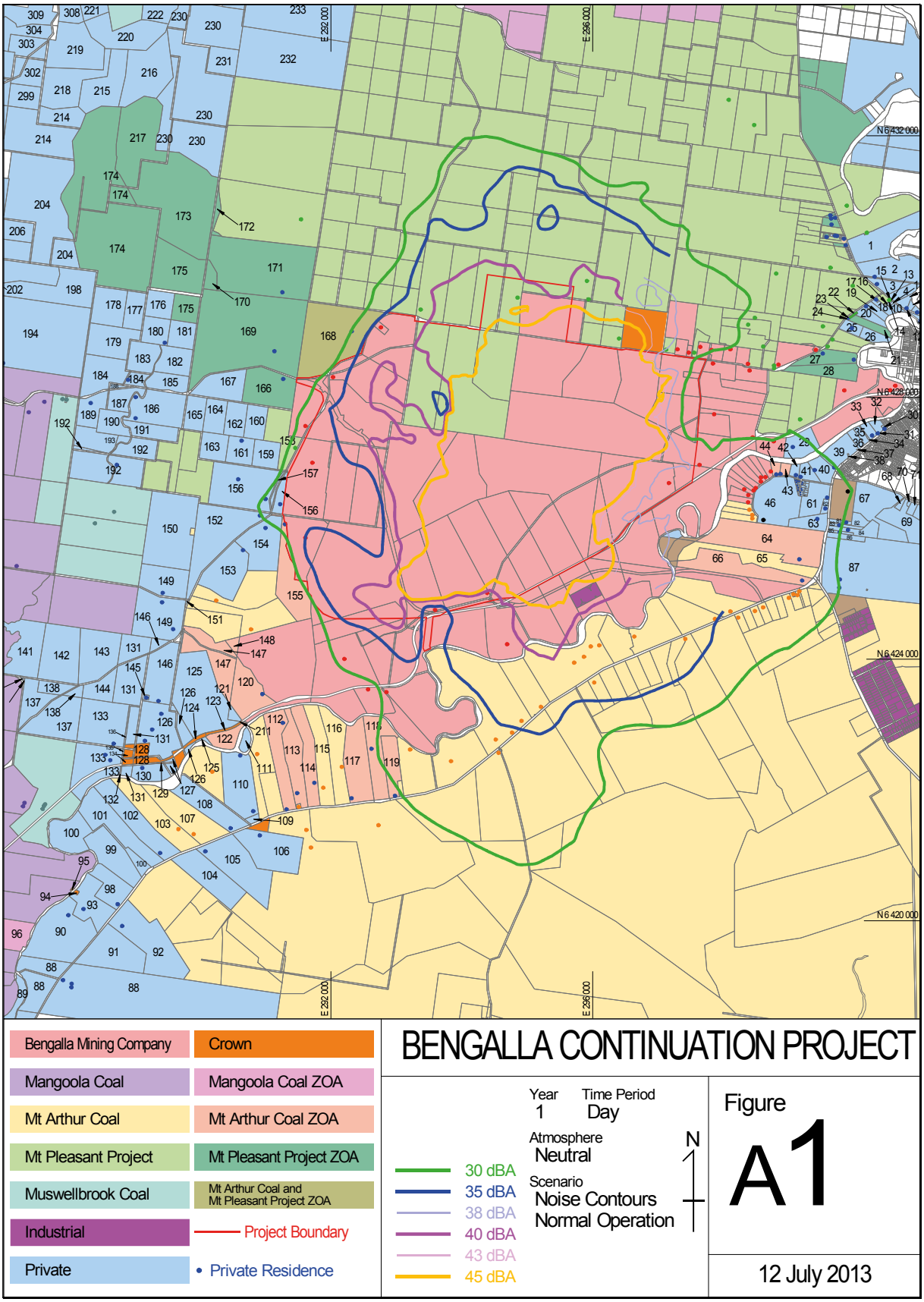
BENGALLA MINE

Land Ownership

FIGURE L1

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

BENGALLA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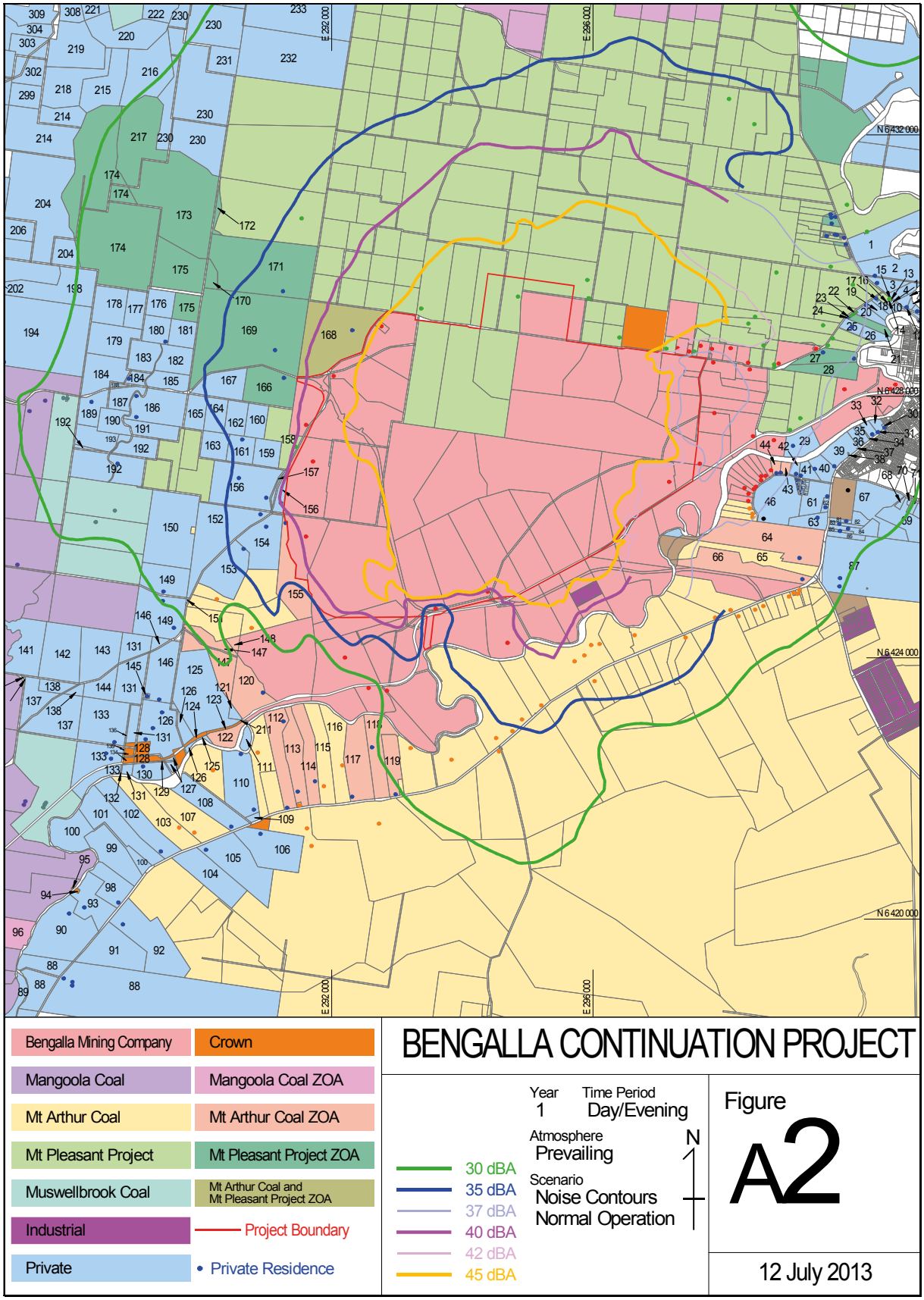
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 1
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure A1
12 July 2013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Crown
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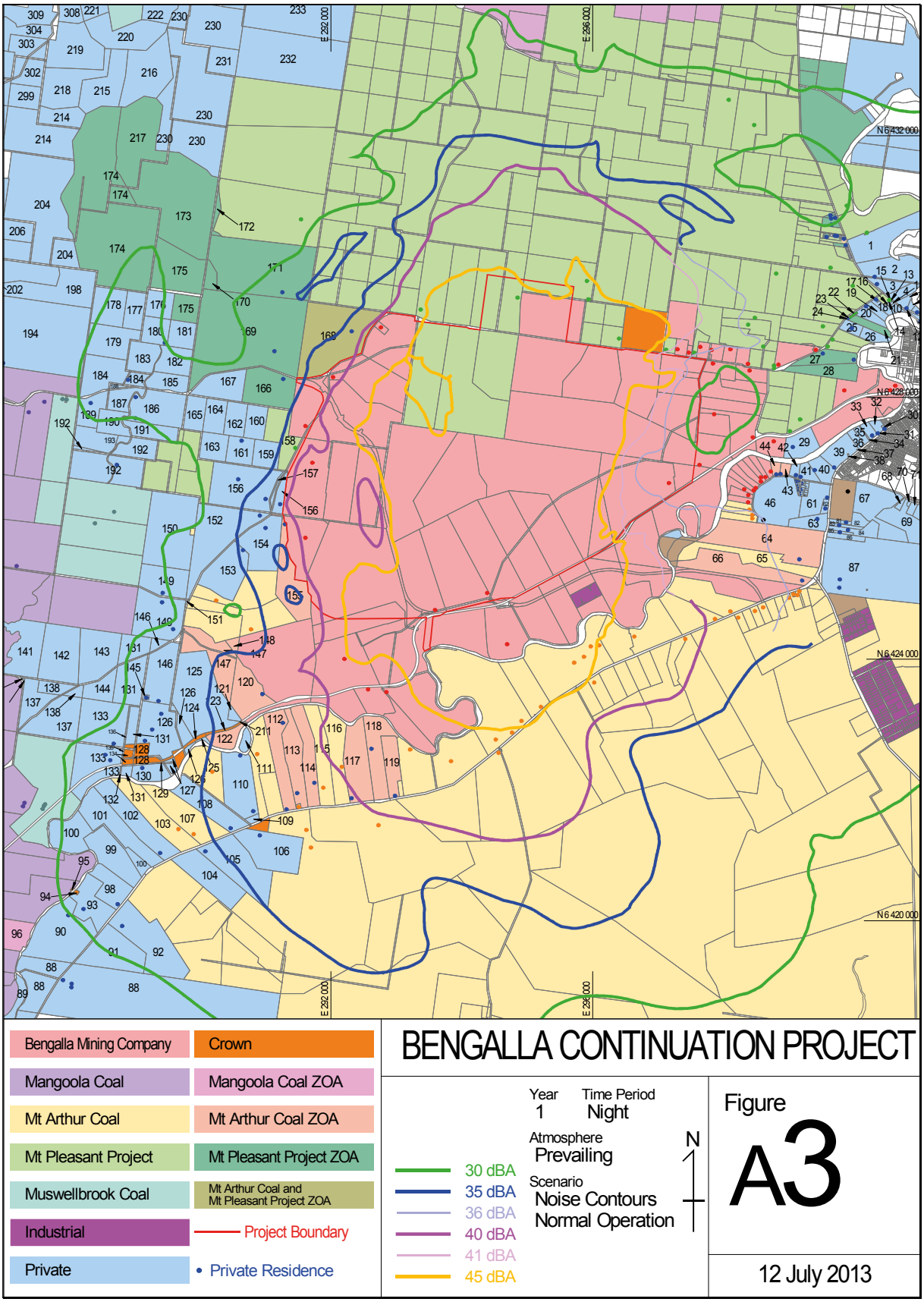
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year
1
Time Period
Day/Evening
Atmosphere
Prevailing
Scenario
Noise Contours
Normal Operation
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
N
Figure
A2
12 July 2013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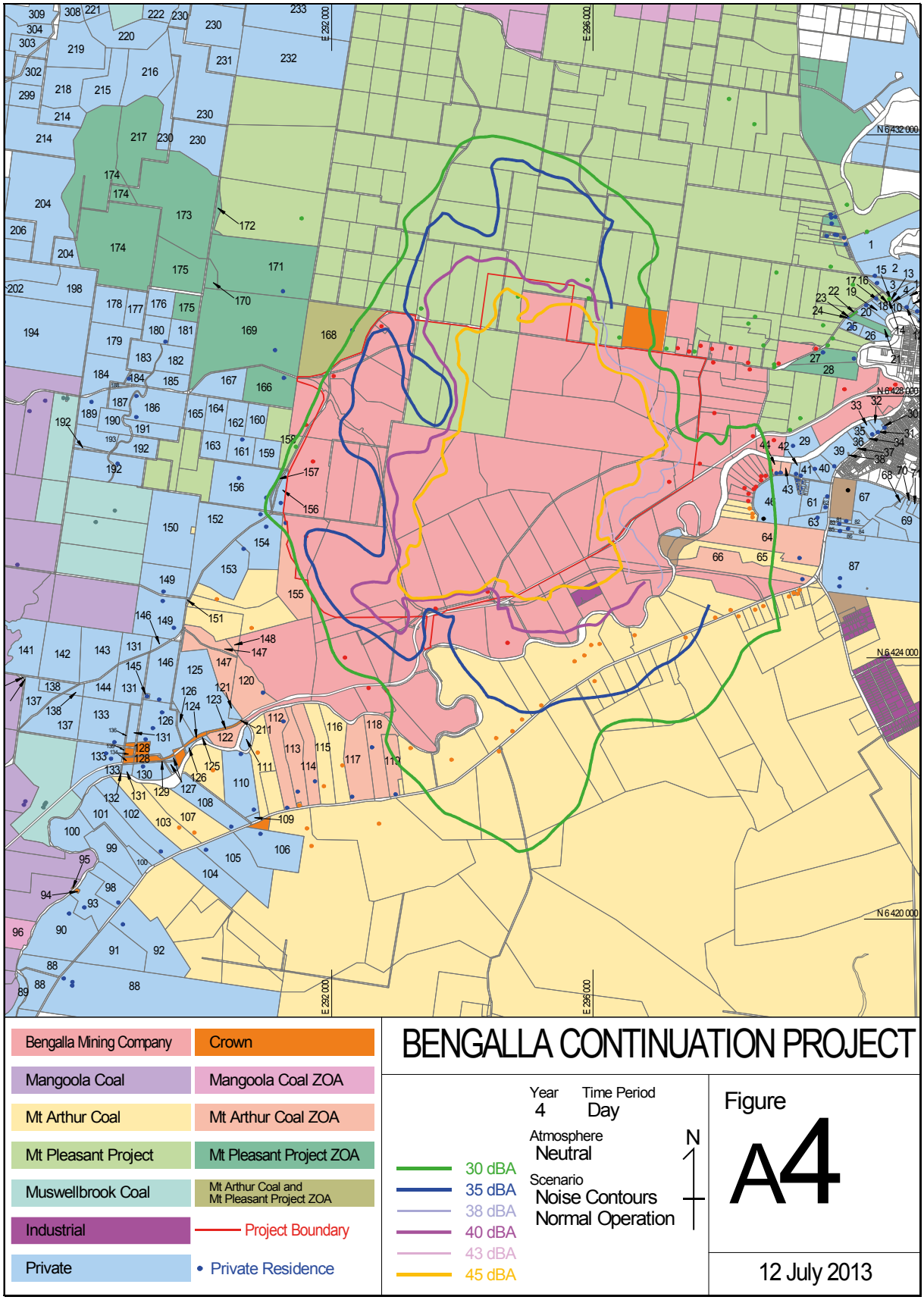
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 1
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure A3
12 July 2013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Bengalla Mining Company
Crown
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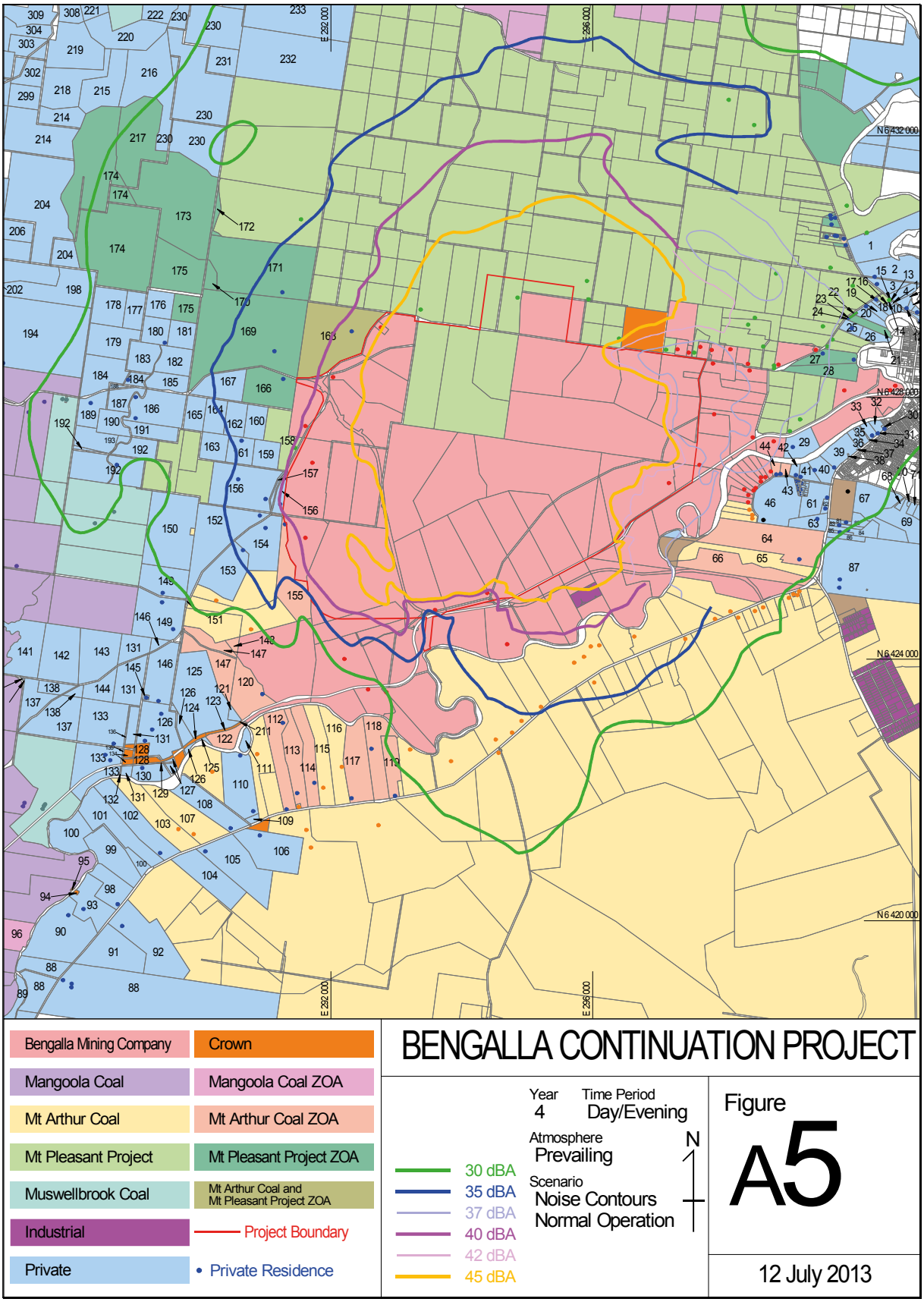
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 4
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure A4
12 July 2013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Bengalla Mining Company
Crown
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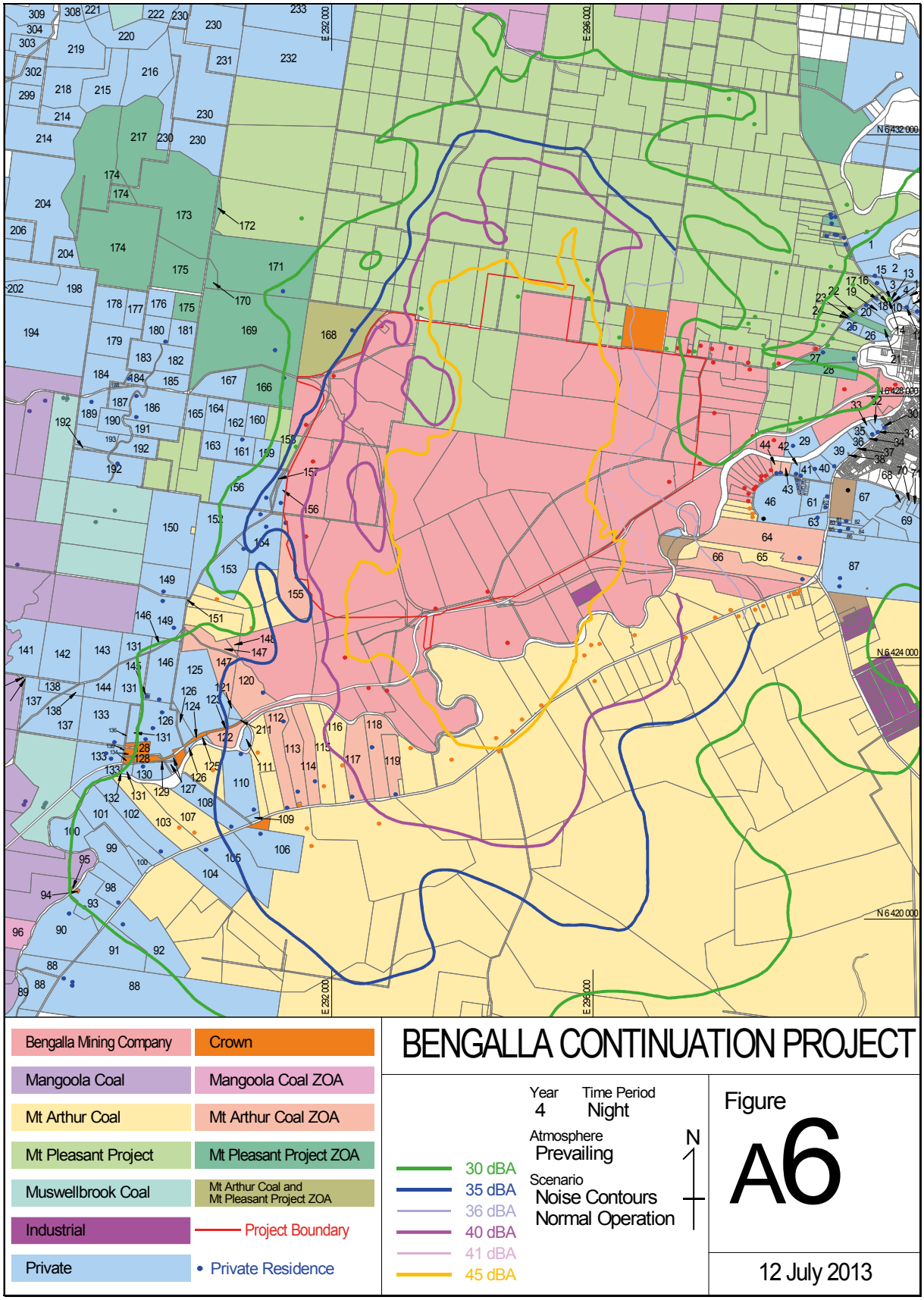
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 4
Time Period Day/Evening
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
N
Figure A5
12 July 2013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N 6 420 000
Bengalla Mining Company
Crown
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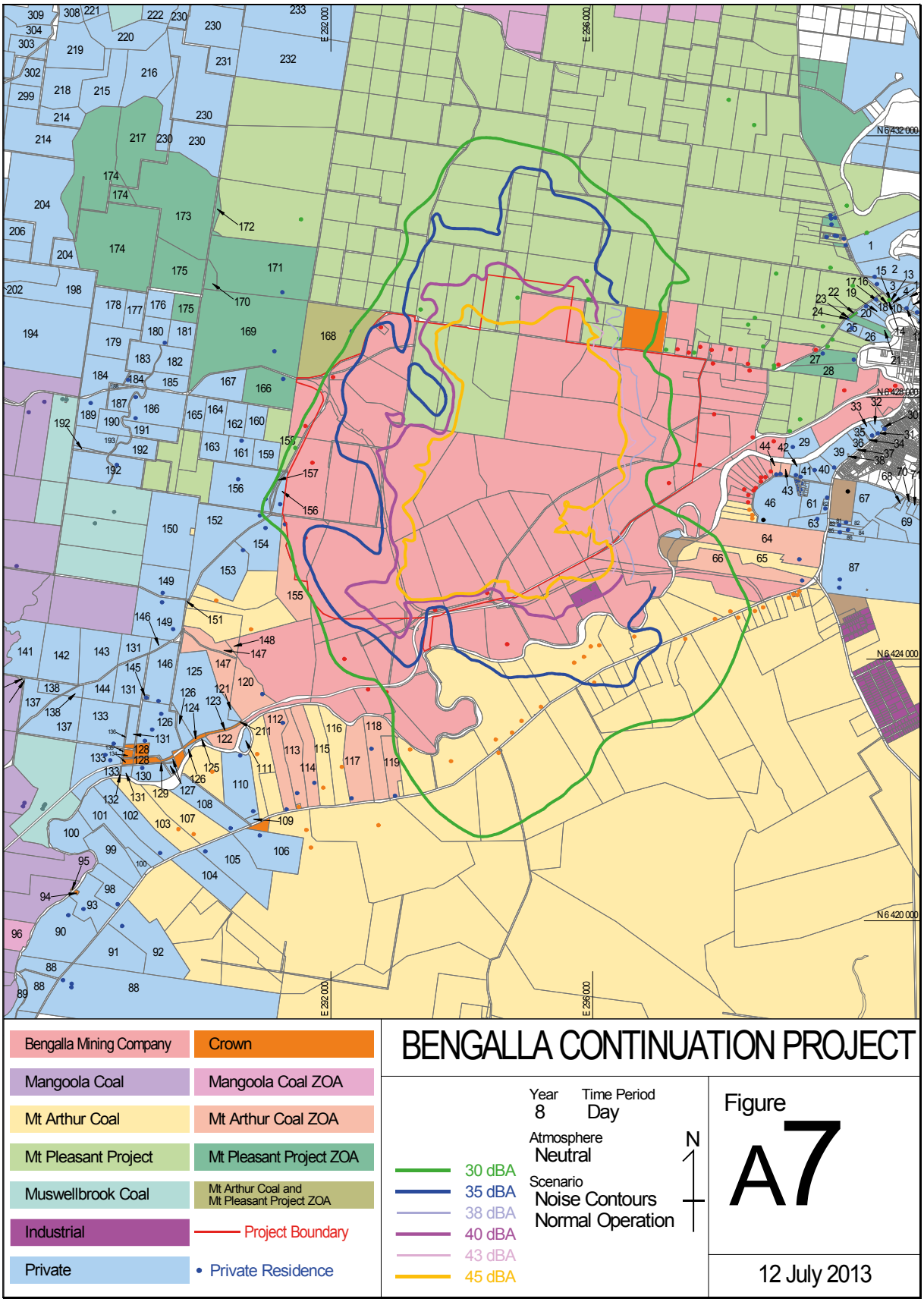
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 4
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure A6
12 July 2013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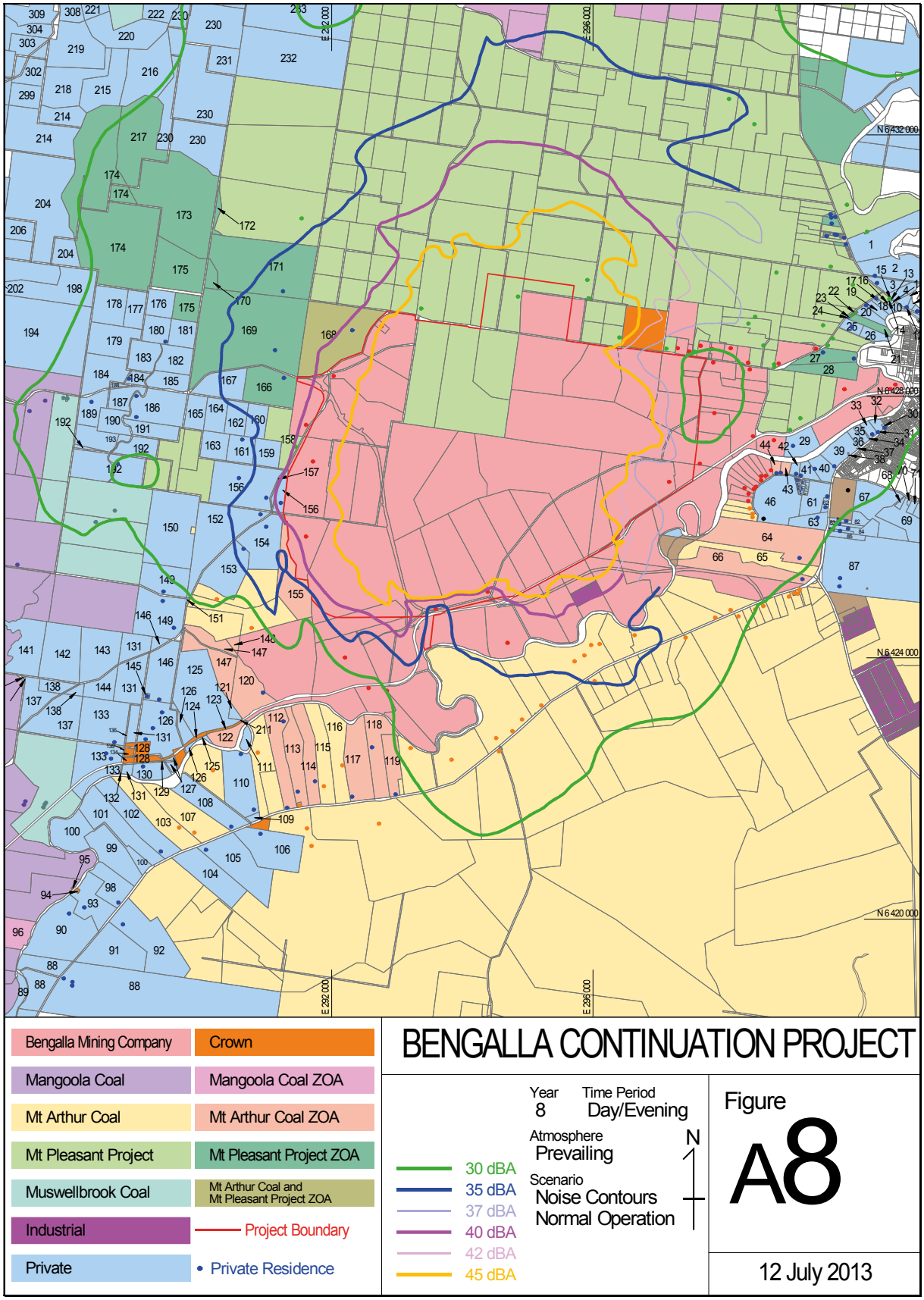
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 8
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure A7
12 July 2013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Crown
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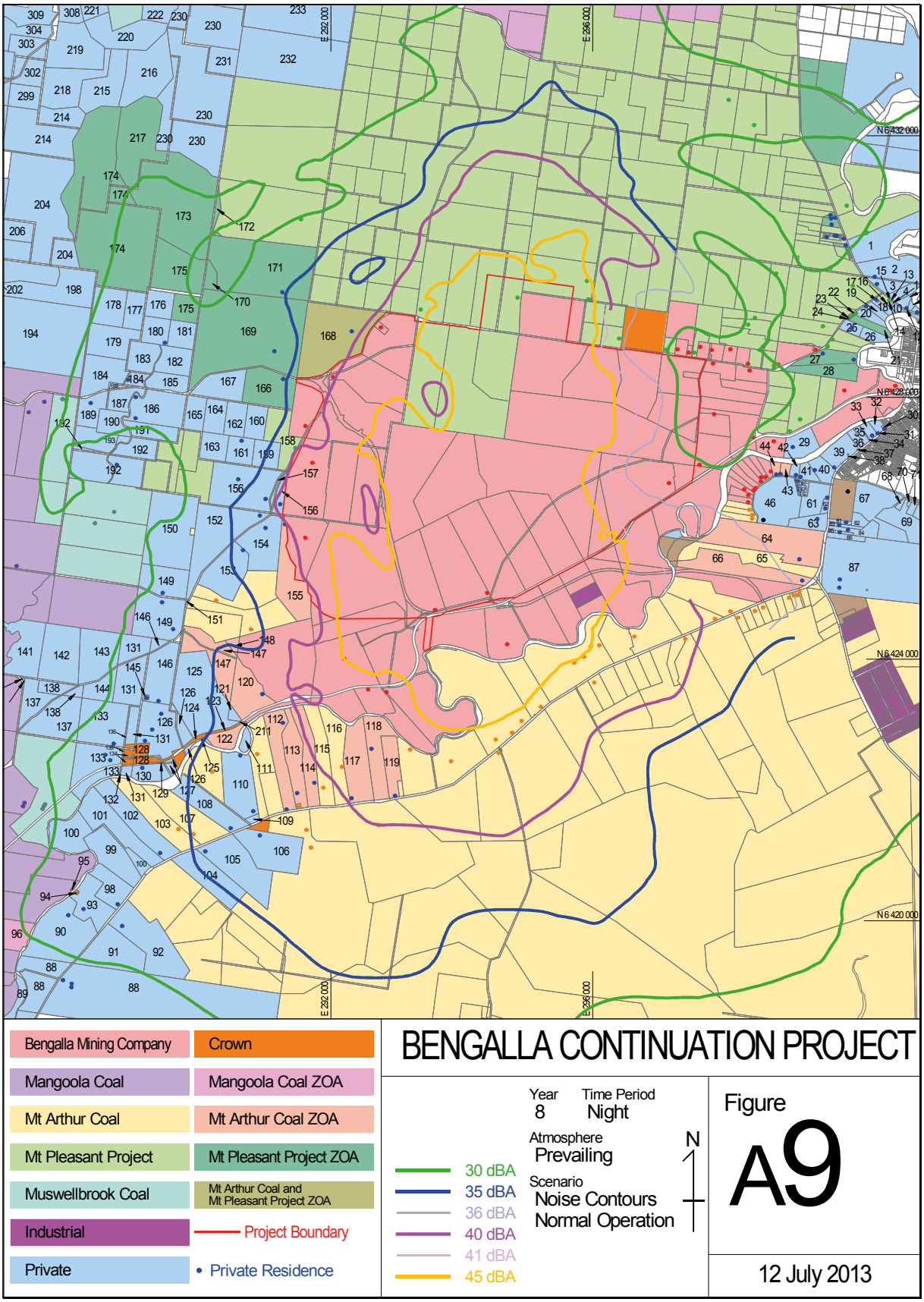
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year
8
Time Period
Day/Evening
Atmosphere
Prevailing
Scenario
Noise Contours
Normal Operation
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
N
Figure
A8
12 July 2013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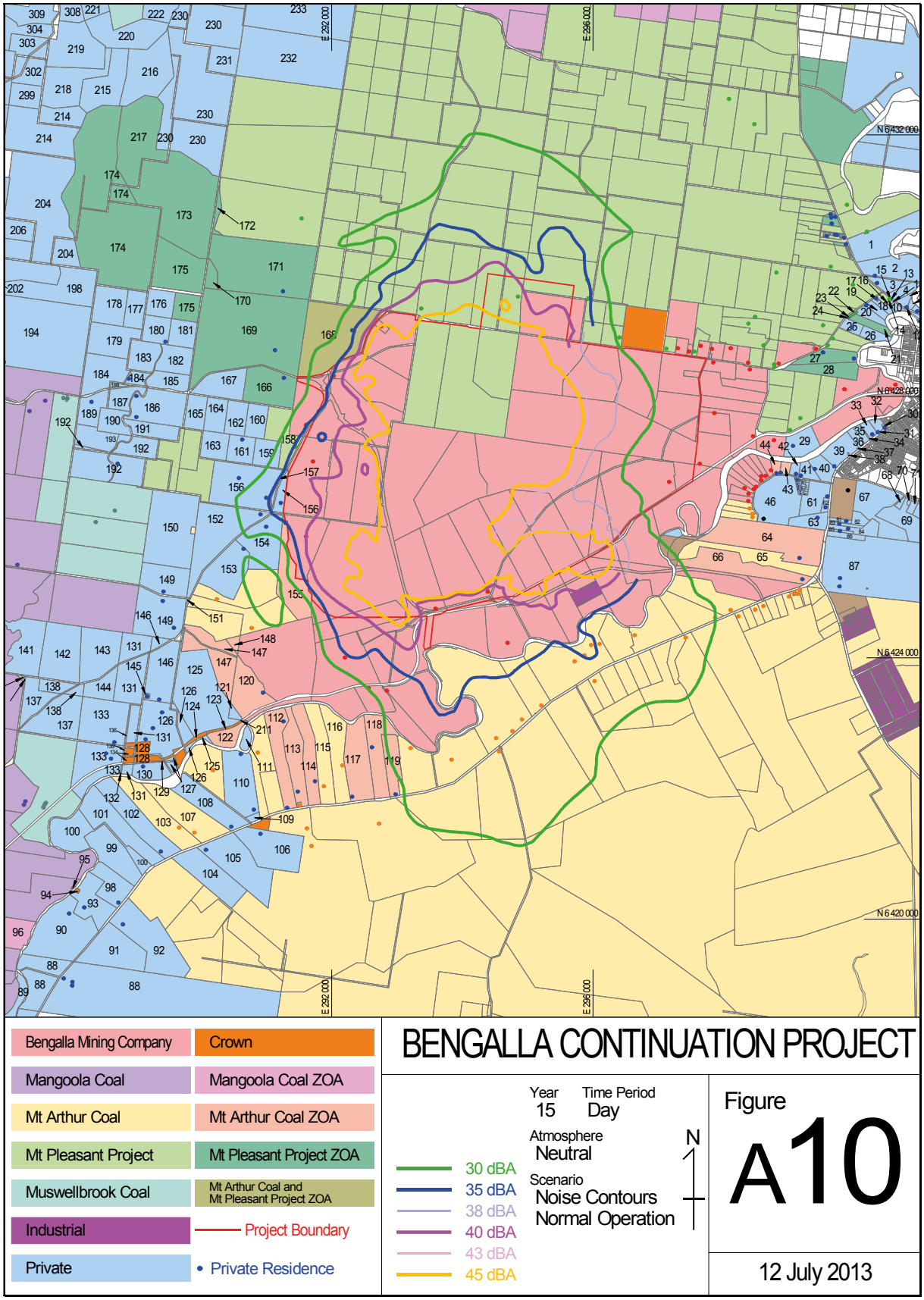
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 8
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure A9
12 July 2013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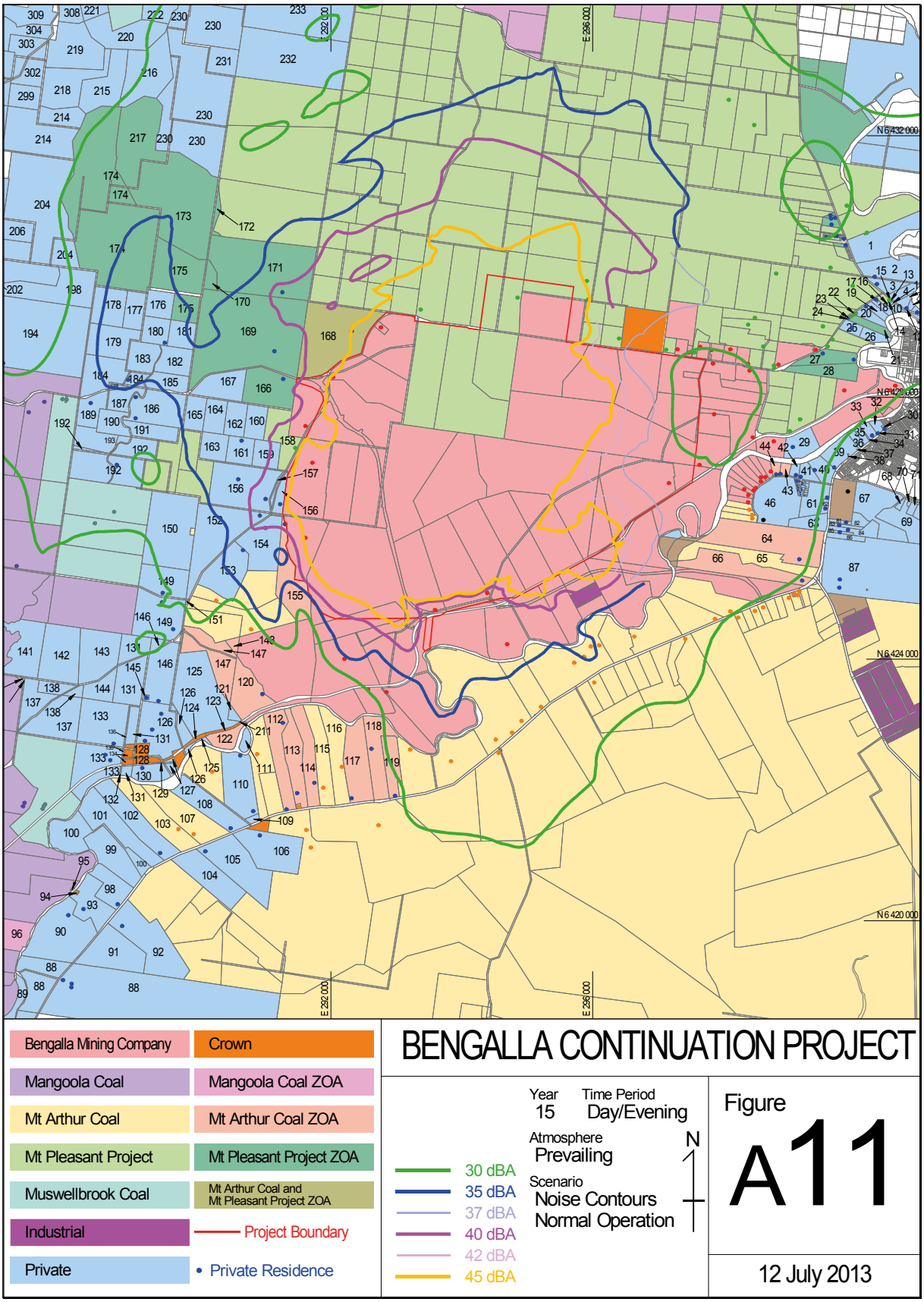
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 15
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure A10
12 July 2013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Mt Pleasant Project
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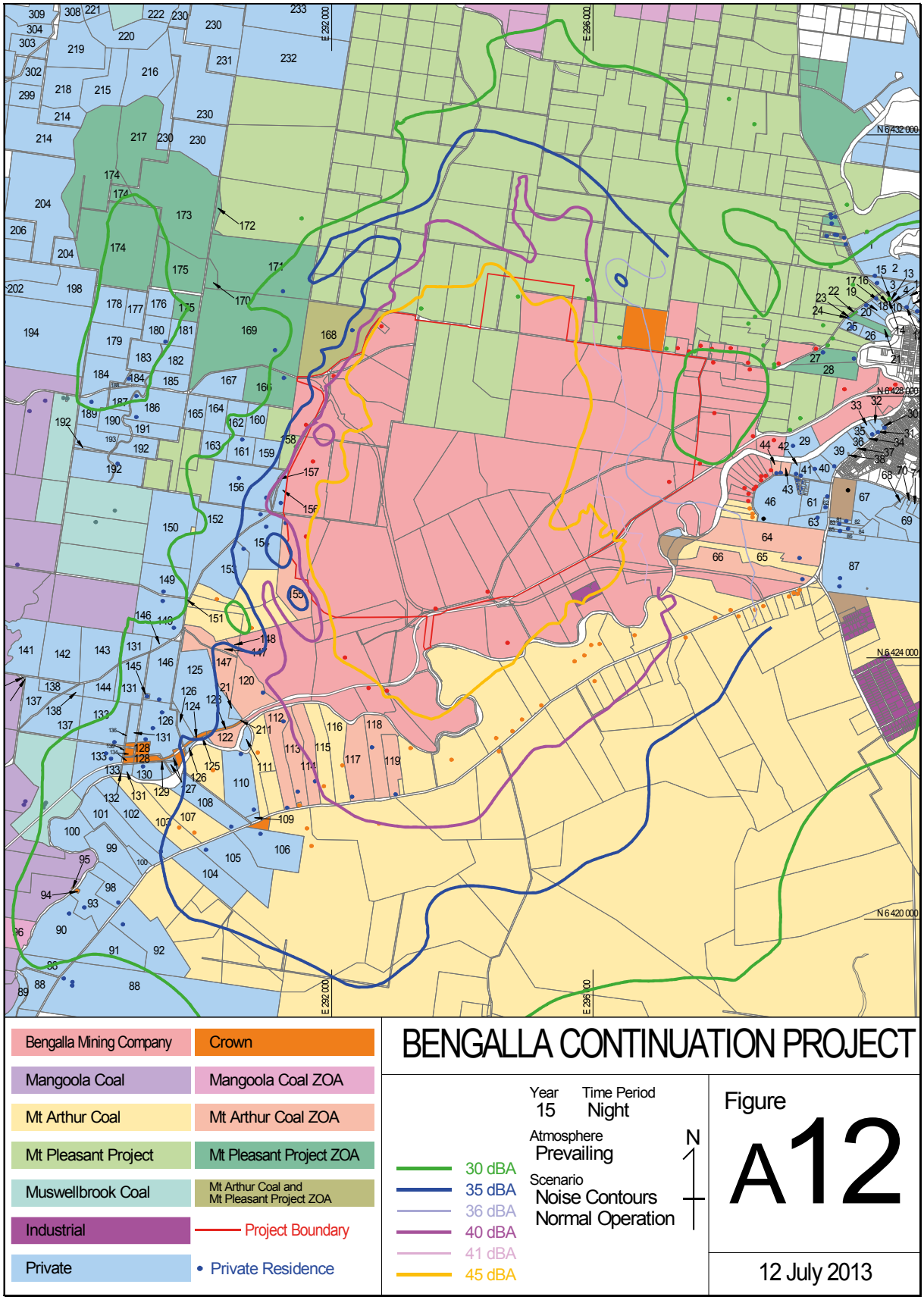
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 15
Time Period Day/Evening
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
N
Figure A11
12 July 2013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Crown
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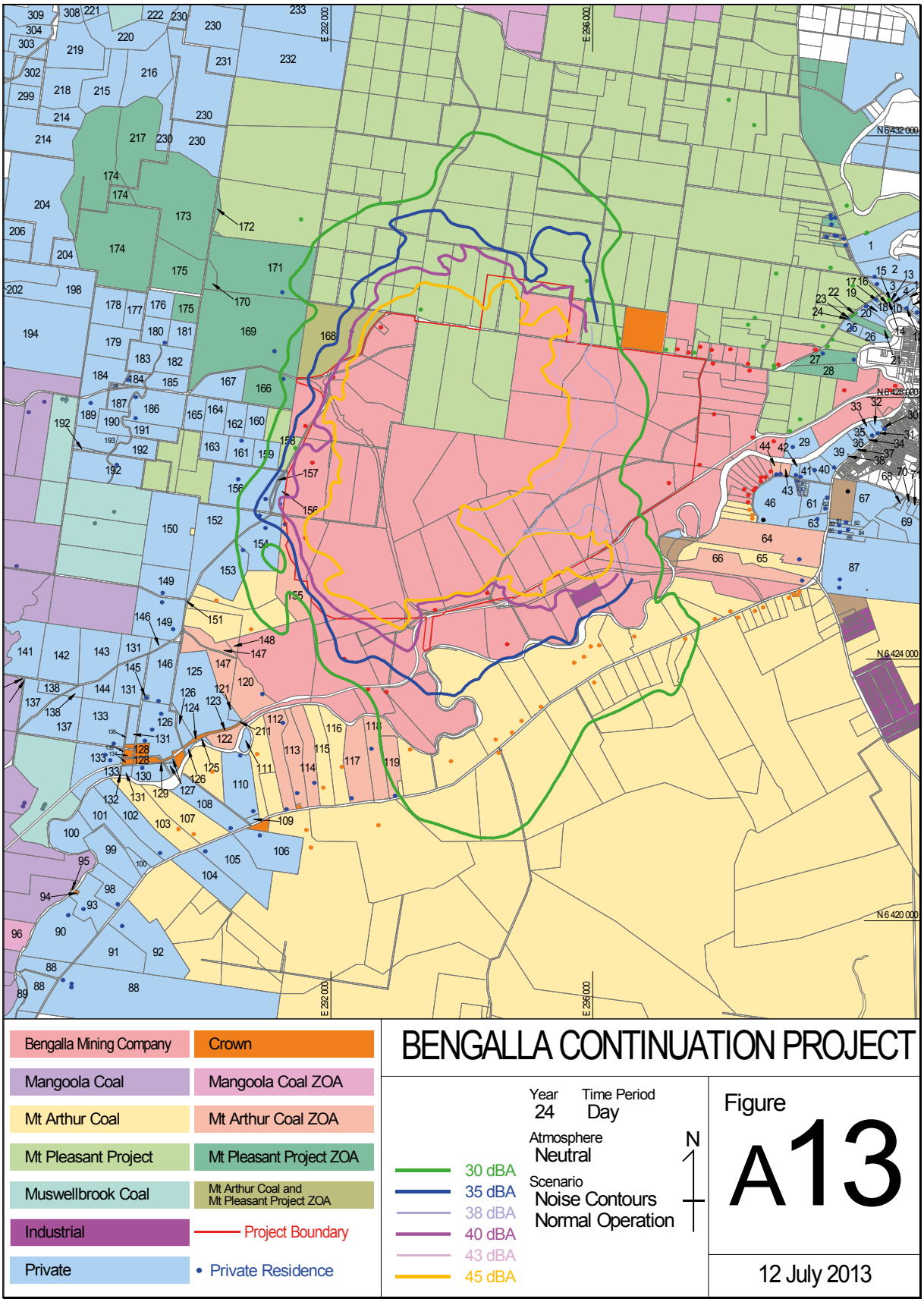
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 15
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure
A12
12 July 2013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Mt Pleasant Project
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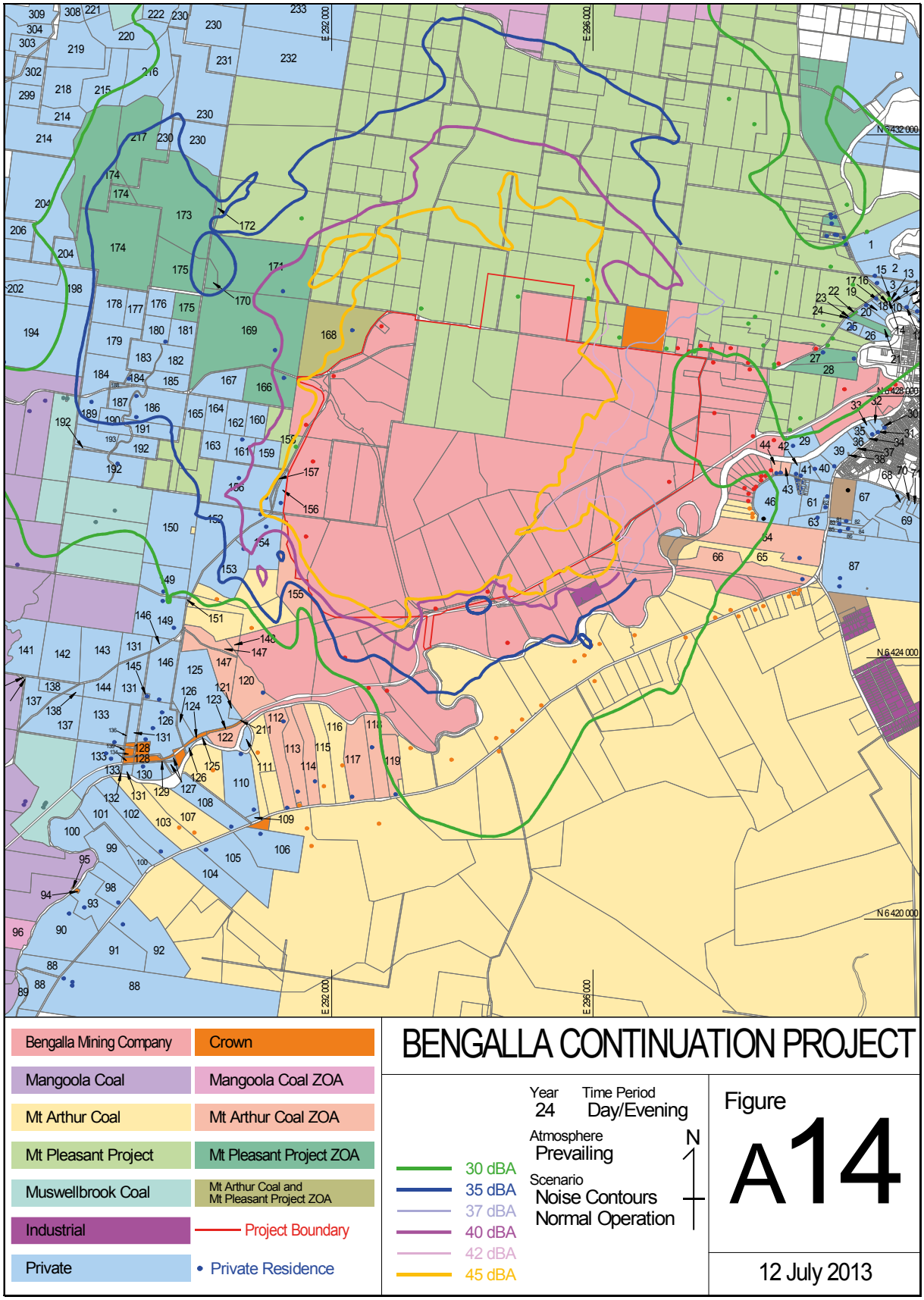
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 24
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure
A13
12 July 2013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Crown
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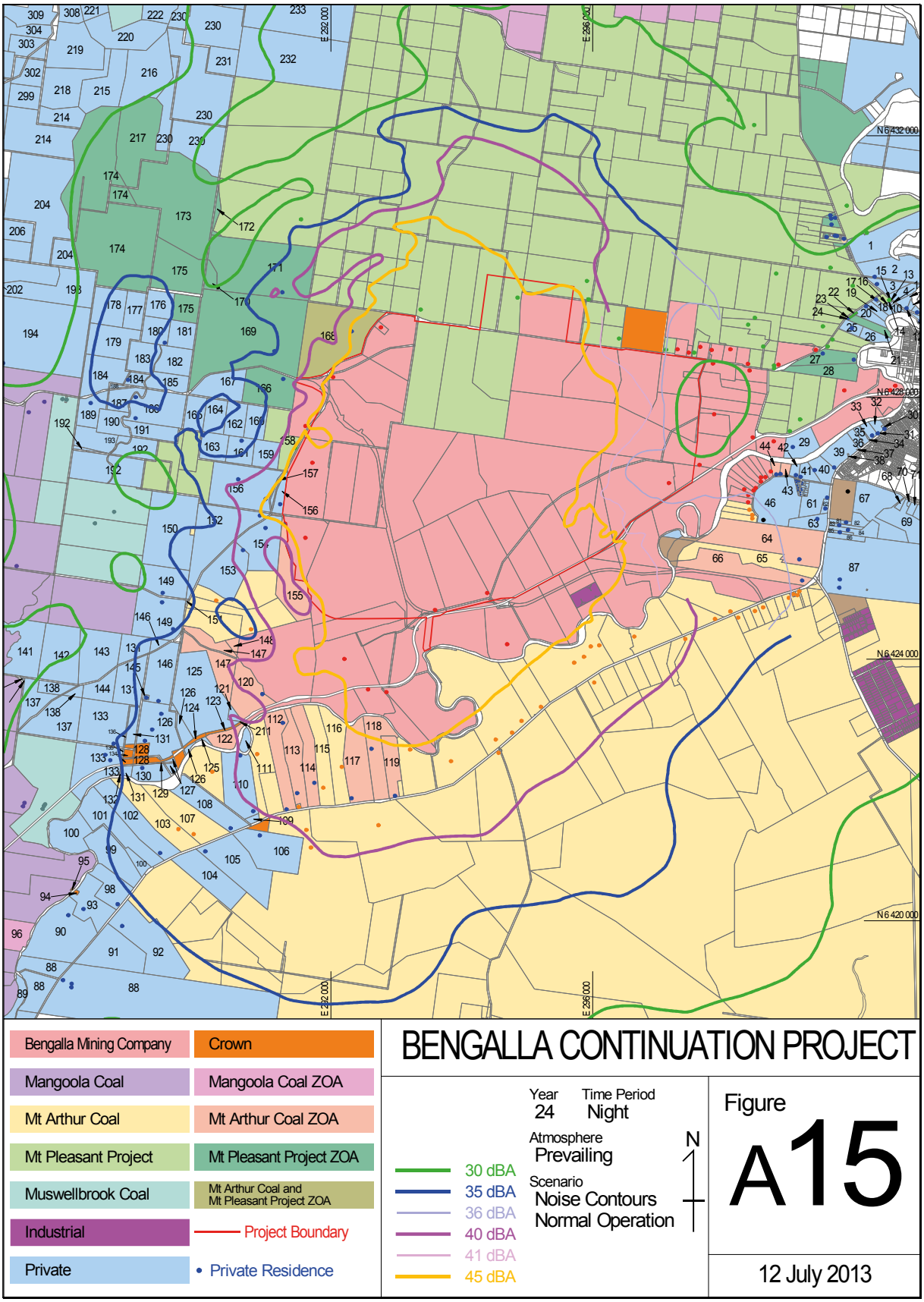
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year
24
Time Period
Day/Evening
Atmosphere
Prevailing
Scenario
Noise Contours
Normal Operation
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
N
Figure
A14
12 July 2013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Bengalla Mining Company
Crown
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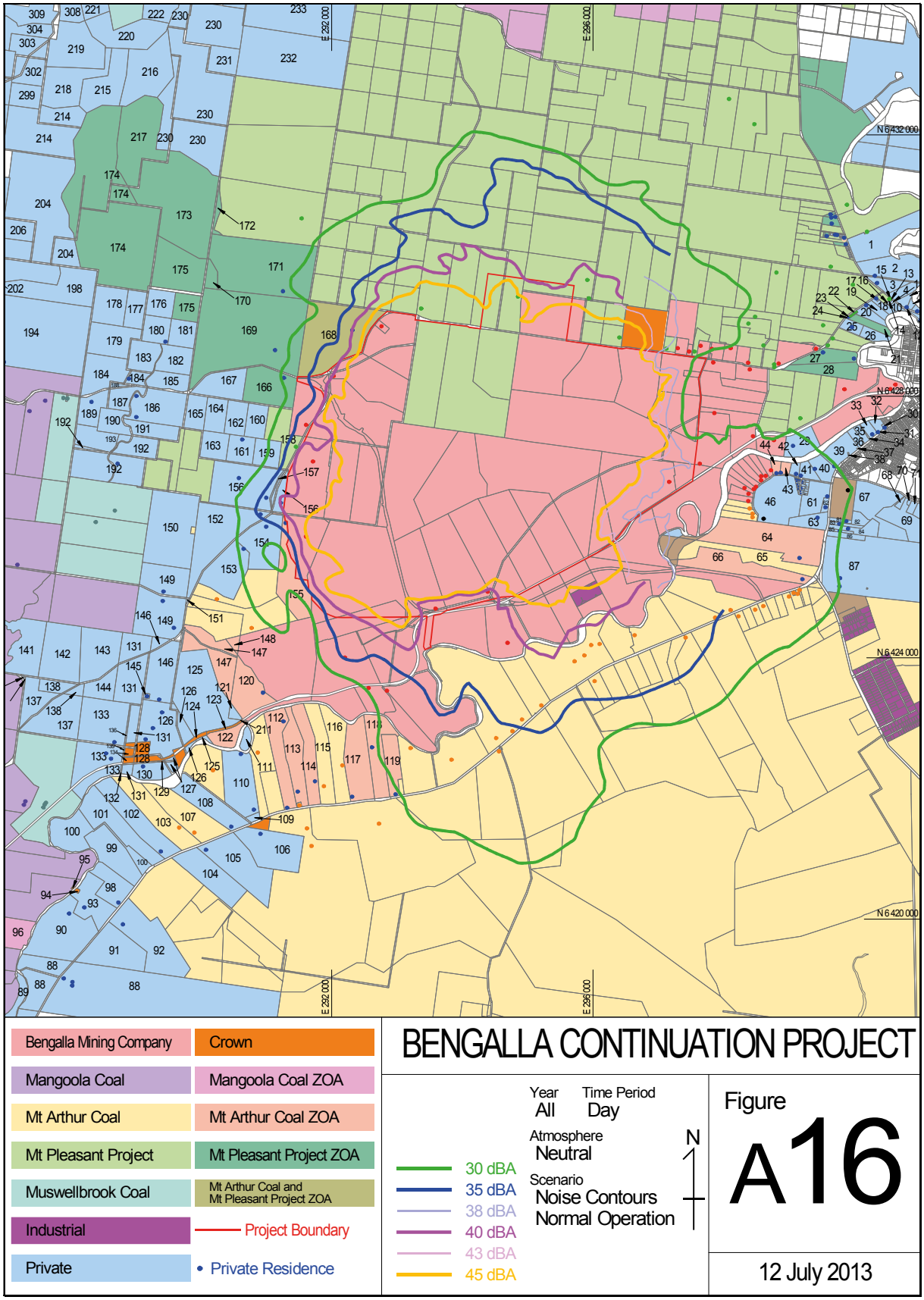
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 24
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure A15
12 July 2013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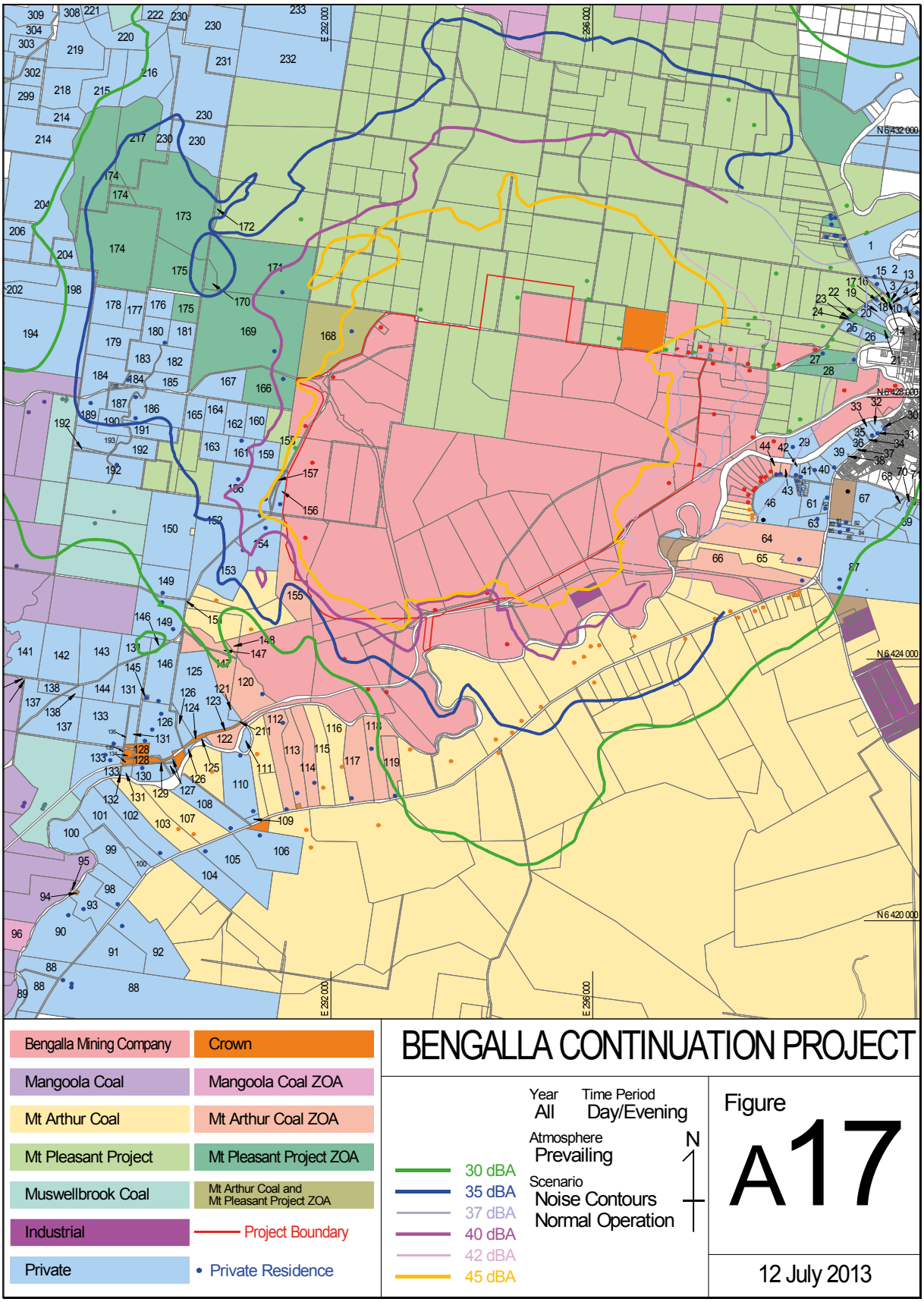
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year
All
Time Period
Day
Atmosphere
Neutral
Scenario
Noise Contours
Normal Operation
30 dBA
35 dBA
38 dBA
40 dBA
43 dBA
45 dBA
N
Figure
A16
12 July 2013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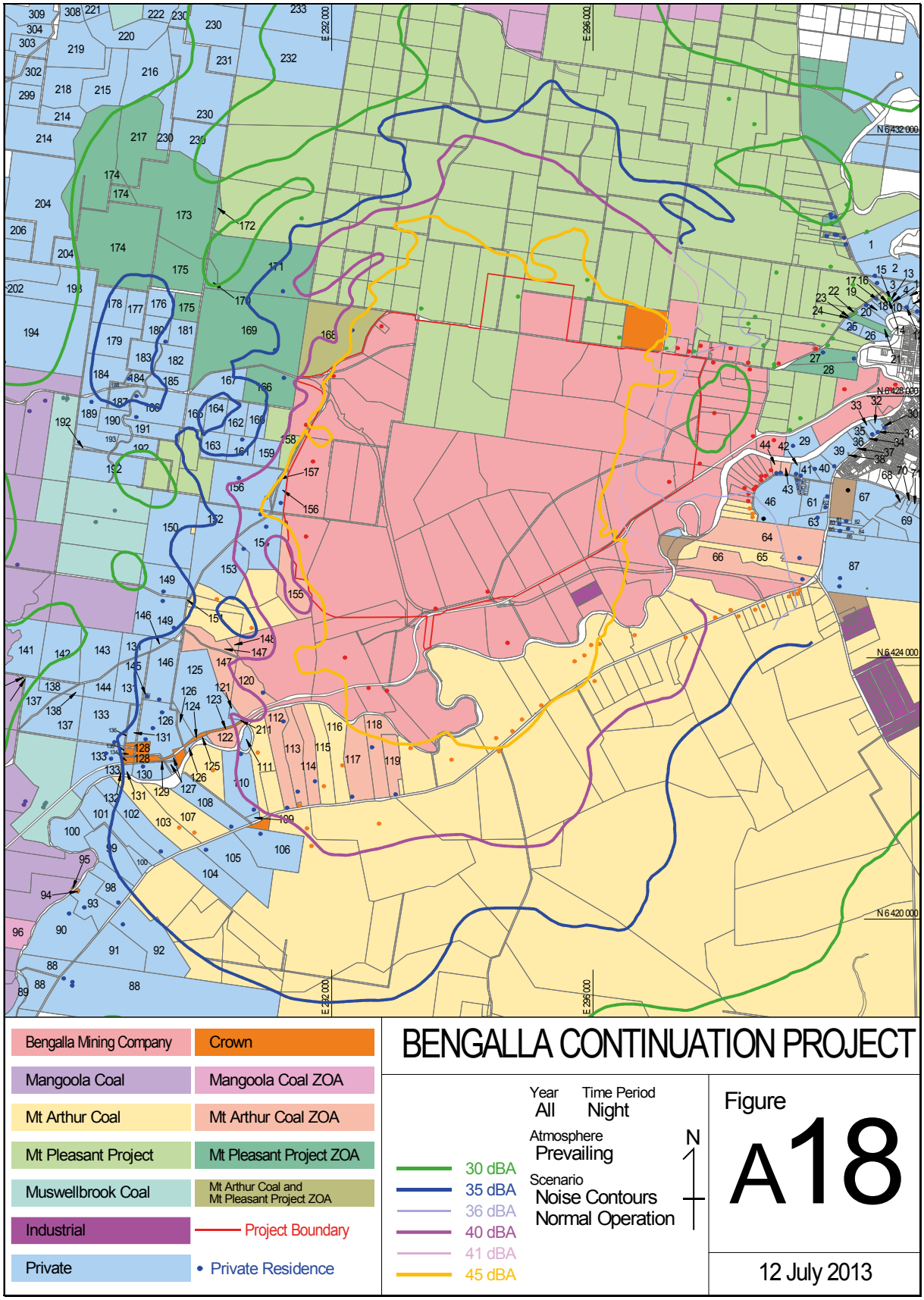
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
30 dBA
35 dBA
37 dBA
40 dBA
42 dBA
45 dBA
Year All
Time Period Day/Evening
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
N
Figure
A17
12 July 2013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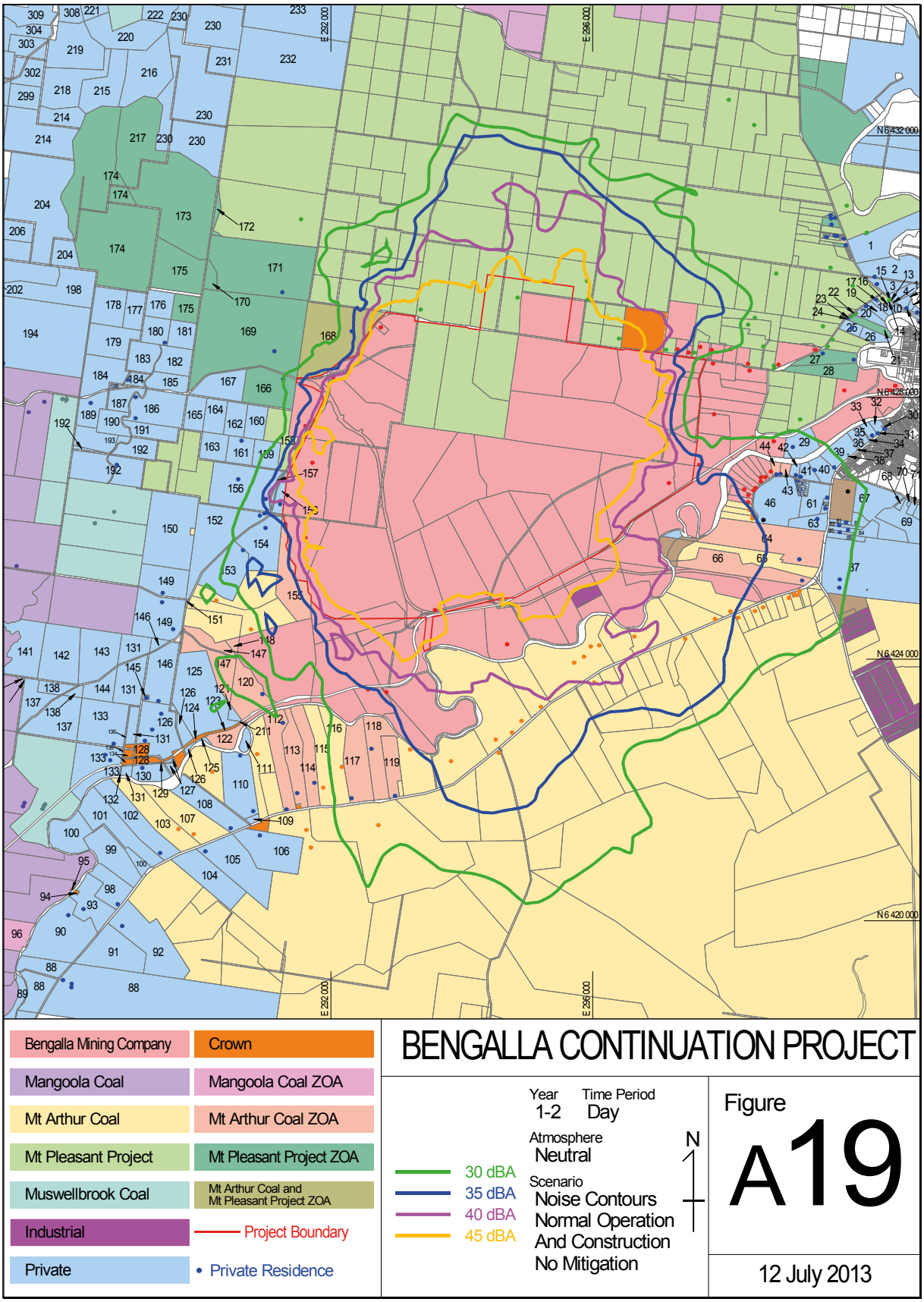
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year All
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Normal Operation
30 dBA
35 dBA
36 dBA
40 dBA
41 dBA
45 dBA
N
Figure
A18
12 July 2013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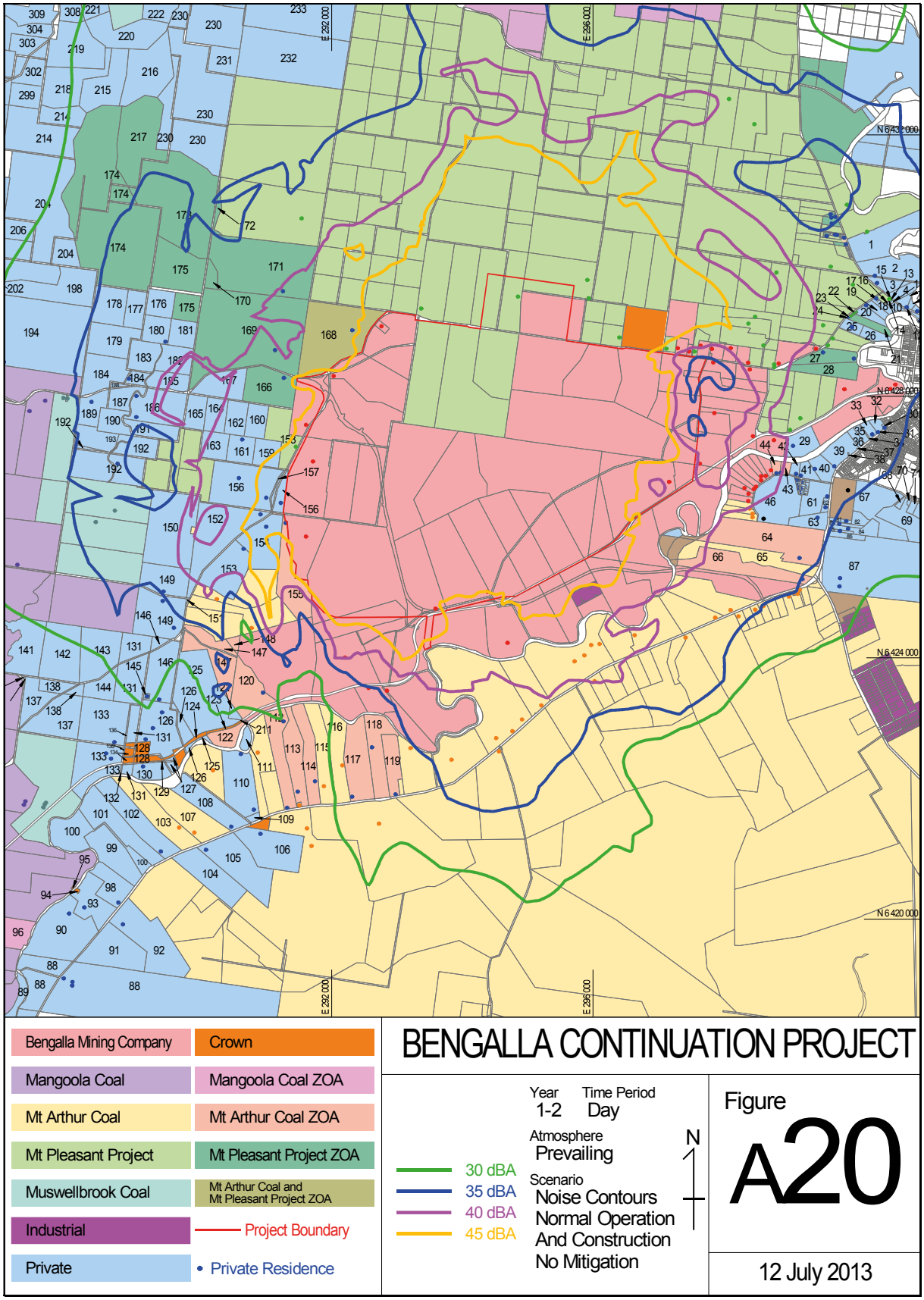
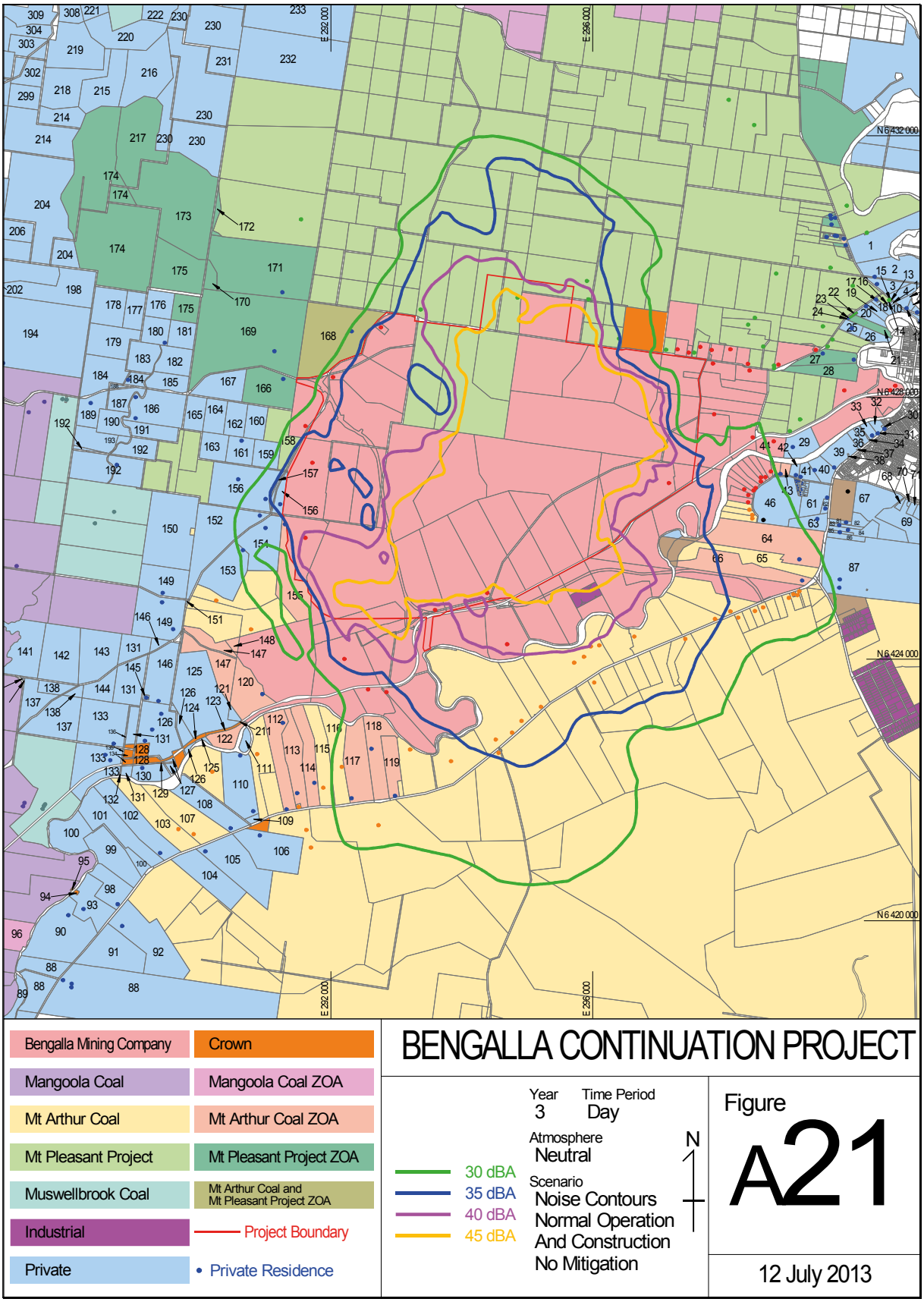
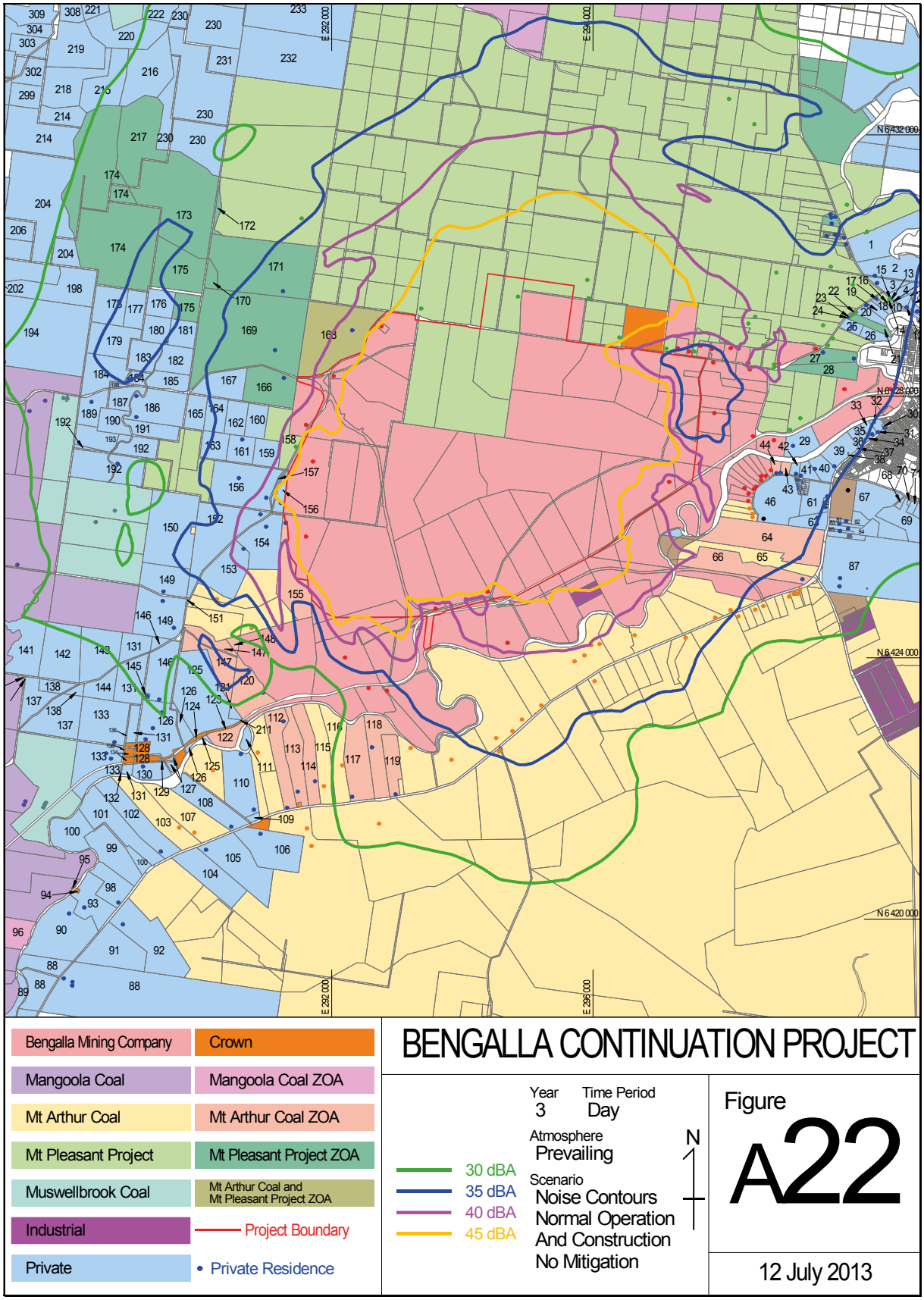
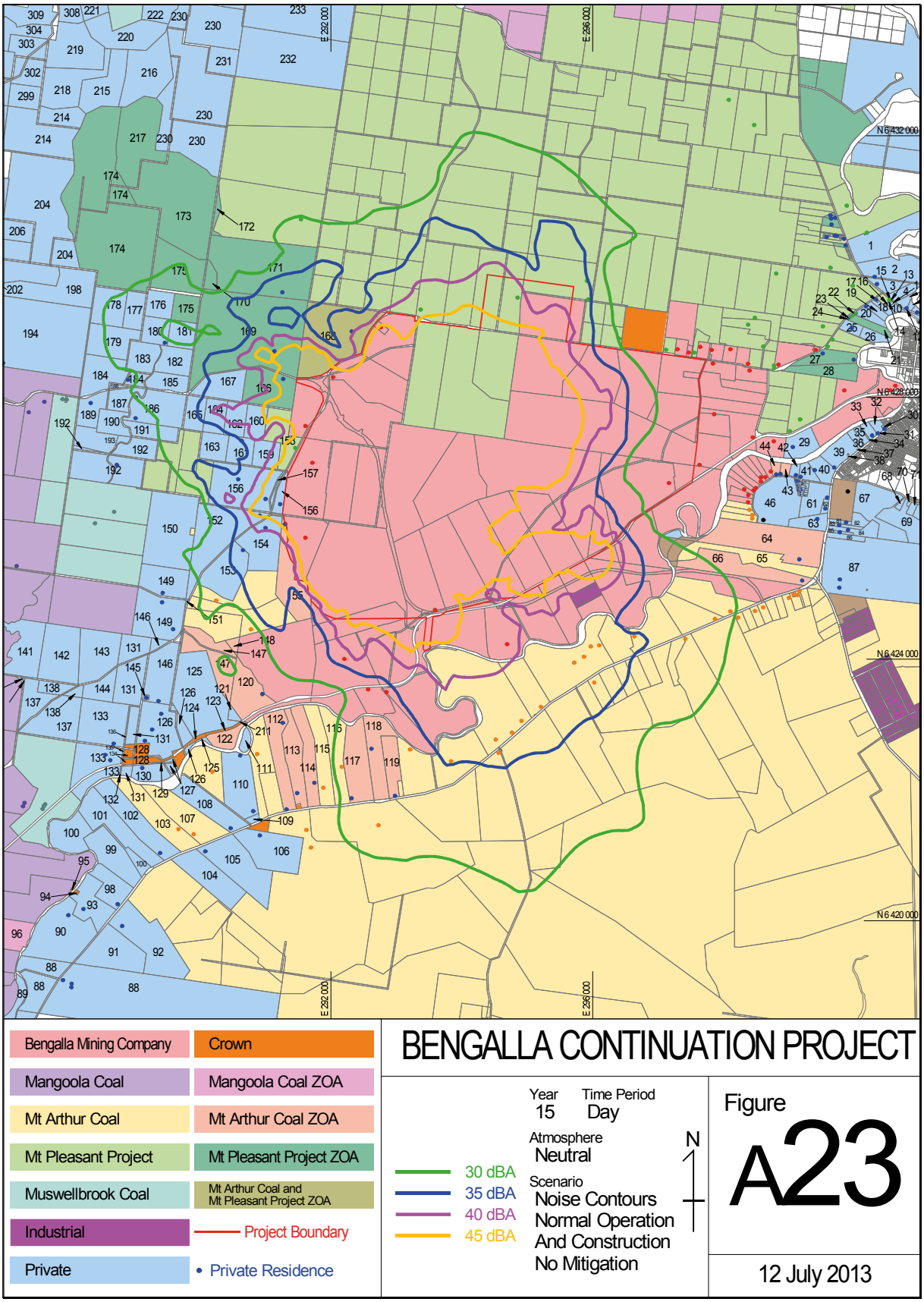
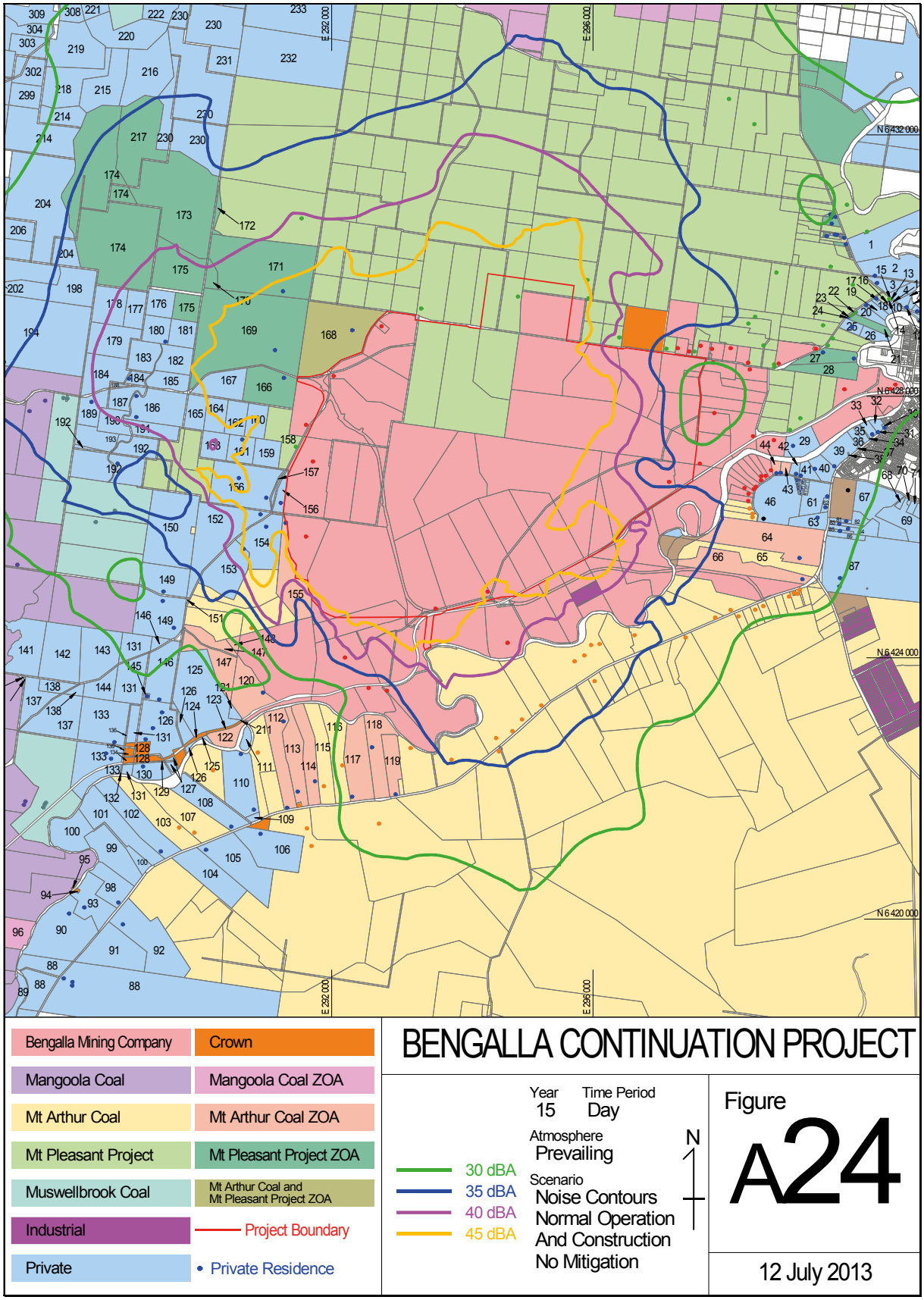
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 1-2
Time Period Day
Atmosphere Neutral
30 dBA
35 dBA
40 dBA
45 dBA
Scenario
Noise Contours
Normal Operation
And Construction
No Mitigation
N
Figure
A19
12 July 2013

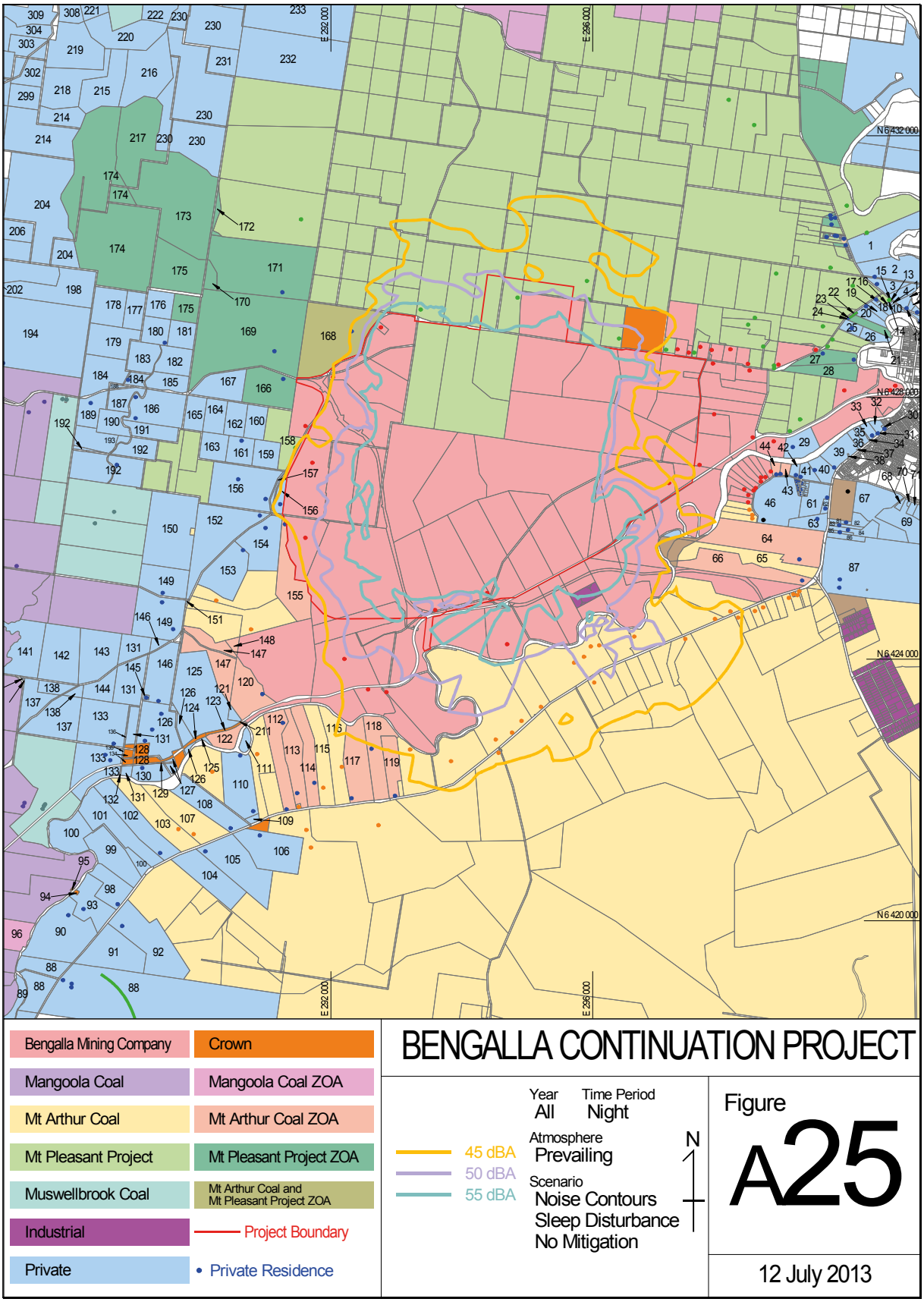

E 292 000
E 296 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year
1-2
Time Period
Day
Atmosphere
Prevailing
Scenario
Noise Contours
Normal Operation
And Construction
No Mitigation
30 dBA
35 dBA
40 dBA
45 dBA
N
Figure
A20
12 July 2013


E 292 000
E 296 000
E 292 000
E 296 000
N 6 432 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 3
Time Period Day
Atmosphere Neutral
Scenario Noise Contours Normal Operation And Construction No Mitigation
30 dBA
35 dBA
40 dBA
45 dBA
N
Figure A21
12 July 2013


E 292 000
E 296 000
N 6 432 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 3
Time Period Day
Atmosphere Prevailing
Scenario Noise Contours Normal Operation And Construction No Mitigation
30 dBA
35 dBA
40 dBA
45 dBA
N
Figure A22
12 July 2013


E 292 000
E 296 000
E 292 000
E 296 000
N 6 432 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 15
Time Period Day
Atmosphere Neutral
30 dBA
35 dBA
40 dBA
45 dBA
Scenario
Noise Contours
Normal Operation
And Construction
No Mitigation
N
Figure
A23
12 July 2013

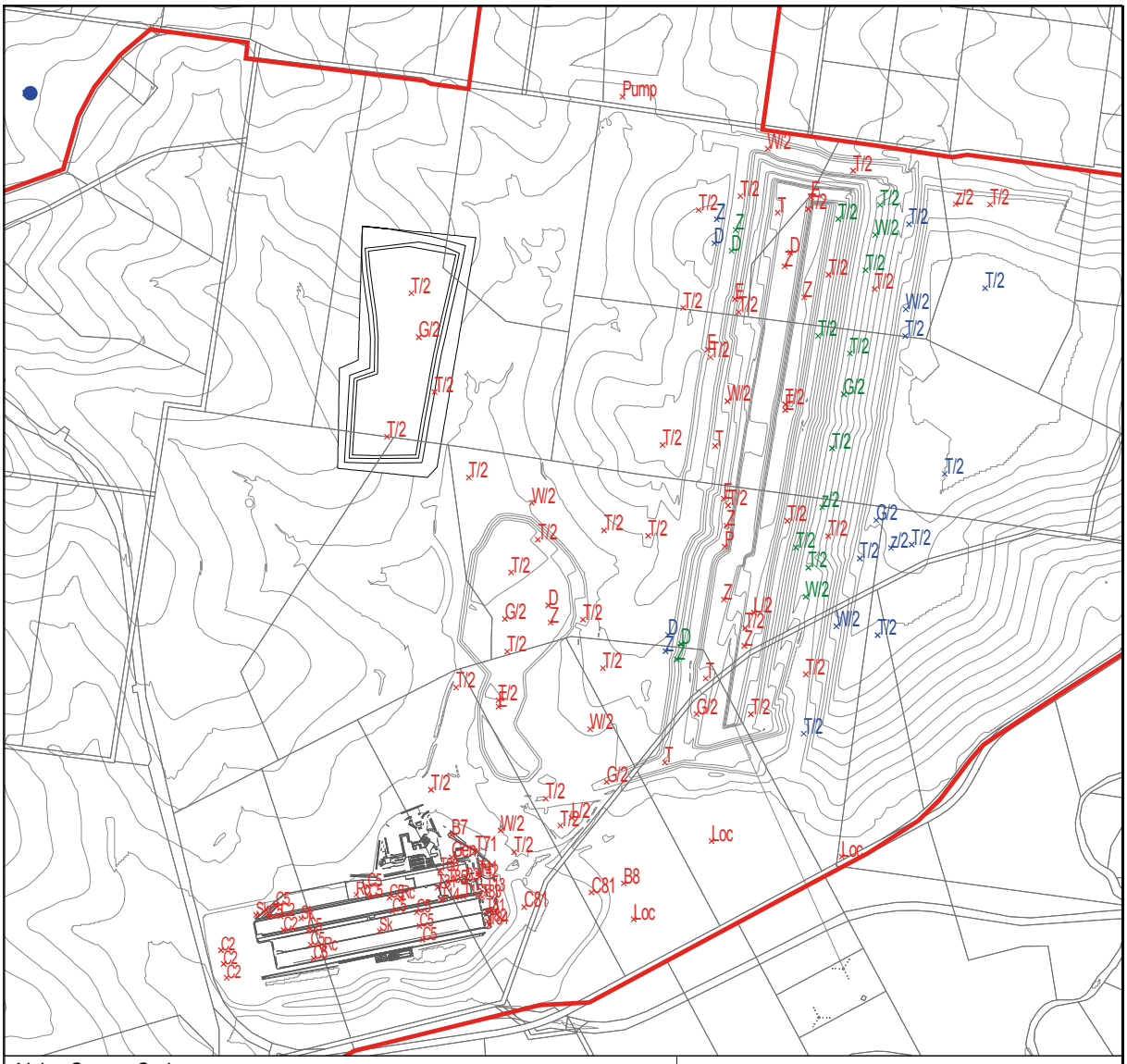

E 292 000
E 296 000
N 6 432 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year 15
Time Period Day
Atmosphere Prevailing
Scenario Noise Contours Normal Operation And Construction No Mitigation
30 dBA
35 dBA
40 dBA
45 dBA
N
Figure A24
12 July 2013


E 292 000
E 296 000
E 298 000
N 6 432 000
N 6 428 000
N 6 424 000
N 6 420 000
Bengalla Mining Company
Crown
Mangoola Coal
Mangoola Coal ZOA
Mt Arthur Coal
Mt Arthur Coal ZOA
Mt Pleasant Project
Mt Pleasant Project ZOA
Muswellbrook Coal
Mt Arthur Coal and Mt Pleasant Project ZOA
Industrial
Project Boundary
Private
Private Residence
BENGALLA CONTINUATION PROJECT
Year All
Time Period Night
Atmosphere Prevailing
Scenario Noise Contours Sleep Disturbance No Mitigation
45 dBA
50 dBA
55 dBA
N
Figure
A25
12 July 2013

APPENDIX B – NOISE SOURCE LOCATION FIGURES

FIGURE	NOISE SOURCE LOCATIONS – NORMAL OPERATION
B1	Year 1
B2	Year 4
B3	Year 8
B4	Year 15
B5	Year 24
FIGURE	NOISE SOURCE LOCATIONS – CONSTRUCTION
B6	Year 1-2 construction
B7	Year 3 construction
B8	Year 15 construction

The noise model included ground contours at 2m intervals over most of the modelled area, with 10 m ground contours over some of the receiver area where 2 m contours were not available. The noise source location figures show 10 m contours over the entire area to improve clarity.



Noise Source Codes

P	Dragline 9020	Bx	Coal bin/feeders
E	Excavator 5500, 3600	Txx	Transfer, Cpp
L	Loader L1800	Sk	Stacker
T	Truck	Rc	Reclaimer
Z	Dozer D11	C2	Conveyor 200m
z	Wheel dozer 854	C5	Conveyor 500m
W	Water Cart R90	C81	Train loadout conveyor
G	Grader 16, 24	Gen	Generators
D	Drill SK50	Pump	Pumps
Loc	Locomotive		

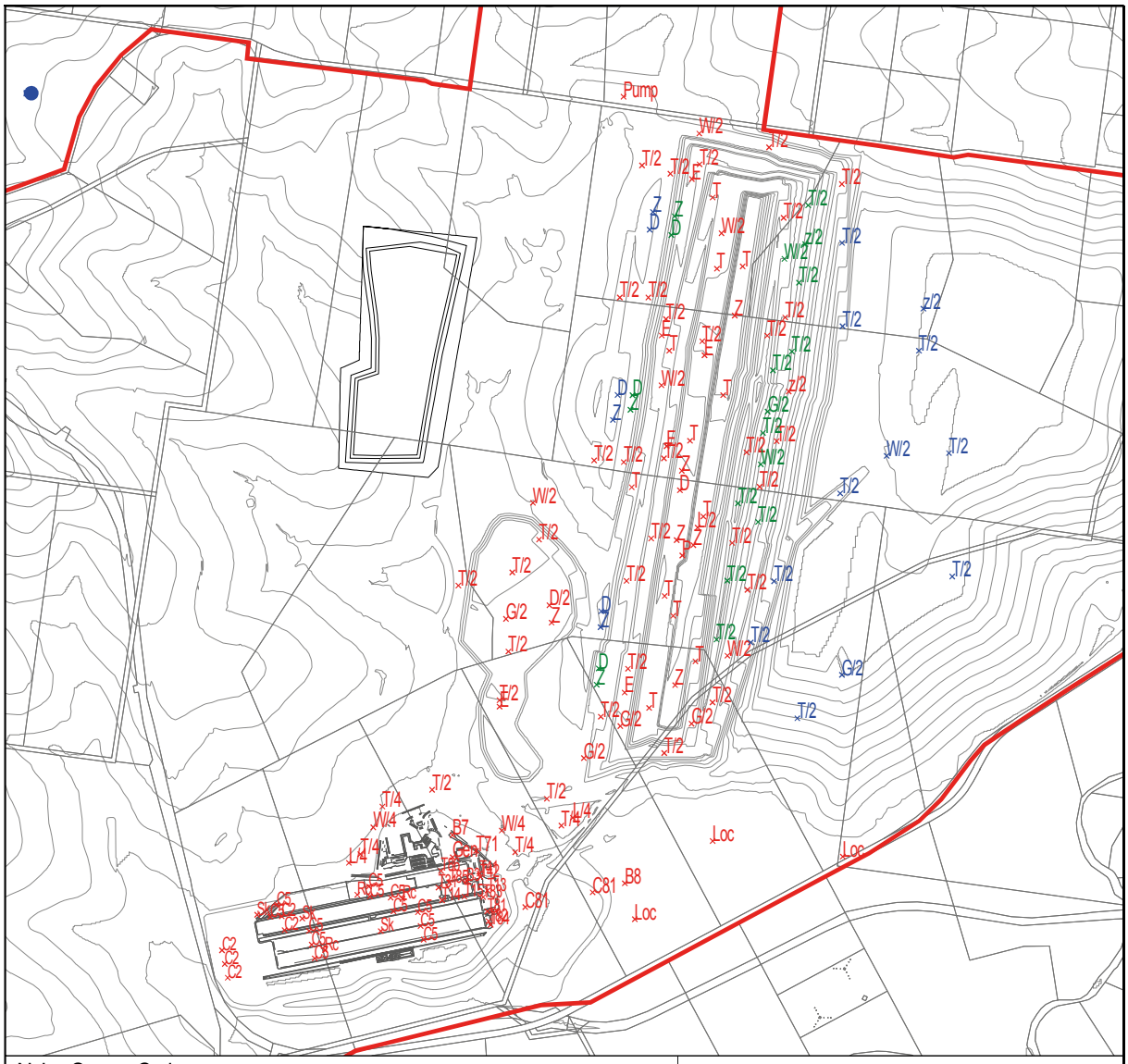
Red - 24hr
Blue - Day Only
Green - Night Only

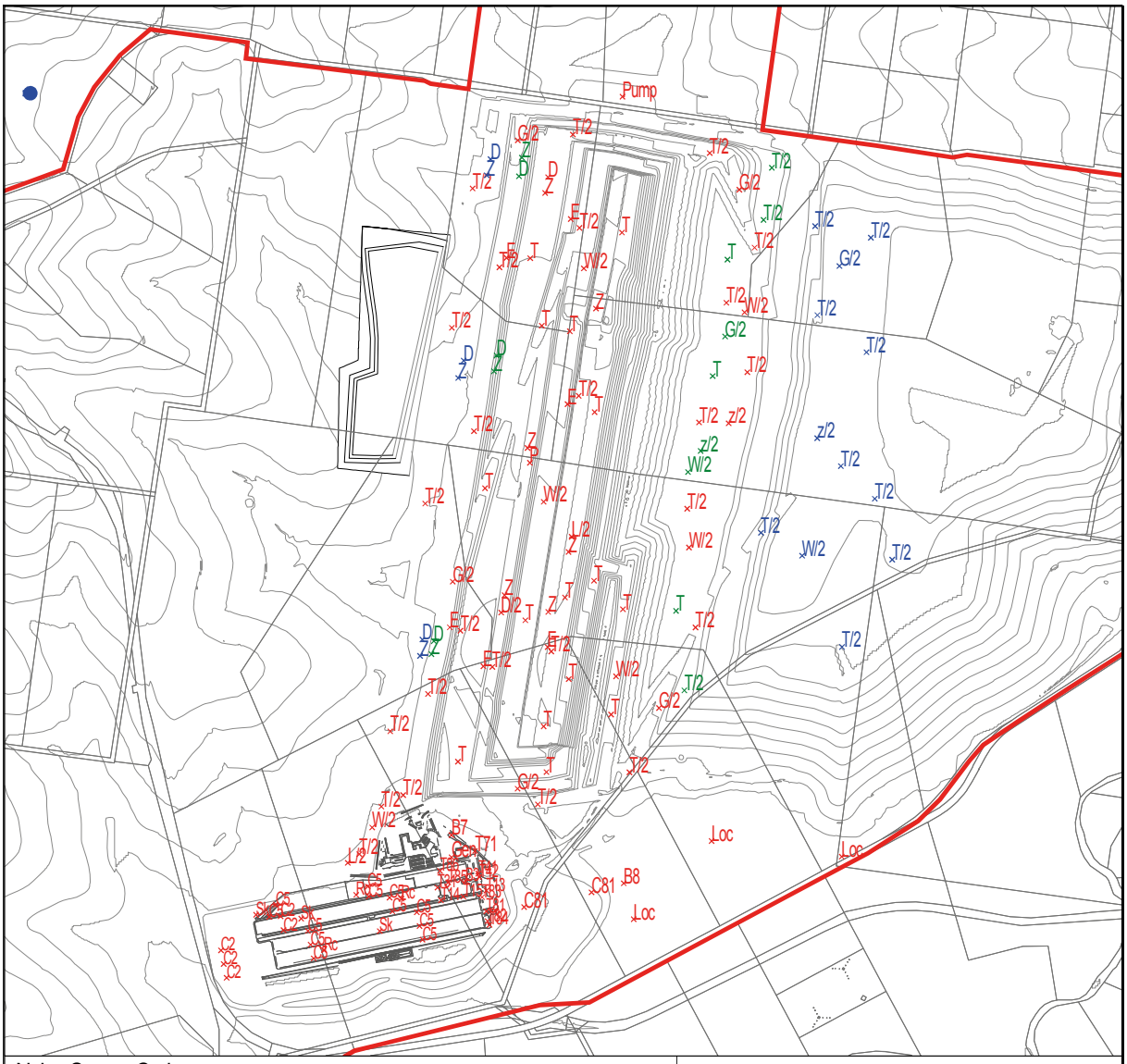
Bengalla Continuation Project

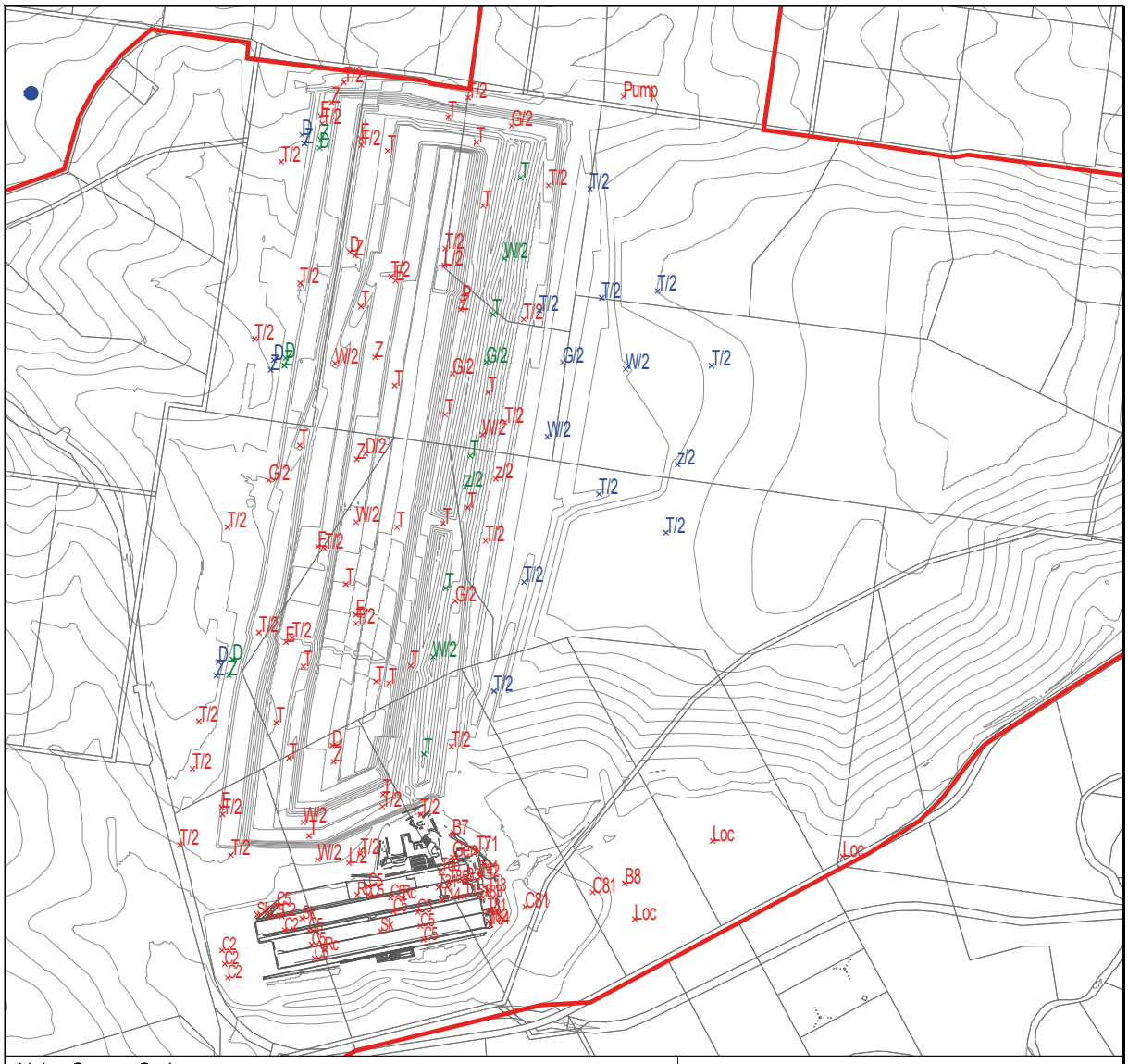
Year 1
Scenario Noise Sources
Version 4

Figure B1

7 December 2012


Pump
Loc
C81
B8
B7
Noise Source Codes
P Dragline 9020
E Excavator 5500, 3600
L Loader L1800
T Truck
Z Dozer D11
z Wheel dozer 854
W Water Cart R90
G Grader 16, 24
D Drill SK50
Loc Locomotive
Bx Coal bin/feeders
Txx Transfer, Cpp
Sk Stacker
Rc Reclaimer
C2 Conveyor 200m
C5 Conveyor 500m
C81 Train loadout conveyor
Gen Generators
Pump Pumps
Red - 24hr
Blue - Day Only
Green - Night Only
N
Bengalla Continuation Project
Year 4
Scenario Noise Sources
Version 4
Figure B2
7 December 2012


Pump
Loc
B7
B8
C81
Noise Source Codes
P Dragline 9020
E Excavator 5500, 3600
L Loader L1800
T Truck
Z Dozer D11
z Wheel dozer 854
W Water Cart R90
G Grader 16, 24
D Drill SK50
Loc Locomotive
Bx Coal bin/feeders
Txx Transfer, Cpp
Sk Stacker
Rc Reclaimer
C2 Conveyor 200m
C5 Conveyor 500m
C81 Train loadout conveyor
Gen Generators
Pump Pumps
Red - 24hr
Blue - Day Only
Green - Night Only
N
Bengalla Continuation Project
Year
8
Scenario
Noise Sources
Version
4
Figure
B3
7 December 2012



Noise Source Codes

P	Dragline 9020	Bx	Coal bin/feeders
E	Excavator 5500, 3600	Txx	Transfer, Cpp
L	Loader L1800	Sk	Stacker
T	Truck	Rc	Reclaimer
Z	Dozer D11	C2	Conveyor 200m
z	Wheel dozer 854	C5	Conveyor 500m
W	Water Cart R90	C81	Train loadout conveyor
G	Grader 16, 24	Gen	Generators
D	Drill SK50	Pump	Pumps
Loc	Locomotive		

N

Red - 24hr
Blue - Day Only
Green - Night Only

Bengalla Continuation Project

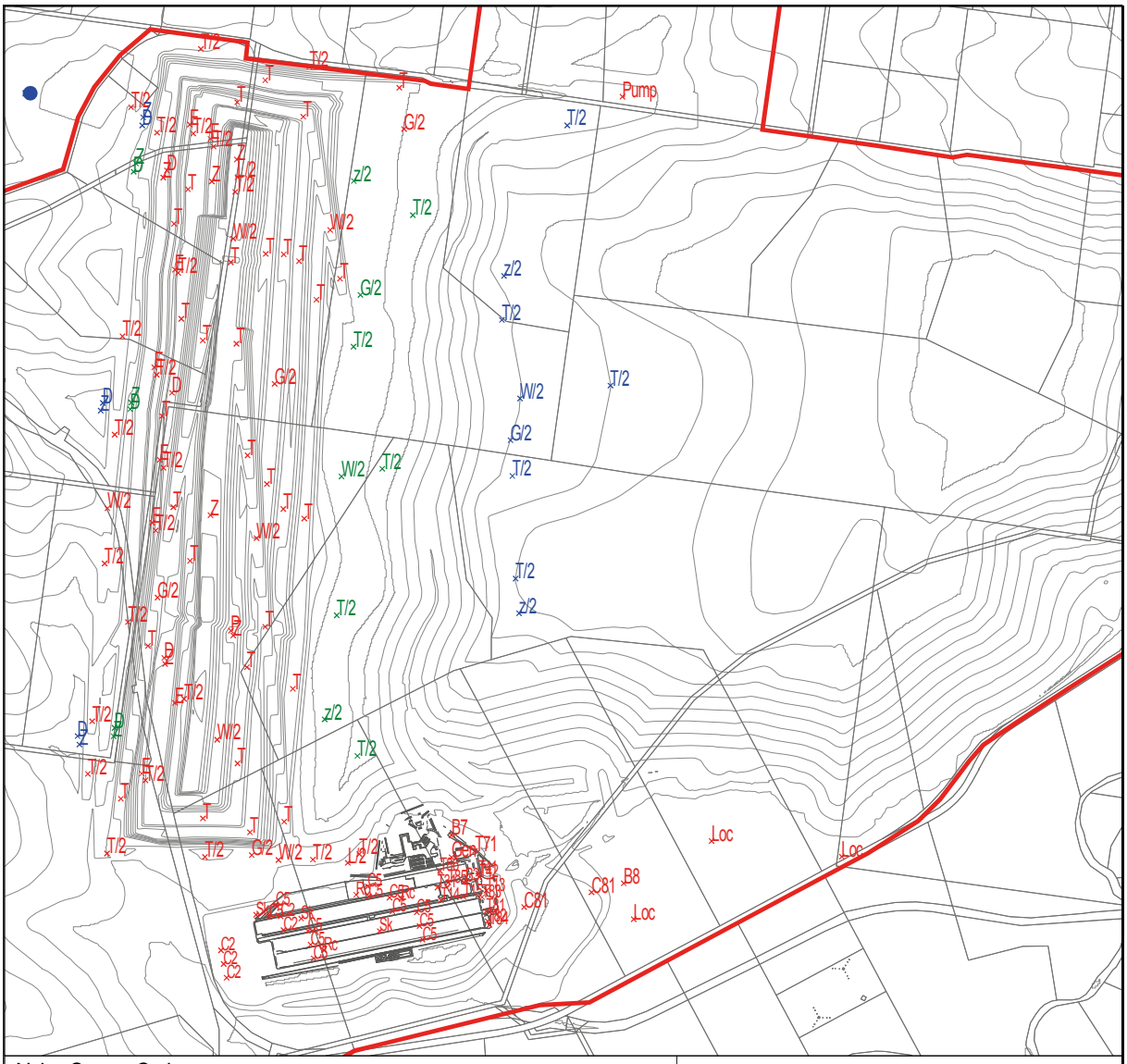
Year
15

Scenario
Noise Sources

Version
4

Figure
B4

7 December 2012



Noise Source Codes

P	Dragline 9020	Bx	Coal bin/feeders
E	Excavator 5500, 3600	Txx	Transfer, Cpp
L	Loader L1800	Sk	Stacker
T	Truck	Rc	Reclaimer
Z	Dozer D11	C2	Conveyor 200m
z	Wheel dozer 854	C5	Conveyor 500m
W	Water Cart R90	C81	Train loadout conveyor
G	Grader 16, 24	Gen	Generators
D	Drill SK50	Pump	Pumps
Loc	Locomotive		

Red - 24hr
Blue - Day Only
Green - Night Only

N

Bengalla Continuation Project

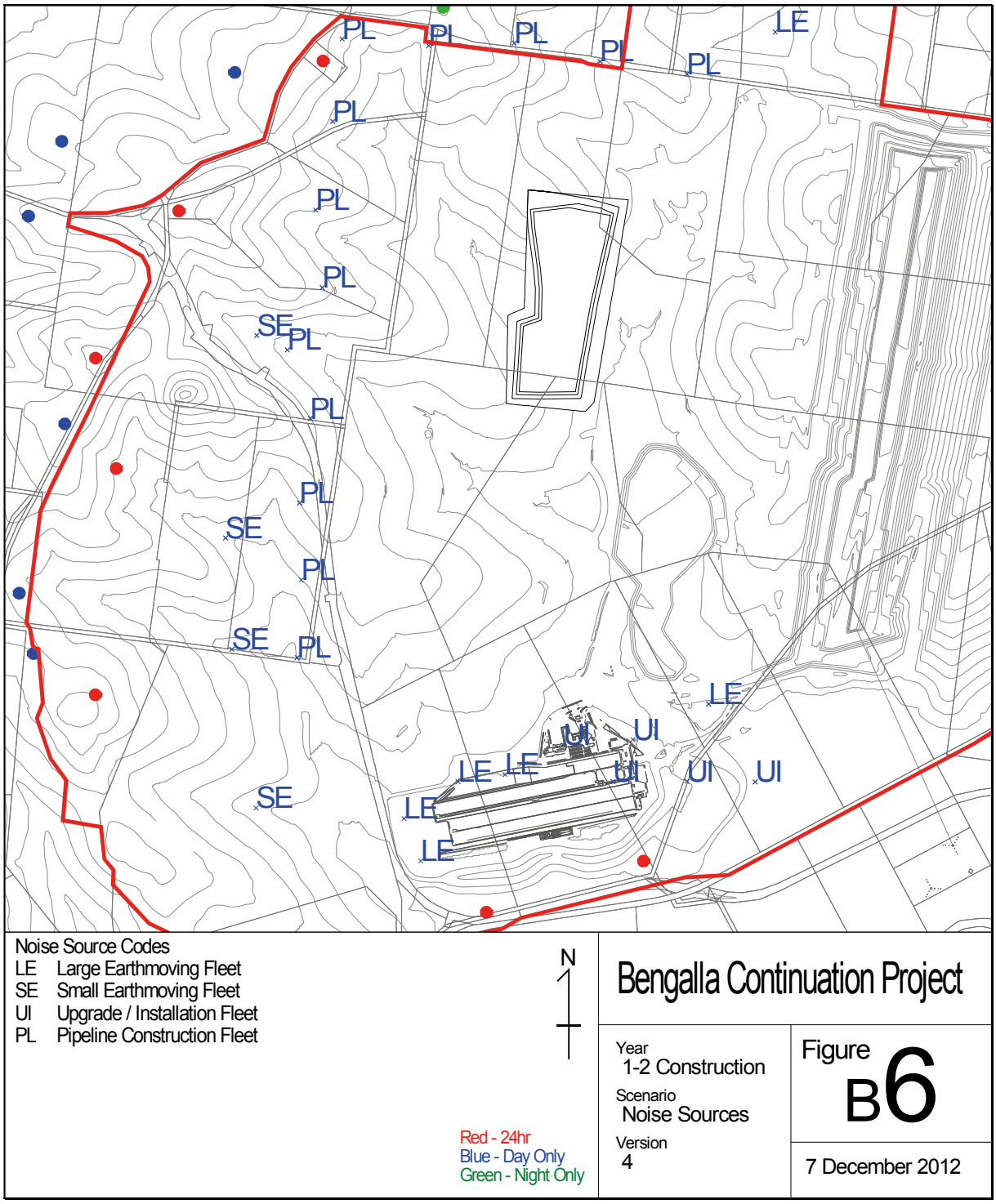
Year
24

Scenario
Noise Sources

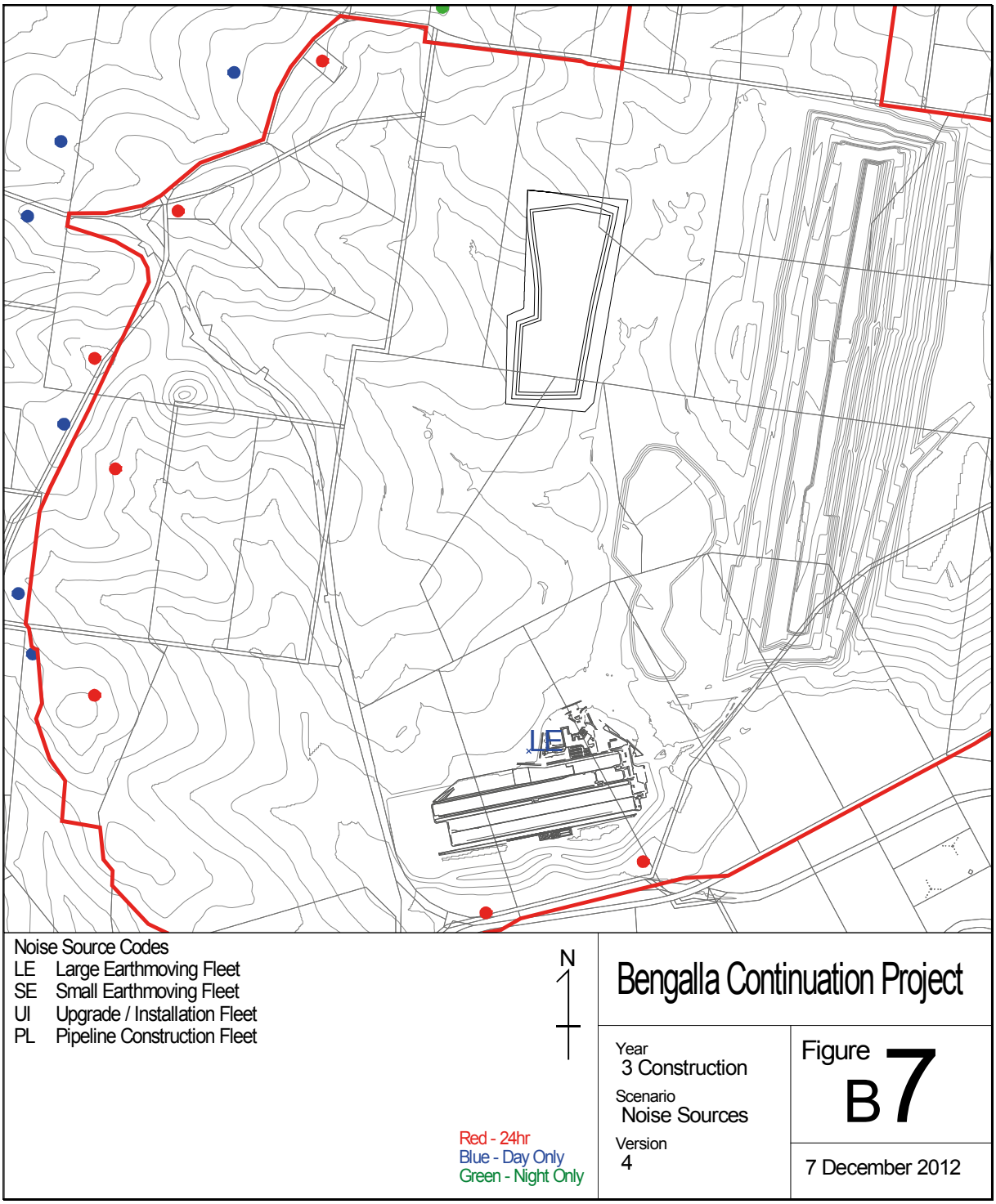
Version
4

Figure
B5

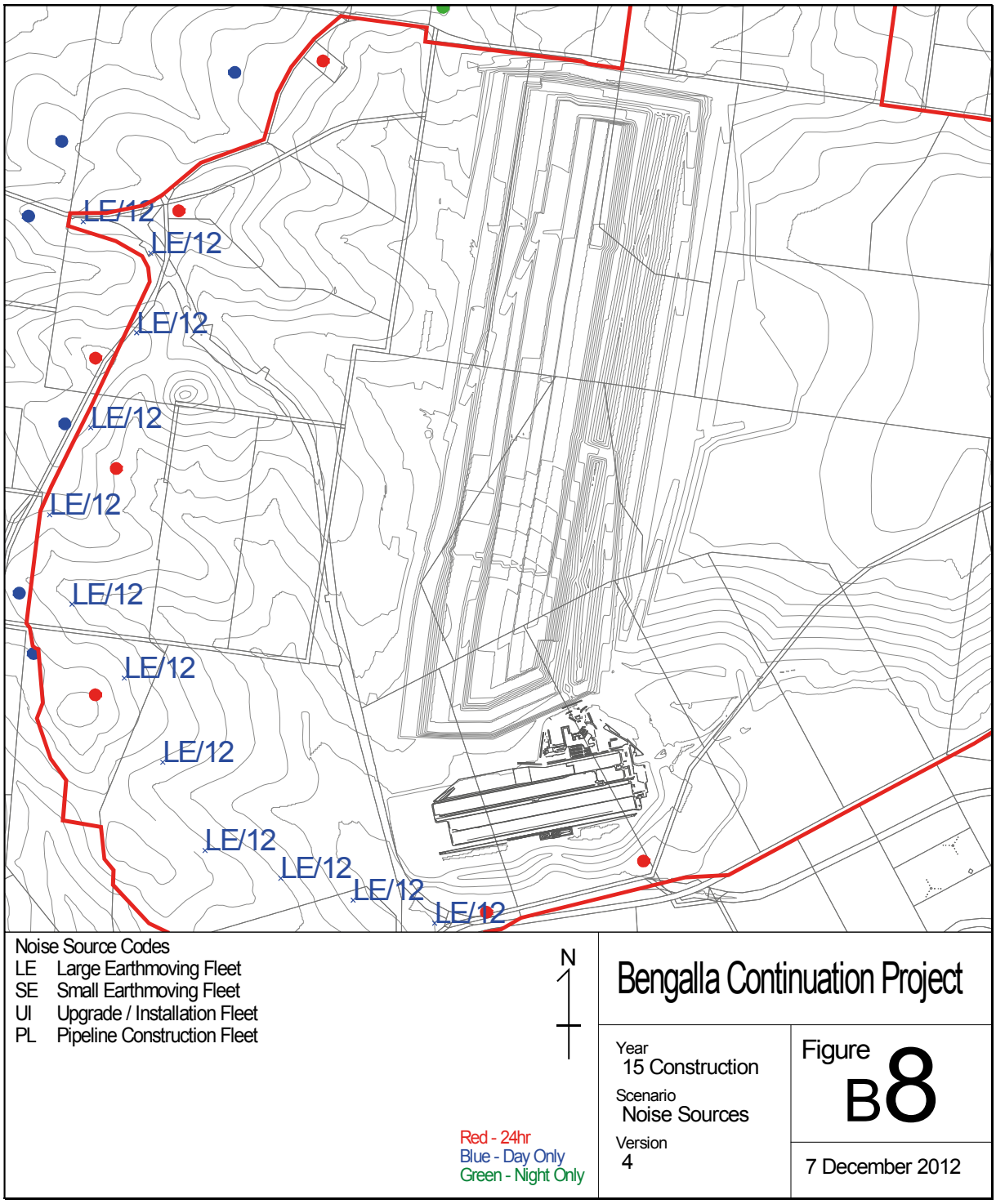
7 December 2012



Construction noise contours for Years 1 and 2 have been calculated by taking the maximum, rather than the sum, of all noise sources shown in Figure B6 assuming the construction fleets move from one location to the next. The resulting contours were then added to the day/evening prevailing operational noise contours for Year 1, assuming normal mining activity occurs in conjunction with construction activity, to present the construction noise contours in Figures A19 and A20.



Construction noise contours for Year 3 have been calculated by adding noise contours from the modelled source shown in Figure B7 with the day/evening prevailing operational noise contours for Year 4, assuming normal mining activity occurs in conjunction with construction activity, to present the construction noise contours in Figures A21 and A22.



Construction noise contours for Year 15 have been calculated by taking the sum of all noise sources shown in Figure B8, where a large earthmoving fleet is assumed to be distributed along the Bengalla Access Road route. The resulting contours were then added to the day/evening prevailing operational noise contours for Year 15, assuming normal mining activity occurs in conjunction with construction activity, to present the construction noise contours in Figures A23 and A24.

APPENDIX C – PREDICTED NOISE LEVEL TABLES

TABLE/FIGURE DESCRIPTION

TABLE C1 Predicted operational noise levels at privately owned residences

TABLE C2 Predicted operational noise levels over 25% of privately owned property areas

FIGURE C1 Landownership figure showing residences owned by mining companies

TABLE C3 Predicted operational noise levels at residences owned by mining companies

Construction and sleep disturbance noise levels are not included in the tables.

Table C1: Operational Noise Levels at Residences, LAeq,15min

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Residence	Predicted Noise Level, LAeq,15min														
2	25.5	19.6	19.6	17.7	17.8	36.6	35.6	34.8	32.6	32.1	33.4	31.2	32.5	31.2	32.0
3	25.0	19.7	19.6	17.7	17.8	36.6	35.6	34.8	32.6	32.2	33.5	31.4	32.8	31.4	32.2
17	24.5	20.1	19.7	17.7	17.8	36.6	35.7	34.9	32.7	32.4	33.6	31.7	33.3	31.8	32.5
19	24.7	20.5	20.0	17.8	18.0	37.0	36.1	35.2	32.8	32.6	33.8	31.7	33.4	32.0	32.7
22	24.9	20.9	20.3	18.0	18.2	37.5	36.5	35.4	32.9	32.9	34.0	31.5	33.3	32.2	33.0
23	25.0	21.0	20.4	18.1	18.3	37.8	36.6	35.5	33.0	33.1	34.1	31.3	33.3	32.3	33.1
24	25.0	21.0	20.4	18.1	18.3	37.9	36.7	35.5	33.0	33.1	34.1	31.3	33.2	32.3	33.2
25	24.6	21.2	20.5	18.1	18.2	37.6	36.3	35.2	32.9	33.1	34.0	31.1	33.1	32.5	33.3
27E	24.4	22.3	20.8	17.7	17.7	36.9	35.9	34.2	31.8	32.0	33.6	30.5	32.7	32.5	33.5
27W	25.2	22.2	21.1	18.3	18.2	38.7	37.3	35.0	32.5	32.8	34.3	30.8	32.5	33.0	33.9
29	30.6	28.2	24.5	18.9	18.1	37.6	36.0	33.9	31.0	29.9	33.9	31.1	32.8	33.4	34.5
39	30.1	26.6	23.7	19.2	18.6	34.8	33.4	32.6	29.8	29.2	34.5	31.2	33.5	33.1	34.1
40	30.9	27.4	24.4	19.4	18.8	35.7	34.2	33.1	30.3	29.4	34.5	31.3	33.6	33.4	34.6
41	31.7	28.2	24.9	19.9	19.2	36.1	34.6	33.1	30.7	29.5	34.6	31.6	33.9	33.6	34.9
42	31.8	28.4	25.1	19.9	19.3	36.5	35.0	33.2	30.9	29.6	34.6	31.7	33.8	33.7	35.0
43	32.1	29.4	25.5	20.2	19.5	37.6	36.0	33.6	31.4	29.9	34.5	32.0	33.7	34.0	35.2
44	32.3	29.6	25.6	20.3	19.6	37.9	36.1	33.7	31.5	29.9	34.5	32.1	33.6	34.0	35.2
46	34.2	30.8	27.4	23.4	22.1	36.5	33.8	32.9	31.9	30.3	36.0	33.6	35.4	35.2	36.2
47	32.1	28.5	25.2	20.2	19.5	36.3	34.5	33.1	30.9	29.6	34.7	31.8	34.0	33.8	35.1
48	32.0	28.4	25.1	20.2	19.5	36.2	34.4	33.0	30.8	29.5	34.7	31.8	34.0	33.8	35.0
49	32.0	28.3	25.1	20.2	19.5	36.1	34.3	33.0	30.7	29.5	34.7	31.8	34.0	33.7	35.0
50	32.1	28.5	25.2	20.3	19.6	36.2	34.3	33.0	30.8	29.6	34.7	31.8	34.1	33.8	35.1
51	32.2	28.5	25.3	20.4	19.7	36.1	34.1	32.9	30.8	29.5	34.8	31.9	34.1	33.8	35.1
52	32.3	28.4	25.3	20.5	19.8	35.9	33.9	32.8	30.8	29.5	34.8	31.9	34.2	33.9	35.1
53	32.4	28.5	25.3	20.7	19.9	35.8	33.7	32.8	30.8	29.5	34.8	32.0	34.3	33.9	35.1
54	32.0	28.1	25.0	20.2	19.5	35.8	34.0	32.9	30.6	29.4	34.7	31.7	34.0	33.7	35.0
55	32.1	28.2	25.1	20.3	19.6	35.8	33.9	32.8	30.7	29.4	34.7	31.8	34.1	33.7	35.0
57	32.3	28.3	25.2	20.5	19.8	35.6	33.7	32.7	30.7	29.4	34.8	31.9	34.2	33.8	35.1
58	32.4	28.3	25.2	20.6	19.9	35.6	33.5	32.6	30.7	29.4	34.8	31.9	34.2	33.8	35.1
59	32.5	28.4	25.3	20.8	20.0	35.6	33.4	32.6	30.7	29.4	34.8	32.0	34.3	33.9	35.1
60	32.6	28.4	25.4	20.9	20.1	35.5	33.3	32.5	30.7	29.3	34.9	32.0	34.3	33.9	35.1
61	31.4	27.3	24.5	20.6	19.8	33.9	32.1	31.4	29.8	28.6	34.7	31.8	34.0	33.5	34.5
62	31.3	27.4	24.8	21.2	20.2	33.5	31.6	30.9	29.8	28.4	34.7	32.0	34.2	33.5	34.6
63	31.7	27.8	25.2	22.0	20.7	33.5	31.4	30.8	30.0	28.5	35.0	32.2	34.5	33.7	34.9
64	32.3	28.7	26.8	24.9	22.8	33.1	30.5	30.4	30.3	28.4	35.3	33.6	35.4	34.4	35.7
66	31.6	28.8	27.3	25.6	23.3	32.0	30.0	29.8	29.8	27.9	35.5	34.4	35.7	34.6	35.7

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Residence	Predicted Noise Level, LAeq,15min														
90	19.2	18.1	19.3	18.8	18.5	19.5	18.4	19.5	18.9	18.6	30.0	29.6	31.0	31.5	33.1
92	20.4	19.8	20.6	20.7	20.2	20.4	19.8	20.6	20.7	20.2	31.1	30.6	32.2	32.5	33.9
93	19.6	18.6	19.7	19.3	19.0	19.8	18.8	19.9	19.3	19.0	30.4	30.0	31.5	32.0	33.5
98	20.5	19.8	20.6	20.4	19.9	20.5	19.8	20.6	20.4	19.9	31.3	31.0	32.5	33.2	34.4
102	21.4	20.6	21.7	21.3	20.8	21.5	20.6	21.7	21.3	20.9	33.1	32.9	34.0	35.0	36.4
103	21.7	20.9	21.9	21.7	21.3	21.9	21.0	22.0	21.7	21.3	33.9	33.6	34.6	35.5	37.3
105	22.8	22.1	23.1	23.0	22.5	22.8	22.1	23.1	23.0	22.5	34.6	34.3	35.4	36.5	37.9
106	24.6	24.2	24.7	24.9	24.8	24.6	24.2	24.7	24.9	24.8	36.2	36.2	36.8	37.5	39.4
107	22.2	21.5	22.5	22.3	21.9	22.3	21.6	22.5	22.4	21.9	34.4	34.1	35.1	36.0	37.9
108	23.5	22.8	23.7	23.7	23.4	23.5	22.8	23.7	23.7	23.4	35.7	35.4	36.3	37.1	39.0
110N	22.4	21.9	22.5	23.1	22.9	23.5	22.4	23.0	23.3	23.1	37.0	36.1	36.8	37.4	40.2
110S	24.1	23.5	24.2	24.3	24.1	24.1	23.5	24.2	24.3	24.1	36.7	36.4	36.9	37.7	39.9
112N	23.9	23.2	23.7	24.2	24.3	24.8	23.8	24.1	24.4	24.4	38.8	37.9	38.8	39.3	41.7
112S	25.5	24.9	25.3	25.6	25.7	25.5	24.9	25.3	25.6	25.7	37.6	37.4	37.9	38.4	40.4
113	25.9	25.2	25.5	25.7	26.0	25.9	25.2	25.5	25.7	26.0	38.3	37.9	38.7	39.1	41.0
114	26.7	26.0	26.1	26.3	26.6	26.7	26.0	26.1	26.3	26.6	39.0	38.6	39.5	39.9	41.7
117	28.5	27.8	27.9	28.1	28.2	28.5	27.8	27.9	28.1	28.2	39.8	39.5	40.2	40.6	42.1
118	29.7	29.1	28.8	29.1	29.4	29.7	29.1	28.8	29.1	29.4	41.7	41.2	41.9	42.7	44.4
119	29.8	29.1	29.2	29.7	29.9	29.8	29.1	29.2	29.7	29.9	41.1	41.5	41.5	41.4	42.7
120	24.4	23.6	24.3	25.2	25.7	27.5	26.0	26.2	25.7	26.0	38.6	37.4	38.3	38.5	41.2
126N	20.4	20.5	20.5	21.2	21.2	25.6	25.2	24.7	23.8	23.3	33.3	32.0	33.8	34.6	37.6
126C	19.8	19.7	19.7	20.6	20.5	24.5	23.7	23.4	22.5	22.0	32.6	31.2	33.1	33.7	36.6
126S	19.3	18.9	19.1	19.9	19.9	23.8	22.5	22.5	21.4	20.9	32.0	30.6	32.5	32.8	35.9
130	19.0	18.4	19.0	19.3	19.0	22.8	20.9	21.6	20.2	19.6	31.8	30.6	32.3	32.4	35.7
133N	17.6	17.2	17.6	18.4	17.9	23.3	21.5	21.7	20.2	19.3	30.8	29.1	31.1	31.6	34.9
133C	17.2	16.9	17.4	18.0	17.6	23.0	21.1	21.5	19.8	18.9	30.8	29.2	30.9	31.5	34.8
133S	17.5	17.0	17.6	18.1	17.7	22.9	20.8	21.4	19.7	18.8	30.9	29.4	31.0	31.5	34.8
145	20.3	20.3	20.3	21.4	21.4	26.6	26.0	25.7	25.4	24.7	32.1	30.6	32.6	33.4	36.3
146	20.5	20.7	20.6	21.5	21.5	26.5	26.0	25.6	24.9	24.3	33.0	31.5	33.4	34.1	37.4
149N	20.1	19.6	19.9	22.0	21.9	30.3	29.4	29.5	29.7	29.7	29.7	27.3	30.5	28.8	32.3
149C	20.2	19.7	20.0	22.0	21.9	30.1	29.3	29.5	30.0	29.8	29.7	27.6	30.9	29.6	32.6
149S	21.0	20.5	20.9	23.8	22.6	29.4	28.9	29.1	29.6	29.0	30.5	28.7	31.9	30.9	34.6
152	29.8	29.4	29.7	33.5	35.7	38.0	38.0	38.0	41.2	44.5	37.4	36.3	38.3	38.9	44.6
153	27.4	26.9	27.0	29.6	30.8	36.4	35.9	36.3	38.6	39.8	35.6	34.6	37.0	37.1	42.1
154	29.3	28.9	29.0	31.7	33.4	37.8	37.9	38.0	40.0	41.9	37.1	35.8	38.0	36.9	42.6
155	31.3	31.1	31.4	34.9	37.8	38.7	39.1	40.0	41.7	44.9	38.3	37.0	39.7	39.1	45.4
156E	31.7	31.5	31.7	36.4	40.1	40.0	40.0	40.6	44.3	47.3	39.4	38.4	40.3	42.0	46.7
156C	30.4	29.9	30.1	34.5	36.6	38.6	38.4	38.3	42.3	45.2	37.6	36.5	38.2	39.5	45.0
156W	24.6	24.0	24.1	27.4	28.2	35.4	35.4	34.2	38.9	39.7	33.2	30.0	34.1	33.0	39.4
161	21.3	20.9	21.4	24.5	26.0	35.5	35.4	34.4	38.4	39.6	31.7	27.3	33.4	30.3	34.1
166	24.8	24.1	24.4	26.8	30.8	38.0	37.5	38.0	38.1	41.3	32.4	30.1	34.5	32.3	37.6
168	30.1	29.9	29.8	34.1	40.0	42.3	41.2	40.8	45.2	48.1	36.7	34.1	38.5	36.9	45.7
169	22.9	22.2	22.7	25.1	27.8	37.7	36.7	36.8	37.4	39.5	31.6	28.9	33.5	29.4	34.8
171	23.8	22.9	23.6	25.9	29.6	38.0	37.5	36.9	41.2	42.9	33.9	31.0	34.7	33.0	39.8
180	17.2	16.5	17.5	19.3	21.4	34.1	33.9	33.4	35.9	37.3	30.1	28.1	31.8	30.4	34.4
184	16.8	16.4	17.0	19.1	21.3	33.5	33.2	33.2	35.3	37.8	31.4	29.2	32.1	31.1	35.7
186N	16.3	15.9	16.5	18.8	21.0	33.2	33.0	32.7	34.6	37.2	30.9	28.4	31.4	30.3	35.2
186S	16.1	15.6	16.4	18.7	20.9	32.5	32.3	31.9	33.0	35.5	30.0	27.0	30.5	28.8	34.1
189	16.8	16.2	16.9	18.9	20.8	32.4	32.1	32.2	33.9	35.8	30.4	28.3	30.9	30.4	34.7
192	15.4	15.0	15.7	17.9	19.6	30.9	30.3	30.0	31.0	32.6	27.9	24.1	29.0	25.0	30.0

Table C2: Operational Noise Levels over 25% of Property Areas, LAeq,15min

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Property (Lots)	Predicted Noise Level, LAeq,15min														
1-5	25.1	19.6	19.5	17.7	17.7	36.3	35.3	34.6	32.5	31.8	33.1	31.2	32.3	31.3	31.9
6,7	23.0	19.9	19.4	17.2	17.5	35.1	34.3	33.9	32.1	31.5	33.0	31.3	32.6	31.5	31.9
8,9	22.8	20.1	19.5	17.3	17.6	34.8	34.0	33.5	31.9	31.3	32.9	31.3	32.5	31.4	31.8
10,13	23.6	20.1	19.6	17.4	17.6	35.8	35.0	34.5	32.5	32.1	33.3	31.5	33.1	31.8	32.4
11	23.8	20.0	19.6	17.4	17.6	36.0	35.1	34.6	32.6	32.1	33.3	31.6	33.2	31.8	32.4
12	23.1	20.0	19.5	17.3	17.5	35.3	34.5	34.1	32.2	31.7	33.1	31.4	32.8	31.6	32.1
14-16	23.9	20.0	19.6	17.5	17.7	36.1	35.2	34.7	32.6	32.2	33.4	31.6	33.2	31.8	32.4
17	24.5	20.1	19.7	17.7	17.8	36.6	35.7	34.9	32.7	32.4	33.6	31.7	33.3	31.9	32.5
18	24.2	20.2	19.8	17.6	17.8	36.4	35.5	34.8	32.7	32.4	33.5	31.7	33.3	31.9	32.5
19,20,21,25,26	24.5	21.1	20.3	17.9	18.1	37.2	36.1	35.1	32.8	32.8	33.8	31.5	33.4	32.3	33.1
22	24.9	20.9	20.3	18.0	18.2	37.6	36.6	35.4	32.9	32.9	34.0	31.5	33.4	32.2	33.0
23	25.0	21.0	20.4	18.1	18.3	37.9	36.7	35.5	33.0	33.1	34.1	31.3	33.3	32.3	33.2
24	25.1	21.0	20.4	18.1	18.4	37.9	36.7	35.5	33.0	33.1	34.1	31.3	33.2	32.3	33.2
27,28	25.2	23.1	21.4	18.2	18.1	38.6	37.8	34.7	32.2	32.4	34.4	30.4	32.4	32.9	33.9
29	30.6	28.1	24.5	19.0	18.2	37.5	36.0	34.0	31.0	30.0	34.2	31.1	33.1	33.4	34.5
30	26.9	23.8	21.8	17.6	17.4	34.1	32.9	31.9	29.4	29.1	33.5	30.5	32.5	31.6	33.0
31	27.2	24.2	22.0	17.8	17.6	34.2	33.0	32.0	29.3	29.0	33.7	30.6	32.6	31.8	33.2
32	27.3	24.1	21.9	17.7	17.5	34.5	33.5	32.3	29.7	29.3	33.6	30.5	32.6	31.9	33.3
33	27.6	24.5	22.2	17.9	17.6	34.7	33.9	32.5	29.8	29.4	33.8	30.6	32.7	32.1	33.4
35,36,39	29.5	26.3	23.5	18.8	18.2	35.5	34.2	32.9	30.0	29.5	34.3	31.1	33.2	32.9	34.0
40	30.8	27.2	24.2	19.6	18.9	35.7	34.2	33.2	30.3	29.5	34.5	31.4	33.6	33.3	34.5
41	31.5	27.9	24.7	19.8	19.2	36.2	34.7	33.3	30.6	29.6	34.6	31.5	33.8	33.5	34.8
42	31.8	28.6	25.1	19.9	19.2	36.9	35.4	33.5	31.0	29.7	34.5	31.7	33.8	33.7	35.0
43	31.9	29.2	25.3	20.0	19.4	37.6	36.1	33.7	31.3	29.9	34.5	31.9	33.7	33.9	35.1
44	32.2	29.8	25.5	20.2	19.5	38.4	36.5	33.8	31.6	29.9	34.4	32.1	33.5	33.9	35.2
46	33.8	30.4	26.8	22.5	21.4	37.2	34.6	33.4	31.8	30.2	35.6	33.1	35.0	34.8	35.9
47	32.1	28.5	25.2	20.2	19.5	36.4	34.6	33.1	30.9	29.6	34.7	31.8	34.0	33.8	35.1
49	32.0	28.3	25.1	20.2	19.5	36.1	34.3	33.0	30.8	29.5	34.7	31.8	34.0	33.7	35.0
50	32.2	28.5	25.2	20.3	19.6	36.2	34.3	33.0	30.8	29.5	34.7	31.8	34.1	33.8	35.1
51	32.3	28.5	25.3	20.4	19.7	36.1	34.1	32.9	30.8	29.5	34.8	31.9	34.2	33.8	35.1
52	32.4	28.5	25.3	20.6	19.8	36.0	33.9	32.8	30.8	29.5	34.8	31.9	34.2	33.9	35.1
53	32.5	28.5	25.4	20.8	20.0	35.8	33.7	32.8	30.8	29.5	34.9	32.0	34.3	34.0	35.2
54,61	32.4	28.1	25.3	21.4	20.4	34.8	32.8	32.1	30.4	29.1	35.0	32.1	34.4	33.9	35.1
55	32.1	28.2	25.0	20.3	19.6	35.8	33.9	32.8	30.6	29.4	34.7	31.8	34.1	33.7	35.0
56	32.2	28.1	25.0	20.4	19.7	35.6	33.7	32.7	30.6	29.4	34.8	31.8	34.1	33.7	35.0
57	32.4	28.2	25.1	20.5	19.8	35.6	33.6	32.7	30.6	29.4	34.8	31.8	34.2	33.8	35.0
58	32.5	28.2	25.2	20.7	19.9	35.5	33.5	32.6	30.6	29.3	34.8	31.9	34.2	33.8	35.1
59	32.5	28.3	25.3	20.8	20.0	35.4	33.3	32.5	30.6	29.3	34.8	31.9	34.3	33.9	35.1
60	32.5	28.4	25.3	20.9	20.1	35.4	33.2	32.5	30.7	29.3	34.9	32.0	34.3	33.9	35.1
62	31.5	27.5	24.8	21.3	20.2	33.7	31.9	31.2	29.9	28.5	34.8	32.0	34.3	33.6	34.7
63	32.7	28.5	25.9	22.7	21.2	34.2	31.9	31.3	30.5	28.9	35.3	32.6	34.8	34.1	35.4
64	35.3	32.4	28.9	25.4	23.6	36.4	34.4	33.4	32.7	30.9	36.5	34.3	36.2	36.1	37.1
65,87	25.1	23.5	22.5	20.8	19.3	26.6	25.4	25.4	25.2	23.9	31.9	30.5	31.7	30.5	31.1
66	36.1	34.0	30.8	28.2	26.1	36.5	34.7	33.3	33.2	31.4	38.0	36.0	37.9	37.3	38.3
81,82,83	30.0	26.7	24.5	21.8	20.4	32.1	30.4	29.8	29.1	27.7	34.7	32.2	34.0	33.0	34.3
84	29.4	26.4	24.4	22.1	20.4	31.5	29.8	29.3	28.7	27.2	34.4	32.3	33.8	32.8	34.0
85,86	30.2	27.1	25.0	22.6	20.9	32.0	30.1	29.8	29.3	27.7	34.7	32.5	34.4	33.3	34.5
48	32.1	28.4	25.2	20.2	19.5	36.2	34.5	33.1	30.8	29.6	34.7	31.8	34.0	33.8	35.0
88	20.8	20.5	21.5	22.3	21.6	20.8	20.5	21.5	22.3	21.6	30.2	29.8	30.4	31.3	32.4

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Property (Lots)	Predicted Noise Level, LAeq,15min														
91,92	21.0	20.4	21.0	21.6	20.8	21.0	20.4	21.0	21.6	20.8	31.3	30.8	32.2	32.7	34.2
93	19.9	19.0	20.1	19.8	19.4	20.2	19.2	20.2	19.8	19.4	30.9	30.6	32.0	32.5	34.0
98	20.5	19.7	20.6	20.3	19.9	20.6	19.7	20.7	20.3	19.9	31.6	31.3	32.7	33.4	34.8
99,100	20.2	19.3	20.4	19.8	19.6	21.2	20.0	20.9	19.9	19.7	31.9	31.7	32.8	33.5	35.2
101	20.2	19.4	20.4	20.0	19.7	21.8	20.3	21.3	20.1	19.8	32.3	32.1	33.1	33.8	35.7
102	21.0	20.1	21.1	20.8	20.4	21.9	20.4	21.5	20.9	20.5	33.0	32.7	33.8	34.6	36.4
103,107	22.0	21.3	22.3	22.1	21.7	22.3	21.4	22.3	22.1	21.7	34.3	34.0	35.0	35.8	37.7
104,105	24.2	23.6	24.4	24.6	24.3	24.2	23.6	24.4	24.6	24.3	35.2	35.2	35.9	37.0	38.2
106,108	25.4	24.9	25.5	25.7	25.7	25.4	24.9	25.5	25.7	25.7	36.5	36.7	36.9	37.7	39.2
109	24.3	23.8	24.4	24.5	24.4	24.3	23.8	24.4	24.5	24.4	36.6	36.3	36.9	37.6	39.8
110,111	23.4	22.8	23.6	23.8	23.5	23.6	22.9	23.6	23.8	23.5	37.0	36.3	37.0	37.6	40.3
112,113	25.4	24.7	25.2	25.3	25.5	25.5	24.7	25.2	25.3	25.5	38.9	38.3	39.1	39.5	41.9
114	26.5	25.8	26.0	26.1	26.5	26.5	25.8	26.0	26.1	26.5	39.5	39.1	40.0	40.7	43.0
117	29.1	28.4	28.3	28.6	28.8	29.1	28.4	28.3	28.6	28.8	41.2	40.8	41.6	42.3	44.4
118,119	30.3	29.8	29.5	30.0	30.3	30.3	29.8	29.5	30.0	30.3	42.4	42.1	42.6	43.4	45.1
120,122,147,148	24.2	23.5	24.1	25.2	25.5	29.7	28.8	28.8	28.6	28.3	37.7	36.5	37.4	37.5	40.0
121,125	22.2	21.7	22.0	23.3	23.4	27.1	26.1	25.9	25.4	24.9	35.1	33.4	34.9	34.6	38.3
126	20.3	20.4	20.4	21.1	21.0	25.1	24.5	24.1	23.2	22.6	33.7	32.4	34.2	34.8	37.7
127,130	20.1	19.5	20.1	20.2	20.0	22.8	21.4	21.9	20.7	20.4	33.0	32.2	33.6	33.8	36.7
131,132,133,135, 136,137,138,139, 140,143,144	18.2	18.1	18.4	19.8	19.5	26.1	25.2	25.3	24.9	23.8	30.5	29.1	30.9	31.4	34.4
145	20.3	20.4	20.4	21.5	21.4	26.7	26.1	25.9	25.6	24.8	32.2	30.7	32.7	33.5	36.4
146	20.8	20.7	20.9	22.6	22.0	28.6	28.3	28.3	28.7	27.7	32.6	31.0	33.1	33.5	36.8
149,150	20.7	20.3	20.4	23.0	23.0	31.7	31.0	31.4	31.8	32.6	30.2	27.9	31.3	30.0	34.2
151	22.1	21.2	21.4	23.9	23.5	30.8	29.8	29.8	30.4	29.7	30.5	27.7	31.4	30.1	34.4
152	25.7	25.2	25.2	28.1	28.3	35.3	35.2	34.8	36.1	36.9	33.5	31.8	34.7	32.8	37.8
153	26.5	25.9	26.1	28.7	29.1	35.0	34.2	34.3	36.3	36.3	34.1	32.6	35.2	35.2	39.6
154	28.8	28.3	28.4	30.7	32.1	37.5	37.4	37.4	39.3	40.8	36.8	35.4	37.7	37.6	42.4
155	28.8	28.1	28.7	30.7	31.7	35.9	35.6	35.2	35.8	36.6	36.1	34.4	37.2	36.7	40.7
156,157	29.5	29.1	29.3	33.4	35.0	38.0	37.9	37.6	41.6	44.3	36.6	35.1	37.4	38.1	43.9
158	29.6	29.3	29.5	33.0	35.0	39.1	39.1	38.6	42.4	44.2	36.6	34.5	37.8	36.9	42.6
159,160,161,162, 163,164,165,186, 187,190,191	21.0	20.5	20.9	23.9	25.7	35.6	35.3	34.3	37.6	38.7	31.8	28.4	33.2	30.3	35.3
166	24.9	24.2	24.4	26.5	29.6	37.9	37.6	37.8	38.2	40.5	32.7	30.0	34.3	31.7	36.8
167	19.9	19.4	19.8	22.3	24.7	36.1	35.7	35.6	37.7	38.7	31.8	28.5	32.8	29.2	34.8
168,169,170,174, 175	22.4	21.7	22.3	24.4	27.6	37.3	36.5	36.3	38.2	39.9	31.6	29.2	33.4	31.1	35.7
171,172,173,217	20.4	19.5	20.1	22.2	23.8	34.6	33.6	33.9	34.9	36.7	29.4	27.9	31.2	29.4	33.5
176,177,178,179, 180,181,182,185	18.9	18.3	19.2	20.3	22.6	34.1	33.7	33.7	36.2	38.4	31.0	29.1	32.2	32.0	35.9
183,184,188	17.5	17.2	17.8	19.6	21.7	33.8	33.6	33.6	35.8	38.1	31.3	29.3	32.3	31.5	35.8
189,193	16.6	15.9	16.7	18.7	20.6	32.2	31.9	32.0	33.5	35.4	30.1	28.0	30.7	30.0	34.4
192	15.9	15.5	16.3	18.3	20.2	31.3	30.8	30.7	32.0	33.7	28.9	25.9	29.6	27.4	32.4
211	22.8	22.1	22.7	23.3	23.5	25.5	23.6	24.0	23.6	23.8	37.4	36.1	36.8	37.1	40.2
230-233	17.2	16.4	17.3	19.1	20.3	31.5	31.1	31.4	33.1	34.6	27.8	26.0	29.1	26.9	31.5

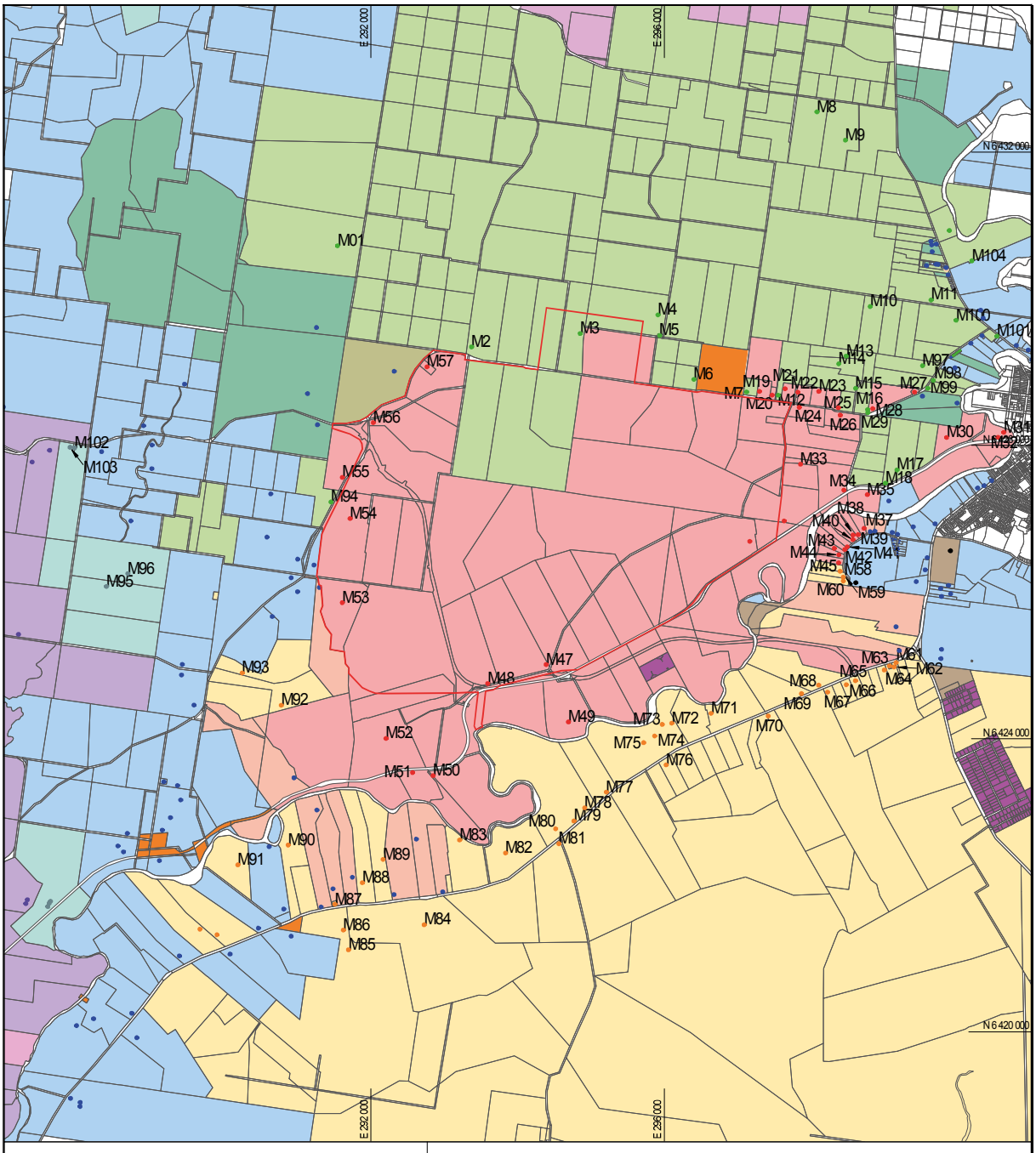

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Table C3: Operational Noise Levels at Mine-Owned Residences, LAeq,15min

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Residence	Predicted Noise Level, LAeq,15min														
M1	21.7	20.9	21.5	23.9	26.2	36.0	34.6	34.3	34.9	37.4	28.6	24.0	30.2	27.2	33.6
M2	37.3	38.7	37.8	42.8	54.4	46.8	47.2	47.2	50.9	58.5	44.4	43.1	44.3	45.9	57.6
M3	44.1	45.4	43.9	42.8	45.2	51.0	52.6	52.1	51.2	55.9	47.0	49.5	50.2	46.9	48.3
M4	41.8	39.0	39.2	35.1	36.1	51.1	50.8	48.8	44.3	47.8	46.2	44.2	46.1	41.1	42.9
M5	44.0	42.1	41.1	35.6	36.3	53.3	52.9	50.7	45.3	48.9	47.3	45.8	47.0	41.6	43.9
M6	48.1	35.1	37.9	29.5	29.7	54.5	45.7	47.0	38.7	39.6	51.9	38.4	37.5	38.2	38.8
M7	37.9	28.1	27.4	24.4	24.8	43.2	35.6	33.5	32.4	34.0	41.8	31.1	30.2	33.4	36.0
M8	24.6	22.4	22.8	19.7	19.0	36.4	36.2	35.3	33.2	32.4	31.8	30.4	32.9	29.2	30.1
M9	24.2	21.9	22.5	19.4	18.7	36.1	35.6	34.5	32.4	31.8	31.3	29.2	31.5	28.1	29.4
M10	27.2	22.6	23.1	19.9	20.2	40.2	36.8	35.0	32.2	32.1	33.9	28.7	30.1	30.0	31.7
M11	25.7	20.5	20.6	18.3	18.8	37.3	35.6	34.2	32.0	31.3	32.3	28.9	30.0	30.2	31.2
M12	32.5	26.1	24.8	21.4	22.5	38.3	32.8	30.2	29.5	29.7	37.0	28.6	27.6	29.8	32.2
M13	28.2	23.7	23.2	20.6	20.0	41.9	38.8	35.5	33.0	32.7	35.0	28.1	29.0	30.4	31.4
M14	28.5	24.1	23.5	21.0	20.2	41.3	38.5	35.7	33.2	33.2	35.0	29.0	29.6	31.3	32.1
M15	27.7	23.1	22.4	19.5	19.0	41.7	39.1	34.9	32.7	32.2	35.4	29.4	30.0	31.4	32.4
M16	25.7	23.2	21.6	18.6	18.3	40.4	39.5	34.4	31.8	31.5	34.7	28.8	29.6	31.0	32.7
M17	28.0	27.5	23.2	18.1	17.4	37.7	36.7	34.0	31.1	30.4	33.7	29.8	31.6	33.3	34.0
M18	29.9	28.1	24.1	18.5	17.7	38.1	36.6	34.1	31.1	30.2	33.4	30.4	32.1	33.2	34.1
M19	36.0	27.1	26.2	23.2	23.9	42.7	35.0	32.2	31.4	32.5	40.0	30.3	29.1	32.1	34.2
M20	33.1	26.4	25.1	21.9	23.2	38.9	33.2	30.5	29.9	30.2	37.7	29.1	28.0	30.4	32.7
M21	32.8	25.6	24.5	21.0	21.8	40.5	34.4	31.3	30.4	30.9	37.7	28.4	27.8	31.0	32.5
M22	30.3	24.9	23.3	20.4	20.8	38.1	33.9	30.1	29.8	30.5	36.1	27.7	27.4	30.3	32.0
M23	29.5	24.3	23.0	20.1	19.9	40.8	38.5	31.5	30.8	31.0	35.1	27.9	27.8	30.9	32.2
M24	27.8	24.8	22.3	19.8	20.1	33.6	31.4	27.4	27.5	27.5	31.0	27.0	26.0	26.9	29.5
M25	26.4	23.5	21.8	19.0	18.5	40.5	39.7	32.0	30.1	29.6	32.6	27.4	27.1	28.8	31.2
M26	26.0	23.6	21.6	18.7	18.2	40.2	39.5	31.7	29.6	29.1	31.4	27.0	26.5	28.1	30.8
M27	25.4	22.2	21.2	18.5	18.5	39.1	37.7	35.2	32.9	33.0	34.4	30.7	32.4	33.1	33.8
M28	25.6	23.1	21.6	18.6	18.3	40.2	39.3	34.6	32.1	31.7	35.0	29.0	30.0	31.4	32.9
M29	25.6	23.2	21.6	18.5	18.2	40.3	39.4	34.3	31.7	31.4	34.3	28.6	29.3	30.9	32.7
M30	25.4	24.8	21.7	17.5	17.4	36.2	35.9	33.6	31.0	30.8	33.6	29.6	31.9	32.6	33.7
M31	24.6	22.7	20.7	16.9	17.1	34.8	33.9	32.4	30.4	29.9	33.2	30.3	32.5	31.6	32.6
M32	25.0	23.0	20.9	16.9	17.1	34.9	34.1	32.5	30.4	29.9	33.2	30.2	32.4	31.7	32.8
M33	28.6	27.5	22.9	19.4	18.7	35.3	34.3	28.6	25.3	24.2	29.1	27.3	25.4	23.8	25.0
M34	29.8	30.5	24.7	19.1	18.2	39.9	37.7	34.5	31.0	28.9	31.4	29.9	30.3	31.2	32.6
M35	30.1	29.3	24.9	19.0	18.2	38.9	37.4	34.6	31.5	29.7	33.0	31.1	32.3	32.9	34.0
M36	35.5	35.1	27.6	21.7	21.0	38.1	38.2	33.7	31.3	30.1	31.7	31.0	30.9	30.8	31.9
M37	32.5	30.0	25.7	20.2	19.5	38.4	36.5	33.7	31.6	30.0	34.4	32.2	33.3	33.8	35.1
M38	33.4	30.7	26.2	20.6	19.9	38.7	36.2	33.6	31.8	30.1	34.6	32.5	33.2	33.9	35.3
M39	33.1	30.4	26.0	20.5	19.8	38.5	36.1	33.6	31.7	30.0	34.6	32.4	33.4	33.9	35.3
M40	33.4	30.7	26.3	20.8	20.1	38.4	35.9	33.5	31.8	30.1	34.7	32.6	33.5	34.1	35.4
M41	33.8	31.2	26.7	21.3	20.6	38.2	35.5	33.6	32.1	30.4	35.0	33.0	34.1	34.4	35.7
M42	33.9	31.4	26.9	21.5	20.8	38.1	35.4	33.6	32.2	30.5	35.1	33.1	34.4	34.6	35.8
M43	34.2	32.2	27.2	21.8	21.0	38.6	35.7	33.6	32.3	30.5	34.8	33.0	34.1	34.5	35.8
M44	34.2	31.9	27.2	22.1	21.3	38.2	35.3	33.7	32.4	30.8	35.3	33.4	34.8	34.9	36.0
M45	34.5	31.9	27.5	22.6	21.8	38.0	35.2	33.7	32.5	31.0	35.6	33.6	35.1	35.3	36.3
M46	36.8	36.7	28.6	23.4	22.8	38.9	38.4	34.0	33.2	32.3	33.7	33.2	32.5	32.9	33.2
M47	39.3	39.1	38.7	37.8	36.4	39.3	39.1	38.7	37.8	36.4	48.1	47.8	48.3	43.6	43.4
M48	34.5	35.3	34.8	36.0	36.2	34.5	35.3	34.8	36.0	36.2	45.1	44.1	44.9	44.0	44.6
M49	38.8	38.8	36.3	35.9	35.5	38.8	38.8	36.3	35.9	35.5	48.9	49.2	48.8	46.5	47.1
M50	30.6	30.0	30.1	31.2	31.7	30.6	30.0	30.1	31.2	31.7	43.1	42.6	43.6	45.2	46.9
M51	29.1	28.7	28.8	30.1	30.4	29.1	28.7	28.8	30.1	30.4	42.7	42.4	43.8	44.1	46.3
M52	31.6	31.7	32.2	33.8	35.3	32.5	32.3	32.5	34.0	35.4	44.2	44.0	45.0	46.2	48.8
M53	35.0	35.0	35.1	39.9	44.3	41.1	41.4	42.0	45.5	48.9	41.3	40.7	42.7	44.4	49.4

Scenario	Day Neutral					Day/Evening Prevailing					Night Prevailing				
Year	1	4	8	15	24	1	4	8	15	24	1	4	8	15	24
Residence	Predicted Noise Level, LAeq,15min														
M54	32.3	31.6	32.4	38.9	41.0	42.2	41.9	43.4	47.1	50.3	40.8	39.2	42.1	43.4	48.5
M55	31.6	30.3	30.9	34.8	37.4	40.8	40.4	40.6	43.5	45.8	38.6	35.9	38.4	39.3	44.7
M56	31.8	31.5	31.8	35.4	40.3	42.2	41.4	41.7	45.4	48.4	38.1	36.0	39.6	38.9	46.2
M57	37.5	34.5	35.6	45.3	59.7	45.4	44.8	45.1	53.0	62.1	42.7	40.2	43.0	47.2	61.0
M58	34.6	31.9	27.7	23.1	22.1	37.7	35.0	33.6	32.6	31.0	36.0	33.8	35.4	35.5	36.4
M59	34.6	31.6	27.8	23.3	22.2	37.3	34.7	33.5	32.5	30.9	36.1	33.9	35.5	35.5	36.5
M60	34.6	31.6	27.9	23.6	22.4	37.1	34.5	33.4	32.4	30.8	36.2	33.9	35.6	35.6	36.5
M61	31.5	29.0	27.6	25.9	23.7	31.8	29.9	29.6	29.6	27.7	35.7	34.8	35.9	34.7	35.8
M62	31.6	29.1	27.8	26.0	23.8	31.8	29.8	29.5	29.5	27.6	35.8	34.9	36.0	34.7	35.8
M63	31.8	29.1	27.9	26.0	23.8	32.1	29.8	29.6	29.6	27.6	35.9	35.0	36.0	34.8	35.9
M64	32.0	29.3	28.1	26.1	23.9	32.2	29.8	29.5	29.5	27.5	36.0	35.1	36.1	34.9	36.0
M65	33.0	30.8	29.4	26.3	24.7	33.1	31.0	29.8	29.3	27.5	36.6	35.1	36.8	35.6	36.8
M66	33.3	31.5	29.8	26.6	25.2	33.5	31.7	30.0	29.2	27.6	36.9	35.4	37.2	36.0	37.1
M67	34.0	32.6	30.7	27.7	26.4	34.1	32.7	30.9	29.3	28.2	37.9	36.4	38.2	36.9	38.1
M68	34.6	33.4	31.3	28.5	27.1	34.7	33.6	31.6	30.4	29.0	38.4	37.2	38.6	37.4	38.5
M69	35.1	34.2	32.5	30.0	28.6	35.1	34.2	32.6	30.7	29.5	39.4	38.5	39.4	38.0	39.1
M70	36.3	36.2	34.0	31.6	30.6	36.3	36.2	34.0	31.6	30.6	40.8	39.9	40.6	39.3	40.3
M71	37.8	37.8	35.6	33.6	33.0	37.8	37.8	35.6	33.6	33.0	43.2	42.1	42.8	41.5	42.5
M72	38.3	38.5	36.8	34.7	34.2	38.3	38.5	36.8	34.7	34.2	44.8	43.8	44.5	42.7	43.7
M73	38.7	38.9	37.3	35.4	35.0	38.7	38.9	37.3	35.4	35.0	45.6	44.3	45.0	43.2	44.1
M74	38.3	38.3	36.6	35.0	34.5	38.3	38.3	36.6	35.0	34.5	46.0	44.4	44.9	43.0	43.9
M75	38.1	37.9	36.1	34.6	33.8	38.1	37.9	36.1	34.6	33.8	46.5	45.0	44.9	42.8	43.8
M76	37.0	36.6	35.2	34.0	32.8	37.0	36.6	35.2	34.0	32.8	44.4	43.1	43.7	41.6	42.7
M77	36.9	35.3	33.3	33.3	32.2	36.9	35.3	33.3	33.3	32.2	45.5	45.3	44.1	41.7	43.0
M78	35.6	34.6	32.9	33.2	32.5	35.6	34.6	32.9	33.2	32.5	45.3	45.7	44.3	41.5	42.9
M79	34.6	33.8	32.5	33.0	32.5	34.6	33.8	32.5	33.0	32.5	44.8	45.6	44.0	41.4	42.7
M80	34.2	33.1	32.3	33.1	32.6	34.2	33.1	32.3	33.1	32.6	44.6	45.5	44.1	42.0	43.1
M81	33.6	32.6	31.8	32.6	32.2	33.6	32.6	31.8	32.6	32.2	44.0	44.8	43.4	41.4	42.4
M82	31.8	31.4	31.1	33.0	32.0	31.8	31.4	31.1	33.0	32.0	43.4	44.3	43.5	42.6	43.6
M83	31.1	30.8	30.6	31.4	31.4	31.1	30.8	30.6	31.4	31.4	43.1	43.3	43.3	43.4	44.8
M84	28.5	27.9	28.2	29.0	28.9	28.5	27.9	28.2	29.0	28.9	39.4	39.4	40.0	40.0	41.3
M85	26.4	25.9	26.5	26.9	27.0	26.4	25.9	26.5	26.9	27.0	37.7	37.9	37.9	38.7	39.9
M86	26.4	25.7	26.2	26.7	26.9	26.4	25.7	26.2	26.7	26.9	37.9	37.8	38.1	38.9	40.2
M87	26.1	25.4	25.7	26.0	26.3	26.1	25.4	25.7	26.0	26.3	38.0	37.7	38.4	38.8	40.7
M88	27.3	26.4	26.6	26.7	27.0	27.3	26.4	26.6	26.7	27.0	39.1	38.7	39.6	40.2	41.8
M89	28.1	27.4	27.2	27.5	27.8	28.1	27.4	27.2	27.5	27.8	40.2	39.8	40.6	41.2	43.2
M90	23.2	22.5	23.2	23.7	23.5	23.8	22.8	23.5	23.8	23.6	37.8	36.9	37.5	38.2	41.1
M91	21.6	21.0	21.7	22.1	21.9	22.7	21.8	22.3	22.3	22.1	35.4	34.6	35.7	36.2	38.8
M92	23.6	23.9	23.2	24.3	24.9	28.4	28.7	26.8	26.2	25.9	32.0	29.8	32.9	30.5	34.2
M93	23.5	23.6	23.3	25.9	25.9	30.9	31.2	30.7	31.6	31.3	30.8	29.2	32.9	32.6	35.8
M94	31.3	30.8	31.4	35.8	38.3	40.3	40.3	40.6	44.0	46.5	38.2	36.6	39.6	39.9	45.4
M95	15.5	15.2	15.9	17.9	19.0	30.6	30.2	30.1	30.6	32.0	29.0	26.7	29.5	27.8	32.2
M96	15.7	15.3	16.1	18.2	19.3	30.6	29.9	30.1	31.3	32.9	28.3	25.8	29.4	27.5	31.8
M97	25.9	21.5	21.0	18.6	18.8	39.2	37.5	35.8	33.4	33.4	34.5	30.4	32.6	32.6	33.4
M98	25.1	21.7	20.9	18.4	18.5	38.4	36.9	35.3	33.2	33.5	34.2	30.8	32.6	33.0	33.7
M99	25.1	21.9	21.0	18.4	18.4	38.6	37.1	35.2	32.9	33.1	34.2	30.8	32.5	33.1	33.8
M100	26.1	20.3	20.1	18.1	18.2	37.5	36.4	35.2	32.7	32.2	33.4	30.9	32.4	31.3	32.2
M101	23.9	19.9	19.5	17.4	17.6	36.0	35.1	34.6	32.6	32.1	33.3	31.6	33.1	31.8	32.4
M102	16.6	16.4	17.0	18.7	20.1	31.5	31.4	31.8	33.0	34.3	29.2	27.5	30.0	29.6	33.1
M103	16.5	16.3	17.0	18.6	19.9	31.3	31.2	31.7	32.9	34.0	28.9	27.2	29.8	29.4	32.7
M104	24.7	19.3	19.7	17.7	17.7	35.8	35.0	33.9	31.6	30.6	31.8	29.5	30.2	29.5	30.2

BENGALLA Mining Company

Visual Impact Assessment

Continuation of Bengalla Mine Project

visual impact assessment

June 2013

a report prepared by

JVP Visual Planning and Design

Continuation of Bengalla Mine Project
visual impact assessment

June 2013

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Glossary

Contrast	The degree to which a development component differs visually from its landscape setting.
Field of View	This area includes the total view, consisting of the primary view zones above and the secondary or peripheral view zones around the primary view zone, out to about 700 either side of the central view line in both vertical and horizontal plain.
Integration	The degree to which a development component can be blended into the existing landscape without necessarily being screened from view.
Overburden Emplacement Area (OEA)	An Overburden Emplacement Area is a prominent feature on the landscape created by open cut mining operations, which involves the inert earth and rock material sitting on top of the coal seams being extracted and placed either back in the mined out areas or on virgin ground. This material is eventually shaped, topsoiled and revegetated to either pasture or forest.
Primary View Zone (PVZ)	This zone is the central most critical part of a view that is seen with the greatest clarity. It is that part of a view that is within a horizontal arc of 300 either side of the centre line of a view and a vertical arc of 300 above the horizontal.
Primary Visual Catchment (PVC)	Areas that have potential views to the Project based on a consideration of topography alone as a screening element.
Seen Area	Areas surrounding the Project within the Zone of Visual Influence, which will have views to the Project.
Screen	The degree to which a development element is unseen due to intervening landscape elements such as topography or vegetation.
Visual Character Units (VCU)	Areas of landscape that have similar topographic, vegetation and land use features that create areas of similar visual character.
Visual Effect	A measure of the visual interaction between a development and the landscape setting within which it is located.
Visual Impact	A measure of a joint consideration of both visual sensitivity and visual effect that when considered together determines the visual impact of a development.
Visual Sensitivity	The degree to which a change to the landscape will be perceived in an adverse way

1. INTRODUCTION

JVP Visual Planning and Design has been engaged on behalf of Bengalla Mining Company (BMC) to complete visual impact assessment for the Continuation of Bengalla Mine (the Project).

The purpose of the assessment is to form part of an Environmental Impact Statement (EIS) being prepared by Hansen Bailey Environmental Consultants (Hansen Bailey) to support an application for a contemporary Project Approval under Division 4.1 of Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) to facilitate the continuation of an the Bengalla Coal Mine.

The primary objective of the assessment is to meet the Director General's Requirements (DGRs) by providing a comprehensive visual impact assessment for submission as part of the EIS.

The DGRs specifically called for:

- A detailed assessment of:
  - Changing landforms on the site during the various stages of the Project; and
  - Potential visual impacts on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and
- A detailed description of the measures that would be implemented to minimise visual impacts of the Project.

The assessment must take into account relevant guidelines, policies and plans as indentified and include:

- Rehabilitation Guidelines;
- Regional Planning Guidelines - The Strategic Regional Land Use Plan – Upper Hunter; and
- Local Planning Guidelines - The Muswellbrook Shire Council Draft Land Use Development Strategy (Coal Mine Land Use Component).

This has been done by completing and documenting the following assessment and analysis steps as outlined in this report:

- An assessment of the existing visual settings created by various landscapes in and around the Project;
- Establishing the visual character and visual effect created by the Project;
- A consideration of the visibility of the Project from sensitive receivers;
- The likely visual impacts created by the Project (including both short term and long term) with regard to visual effect and sensitivity;
- An assessment of potential night light effects;
- Consideration of cumulative visual impacts in the locality; and
- The development of mitigation strategies to ameliorate adverse visual impacts.

1.1 The Project

BMC operates the Bengalla Mine (Bengalla) which is located approximately 4 km west of Muswellbrook in the Upper Hunter Valley, NSW (see Figure 1.1). BMC was initially granted DA 211/93 following submission of the 1993 Bengalla Environmental Impact Statement (Bengalla EIS) under the Environmental Planning and Assessment Act 1979 (EP&A Act) in August 1995. Bengalla (as modified) has approval to operate for a 21-year period from 1996, producing up to 10.7 Million tonnes per annum (Mtpa) of ROM coal.

This visual impact assessment has been prepared to support an application for Development Consent under Division 4.1 of Part 4 of the EP&A Act to facilitate the continuation of mining of coal within the Project Boundary for a further 24 years. The Project consists of the following features:

- Open cut mining at a rate of up to 15 Mtpa ROM continuing to utilise a dragline and truck / excavator fleet;
- Extending mining to the west of current operations;
- An out of pit Overburden Emplacement Area (OEA) to the west of Dry Creek which may be utilised for excess spoil material until it is intercepted by mining;
- Processing, handling and transportation of coal via the existing CHPP (to be upgraded) and rail loop for export and domestic sale;
- An additional CHPP stockpile and ROM coal stockpile;
- Continued use, extension and upgrades to existing coal infrastructure;
- The construction of a radio tower;
- Relocation of the Explosives Magazine and Reload Facility;
- Relocation of a section of Bengalla Link Road near the existing mine access road to enable coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent re-alignment of Dry Creek through rehabilitation areas once stability is established;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam);
- The construction of raw water dams and a clean water dam;
- A workforce of approximately 900 full time equivalent personnel at peak production; and
- Supporting power and water reticulation infrastructure.

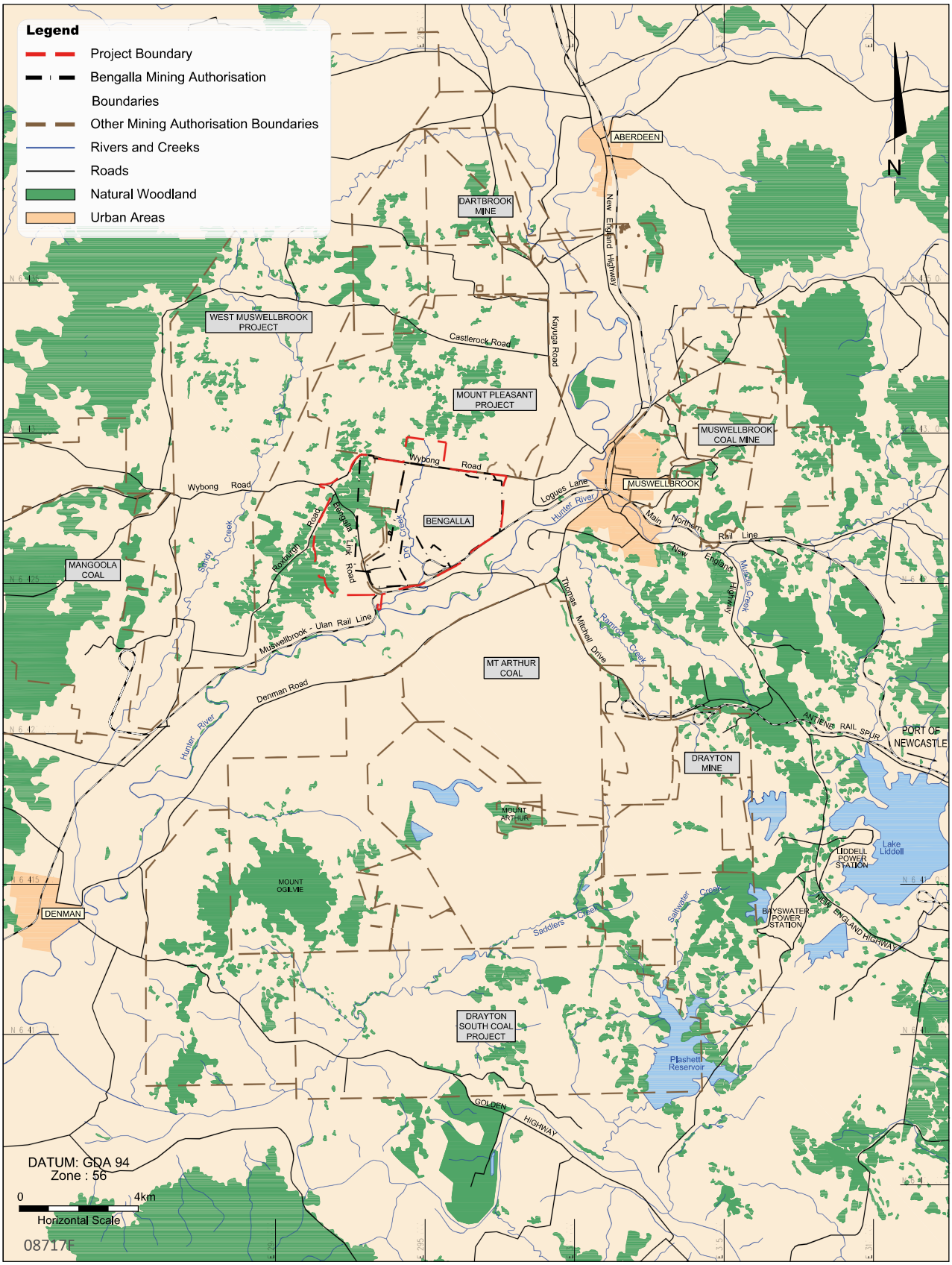


Figure 1.1 | *Bengalla Mine Locality Plan*

2. ASSESSMENT METHODOLOGY

2.1 Introduction

The methodology to determine the level of visual impact of the Project involves, in the first instance, a consideration of the existing visual environment (see Section 3). This includes a consideration of existing landscape settings, and how they are seen from various viewing locations. In this way the visual character of the landscape as well as visual sensitivity of the various viewing locations can be determined.

Secondly, the visual effect of the Project is determined by considering the visual characteristics of the Project in the context of the landscape within which it is seen (see Section 5).

A combined consideration of both visual sensitivity (Section 6) and visual effect identifies impacts (Section 7) and directs if any mitigation strategies are required (Section 8). The overall method of visual assessment of the existing landscape and the Project in the context of the landscape is outlined in Figure 2.1.

2.2 Evaluation of the Existing Visual Environment

An evaluation of the existing visual environment includes an assessment of both the existing landscape setting and viewing locations within it, as described below. It also includes consideration of the statutory framework within which any development must be considered.

2.2.1 Landscape Setting

The visual character of the regional and local landscape in the vicinity of the Project is created by a mosaic of topographic form, vegetation and land cover, hydrological features and land use patterns. These landscape features combine in various ways to create areas of relative visual uniformity that can be defined as Visual Character Unit (VCU). The VCUs are rarely seen in isolation but rather in combination with one another in various vistas that are obtained from viewing locations such as residences and roadways.

This is significant as the Project is therefore always seen in the context of an existing landscape setting made up of one or more of the VCUs. The Project then combines with one or more VCU to create a view seen from various locations.

Defining the landscape in terms of these VCUs assists in understanding the visual character of the landscape as a whole with which the Project interacts.

2.2.2 Viewing Locations

Viewing locations are those areas where people are likely to obtain a view of the Project. These viewing locations have different significance based on numerous factors, collectively evaluated through land use and viewing distance to the Project. Viewing locations could include residences, roads, commercial and recreation areas as well as urban and other rural areas.

2.2.3 Visual Character of Project

The Project will have certain visual characteristics. The elements of the mine will express themselves in terms of form, shape, line, and colour and to a lesser extent texture.

An understanding of this visual character will provide an appreciation of how various mine elements will be seen in the landscape.

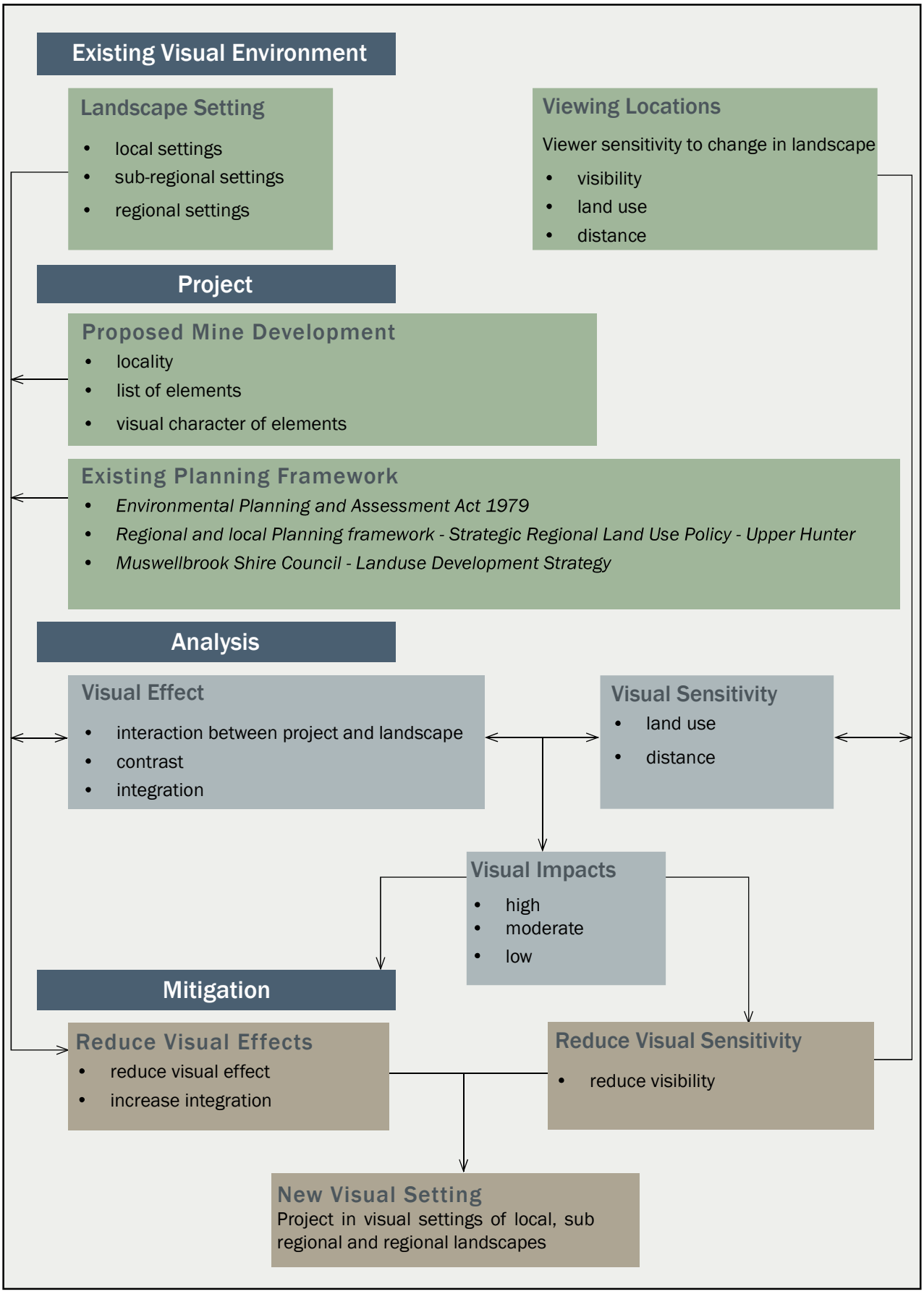


Figure 2.1 | *Visual Assessment Methodology*

2.3 Statutory Framework

Strategic Regional Land Use Policy – Upper Hunter

The NSW Government released the Strategic Regional Land Use Policy (SRLUP) for the Upper Hunter region in September 2012. The Plan represents a component of the government's broader Strategic Regional Land Use Policy that comprises initiatives to address land use conflicts in areas such as the Upper Hunter and with a particular focus on managing coal and coal seam gas issues.

The policy defines areas of biophysical strategic agricultural land and critical industry clusters, including clusters for the equine and viticulture industries. In accordance with the SRLUP, coal mining and coal seam gas projects that are located in areas of defined biophysical strategic agricultural land or critical industry clusters must consider the potential for impacts in accordance with the prescribed 'Gateway Criteria' listed within the plan. The Project occurs within the proposed equine critical industry cluster. As such, an assessment has been conducted against the gateway criteria for this cluster as provided in the draft plan to determine whether the Project would lead to a significant impact on the equine critical industry cluster.

The gateway criteria with regard to critical industry clusters require the following to be considered:

Whether the proposal would lead to significant impacts on the critical industry cluster through:

- Surface area disturbance,
- Subsidence,
- Reduced access to agricultural resources,
- Reduced access to support services and infrastructure,
- Reduced access to transport routes, or
- Loss of scenic and landscape values.

This visual impact assessment has considered the potential for the Project to lead to significant impacts on the equine critical industry cluster through loss of scenic and landscape values.

Draft Land Use Development Strategy (Coal Mine Land Use Component)

This plan developed by Muswellbrook Shire Council recognises the economic and employment benefits of the coal mining industry to the region. The plan draws attention to the need to consider the impacts of mines in the operational and post operational phases, especially in relation to impacts on surrounding land use especially tourism and amenity values. It recognises the importance of quality rehabilitation and post land use viability.

The plan makes specific reference to the need to respect the visual settings of specific land uses that include thoroughbred horse studs, winery cellar doors and other tourist facility or public places, including public areas within national parks.

2.4 Impact Analysis

The analysis of the interaction between the existing visual environments, including existing and approved mining operations and the Project provides the basis for determining visual impacts and mitigation strategies. This is completed by defining the visual effect of the various elements of the Project and visual sensitivity of viewing locations, to determine impact.

2.4.1 Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different land use areas in the vicinity of a development.

In this regard, residential, tourist and / or recreation areas generally have a higher visual sensitivity than land use areas including industrial, agricultural or transport corridors. Land uses (such as residential) use the scenic amenity values of the surrounding landscape and may be used as part of a leisure experience and often over extended viewing periods. Figure 2.2 indicates the levels of visual sensitivity associated with the Project.

However, the visual sensitivity of individual private residences may range from high to low, depending on the following additional factors:

- Screening effects of any intervening topography, buildings or vegetation. Residences with well screened views of the Project will have a lower visual sensitivity than those with open views;
- Viewing distance from the residence to visible areas of the Project. The longer the viewing distances, the lower the visual sensitivity; and
- General orientation of residences to landscape areas affected by the Project. Residences with strong visual orientation towards the Project (i.e. those with areas such as living rooms and/or verandahs orientated towards it) will have a higher visual sensitivity than those not orientated towards the Project, and which do not make use of the views towards the Project.

For any area to be given a sensitivity score, it must have visibility to the Project.

This visibility was determined based on a field assessment conducted on 15-16th February 2012, as well as a computer generated assessment and evaluation of topographic and vegetation data.

Visibility / Land Use			Visibility to Project			
			High ◄			► Low
			Nearest visible mine elements less than 2.5km away	Nearest visible mine elements between 2.5 - 7.5 km away	Nearest visible mine elements between 7.5 - 12.5km away	Nearest visible mine elements more than 12.5km away
Sensitivity of Land Use	High	Urban and rural houses	High Sensitivity	High/Moderate Sensitivity	Moderate Sensitivity	Low Sensitivity
		Tourist destination of visually sensitive land uses eg. horse studs, vineyards etc.	High Sensitivity	High/ Moderate Sensitivity	Moderate/Low Sensitivity	Low Sensitivity
		Designated tourist & main roads - New England Highway, Denman Road	High Sensitivity	Moderate Sensitivity	Low Sensitivity	Low Sensitivity
		Other roads - Roxburgh, Edderton, Wybong, Thomas Mitchell Drive	Moderate Sensitivity	Low Sensitivity	Low Sensitivity	Low Sensitivity
	Low	Minor local roads in rural zone	Moderate/Low Sensitivty	Low Sensitivity	Very Low Sensitivity	Very Low Sensitivity
		Broad acre rural lands	Low Sensitivity	Low Sensitivity	Very Low Sensitivity	Very Low Sensitivity

Figure 2.2 | *Visual Sensitivity*
Land Use and Project Visibility combine to create Visual Sensitivity

2.4.2 Visual Effect

Visual effect is a measure of the level of visual contrast and integration of the Project with the existing landscape. In this instance the existing landscape includes the existing mining operations.

An existing landscape has certain visual characteristics expressed through the visual elements of form, shape, line, colour and texture. A development such as mining has different visual characteristics that will create contrast with the existing landscape. However, in this case, existing and approved mining operations are part of the landscape, so to an extent, the visual effects of the Project borrow visual character from these operations, reducing visual effects.

The visual effect of a development is determined by factors as illustrated in Figure 2.3 These factors also determine the magnitude of the development on the visual effect and are determined by consideration of the following:

Contrast and Integration

The degree to which the visual characteristics of the Project contrast with the existing landscape will determine the level of visual effect. A newly created mine pit and pre-rehabilitated OEA will have high contrast and low integration with the existing landscape and create a Type 1 visual effect. Rehabilitated mine areas will have a moderate to high level of integration and low levels of contrast with the existing landscape and create a Type 2 or Type 3 visual effect.

An extension of operations to an existing mine (such as the Project) will have a lesser visual effect. A successfully rehabilitated Project will have a Type 3 visual effect due to limited contrast with the neighbouring natural landscape.

In a similar way a development is said to be integrated with the existing landscape based on issues of scale, position in the landscape and contrast. High visual integration is achieved if a development is dominated by the existing landscape, is of small scale and/or of limited contrast.

	Visual Properties		Visual Effect Levels			
	Visual Contrast	Visual Integration	Proportion of View Occupied by the Project			
Visual Properties in Primary View Zone	High Development elements do not borrow, form, shape, line, colour or texture or scale from existing features of the visual setting and contrast levels are high with existing landscape and or.... eg. Active face of OEA	Low The development lacks integration with visual setting because of scale totally dominating the ability of site or surrounding features, vegetation and or topographic features to integrate the development.	It occupies more than 2.5% of the primary view shed	It occupies between 1 - 2.5% of the primary view shed	It occupies less than 1% of the primary view shed	Type 1
	Moderate Development elements borrow from some features of the visual setting in terms of form, shape, line pattern and or colour and scale, reducing visual contrast with existing setting and or..... eg. newly rehabilitated pit area	Moderate The development has some degree of visual integration with setting from other features, vegetation and or topography achieve some level of integration	It occupies more than 20% of the primary view shed, generally when in a foreground location	It occupies between 20-10% of the primary view shed	It occupies less than 10%	Type 2
	Low Development elements borrow extensively from features in visual setting in terms of form, shape, line, pattern colour and scale minimizing contrast with the existing setting. eg. rehabilitated landscape pattern	High Visual integration is high due to other features, vegetation and or topography achieving dominance and screening or filtering	It occupies more than 40% of the primary view shed	It occupies 40-30% of the primary view shed	It occupies less than 30% of the primary view shed	Type 3
Note: The visual effect of the mine pits changes through time with the process of rehabilitation. The more advanced the level of rehabilitation, the higher the visual integration, and the higher the percentage of PVZ the project can occupy.			**High Visual Effect**	**Moderate Visual Effect**	**Low Visual Effect**	

Figure 2.3 | *Visual Effect*

The Proportion of a View that includes the Project

For any given level of contrast and integration there is a Type 1, 2 or 3 visual effect. For any type of visual effect i.e. Type 1, 2 or 3, the lower the proportion of the view that is occupied by a development, the lower will be the level of visual effect.

For lower visual contrast and high integration type development it will require a higher proportion of a view to be occupied to create a high visual effect, e.g. a rehabilitated OEA. Conversely a high contrast and low visual integration development type, e.g. a pre-rehabilitated OEA will only require a small area of a total view to create a high visual effect.

Thus for any development and visual effect type i.e. 1, 2 or 3, defining the proportion of the total field of view occupied by the Project will assist in determining a high moderate or low visual effect This in turn is most appropriately determined by defining what percentage of the Primary View Zone (PVZ) it occupies, see Figure 2.3.

The PVZ is the area that is occupied by an arc created by sight lines from the eye radiating out horizontally at angles of 30° and vertically at angles of 20° around a centre view line, Figure 2.4. The PVZ is the most critical central part of a view. It is not the total view, however, still the most important part.

Estimating the percentage of the PVZ occupied by a development will provide a more critical measure than looking at the development in the context of the whole view zone. The whole view zone would include both primary and secondary view areas, representing a view arc of 120°, whereas the central view arc of 40-60° represents the PVZ only.

Generally, a high visual effect will result if the visible area of a development has a high visual contrast and low integration to the surrounding landscape. This high visual effect is further compounded when the development takes up a higher percentage of the PVZ. A low or very low visual effect will occur if there is minimal contrast between the visible area of a development and the existing landscape setting and / or the area occupied by the development forms only a small percentage of the total view.

Distance from Project Site	Area of Primary View Zone
1 km	0.60 km²
2 km	2.4 km²
3 km	5.43 km²
4 km	9.66 km²
5 km	15.09 km²
6 km	21.73 km²
7 km	29.57 km²
8 km	38.62 km²
9 km	48.88 km²
10 km	60.35 km²
11 km	73.02 km²
12 km	86.9 km²
13 km	101.99 km²
14 km	118.29 km²
15 km	135.79 km²

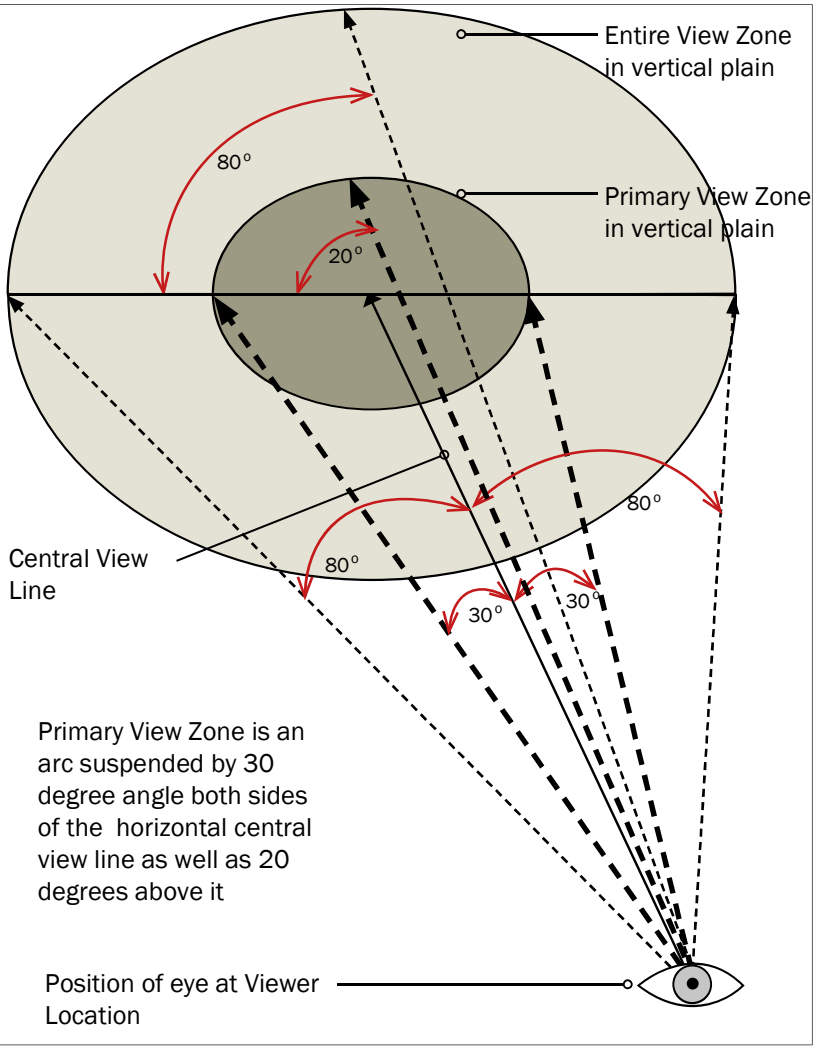


Figure 2.4 | *Primary View Zone*
The Area of Primary View Zone at Various Distances from the Project

		Visual Sensitivity		
		High	Moderate	Low
Visual Effect	High	High Visual Impact	High/Moderate Visual Impact	Moderate/Low Visual Impact
	Moderate	High/Moderate Visual Impact	Moderate Visual Impact	Moderate/Low Visual Impact
	Low	Moderate/Low Visual Impact	Moderate/Low Visual Impact	Low Visual Impact
	Very Low	Low Visual Impact	Very Low Visual Impact	Very Low Visual Impact

Figure 2.5 | *Visual Impact*
Visual Impact is the interaction between visual effect and sensitivity

2.4.3 Visual Impact

The visual impact of the Project has been determined by considering both visual effect and visual sensitivity, which when considered together determine impact levels. The way in which the visual parameters of visual sensitivity and visual effect are cross referenced and the outcomes are illustrated in Figure 2.5.

2.5 Application of Methodology

For the purposes of the visual impact assessment, a number of sites within key sectors of the Primary Visual Catchment (PVC) were selected as representative viewing locations. These sites were selected in consideration of the Project's evolution and previous assessments undertaken at Bengalla, for comparative purposes.

Whilst there will be variation in the impacts on specific viewing locations, an overall assessment of the visual impact on the selected locations will be representative for the views experienced from the various sectors

2.5.1 Visibility

For a visual impact to be experienced, landscape alterations resulting from the Project need to be visible. Visibility of the Project from adjoining view locations was determined by viewing into the Project Boundary from a range of potential view points.

2.5.2 Visual Sensitivity

The visual sensitivity of various viewing areas was determined by a review of aerial photography, plans of the Project and maps of the surrounding areas. This included the consideration of land use, viewing distances and the general level of screening available from topography, buildings and vegetation. The assigned sensitivities within each sector were also evaluated based on field study conducted February 2012 and other study data.

2.5.3 Visual Effect

The visual effect of the mining operations at the Project on external viewpoints has been assessed at various locations (as illustrated in a number of photomontage images and cross-sections) taken from various view points within key sectors of the PVC. Viewpoints included:

- New England Highway north of Muswellbrook;
- View Place in north Muswellbrook;
- Ironbark Road views from the Ironbark Estate;
- Racecourse Road;
- Denman Road; and
- Roxburgh Road to the west of Bengalla.

These locations were selected to illustrate views from various view points around Bengalla. The assessments from these locations have been structured to display worst case views of the Project from these areas.

2.5.4 Photomontage & Cross-Section Development

Photographs of the existing operations were taken at standing eye level from each viewing location and photograph locations were accurately surveyed. Three dimensional (3D) computer models of the Project at year 4, 15 and 25 and the surrounding area were then developed from digital surface topography and Project mine plans.

The photomontage models enabled accurate views of the Project to be generated at a specified location and take into account screening of views by natural topography. The photographs of the Project Boundary were overlain on the model view and the location of future visible components of the Project were determined considering any foreground screening from topography or vegetation in the photograph. The colours and textures of rehabilitation and the active mining from a similar viewing distance were then applied to the corresponding components of the visible sections of the Project. The end result is an accurate and realistic photomontage of the future view of the Project.

At each viewing location, a photomontage set has been completed. The first photograph in each set illustrates the existing view (a), with subsequent photographs illustrating the Project operating during various phases of the mine life. The photomontages were then used to assist in determining the level of visual effect of the Project from each of the selected representative view points. Once the visual effect of the Project was determined, the visual impact on each residential viewing sector was determined using Figure 2.5.

The explosives magazine will be located on top of the OEA for operational and safety reasons. To evaluate the visibility of this element, cross sections were completed to critical areas in Muswellbrook. These sections will determine whether the topography of the OEA will screen view lines or that the OEA will need to be complemented with micro-topographic features, e.g. bundling and or tree planting.

2.6 Treatments

Visual impact mitigation strategies were developed for both on-site and off-site situations to ensure that visual effects and / or visibility / visual sensitivity factors are decreased in appropriate time frames to achieve appropriate impact mitigation.

2.6.1 Reduce Visual Effects

Rehabilitation of the Project active mining areas within the Project Boundary will decrease the visual contrast created by mining operations to the existing landscape. In addition, rehabilitation strategies that emulate patterns, shapes, line and colour of the existing landscape will reduce the contrast between the Project and the existing landscape, reducing visual effect.

2.6.2 Reduce Visual Sensitivity

Reducing visual sensitivity is achieved by conducting treatments to minimise visibility to the Project. Due to the scale of open cut coal mining components of the Project, such as the OEA and active extraction area, screening is most effectively achieved at or close to the point of viewing. Such screening treatments can also be used to re-direct views to areas not affected by mining, as well as generally enhancing the landscape at the viewing point.

2.6.3 New Visual Setting

On completion of mining operations and following rehabilitation, a final landform will be created. This new landform will reflect the pre-mining land use of agriculture.

3. EXISTING ENVIRONMENT

3.1 Introduction

This section of the report describes the visual character of the existing environment. This is necessary in order to establish a baseline on which changes are compared against, and the Visual Effect is measured.

As shown in Figure 3.1, the existing environment surrounding Bengalla is comprised of a range of different landscapes and features. This variety is based on differences in topography, vegetation cover and land use patterns.

3.2 Primary Visual Catchment

Bengalla is located 4 km west of Muswellbrook in the Upper Hunter Valley of NSW. The PVC represents the area within which the majority of critical views of the Project are obtained.

The Project PVC is defined by the ranges to the west and north of the site, and the town of Aberdeen to the north-east. The catchment area is further defined by Muswellbrook to the east, and the hills behind, and by the existing Mt Arthur Coal Mine to the south. The small ridge located in the centre of the Mt Arthur Coal Mine marks the south-eastern corner of the PVC. See Figure 3.1.

3.3 Land Ownership

The land ownership around Bengalla is dominated by land within mining leases held by various mining companies, Figure 3.2. To the north, land is within the Mount Pleasant Project Area. To the south, land is dominated by Mt Arthur Coal Mine and to the west, but in a different visual catchment is land within the Mangoola Coal Project.

Private lands are mainly located to the east and west. To the east the visual catchment is dominated by Muswellbrook. This township area represents an area of high visual sensitivity. To the west there are a number of small scale rural holdings and rural residences and some rural/tourist destinations that are also sensitive to the Project.

3.4 Visual Character of the Landscape

As described above in Section 2.2.1, the visual character of the landscape in the vicinity of the Project is created by Visual Character Units (VCU) that combine to make up a particular view from any viewing location.

While the visual character of the Project is defined in Section 4 of this report, the visual character of the existing landscape into which the Project will be placed is defined by several separate VCUs.

The Visual Character Units within the PVC include:

- Hunter River Floodplain;
- Foothills;
- Mine and industrial uses;
- Town areas; and
- Surrounding ranges.

Within each VCU there may be a range of visual receivers. These receivers have varying sensitivity to landscape modification. The more critical visual receivers include:

Towns:

- Muswellbrook; and
- Aberdeen.

Roads:

- Wybong Road;
- Kayuga Road;
- New England Highway;
- Denman Road; and
- Roxburgh Road.

Rural Areas:

- Houses along Denman Road;
- Houses in Northern Foothills;
- Houses on the edge of the Hunter River Floodplain; and
- Historic houses on Hunter River Floodplain

The PVC is strongly defined by the Hunter River Floodplain which runs from the south-west corner around Bengalla and north to the western edge of Aberdeen. A further critical element of this PVC is the existing mining operations in the area. This includes the existing Bengalla operations and Mt Arthur Coal Mine located to the south of Bengalla, and Mangoola Coal to the west. It also includes the future approved mine area to the north in the Mount Pleasant Project.

Figure 3.1 illustrates the environment and individual VCUs which are briefly described below.

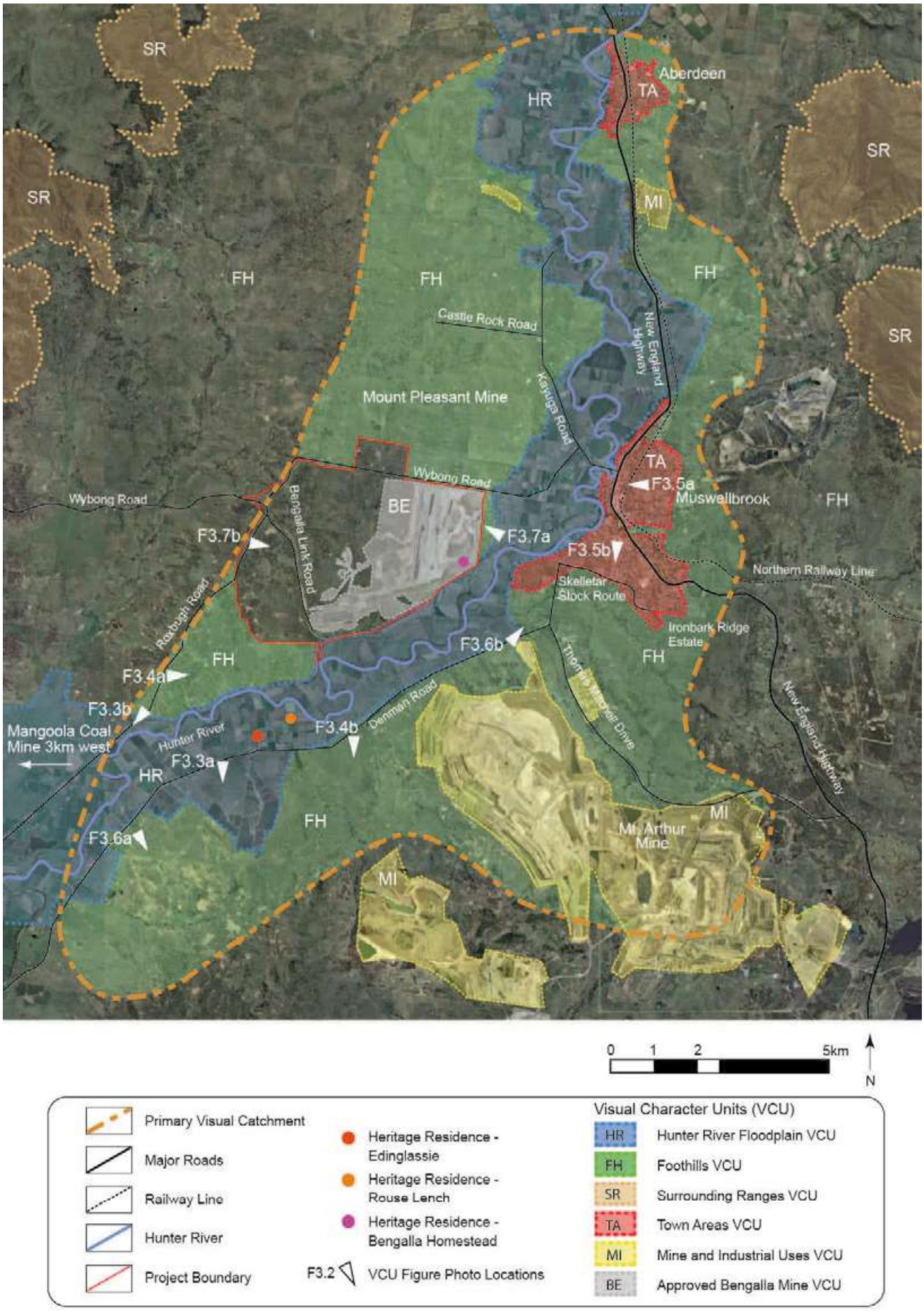


Figure 3.1 | *Existing Environment*

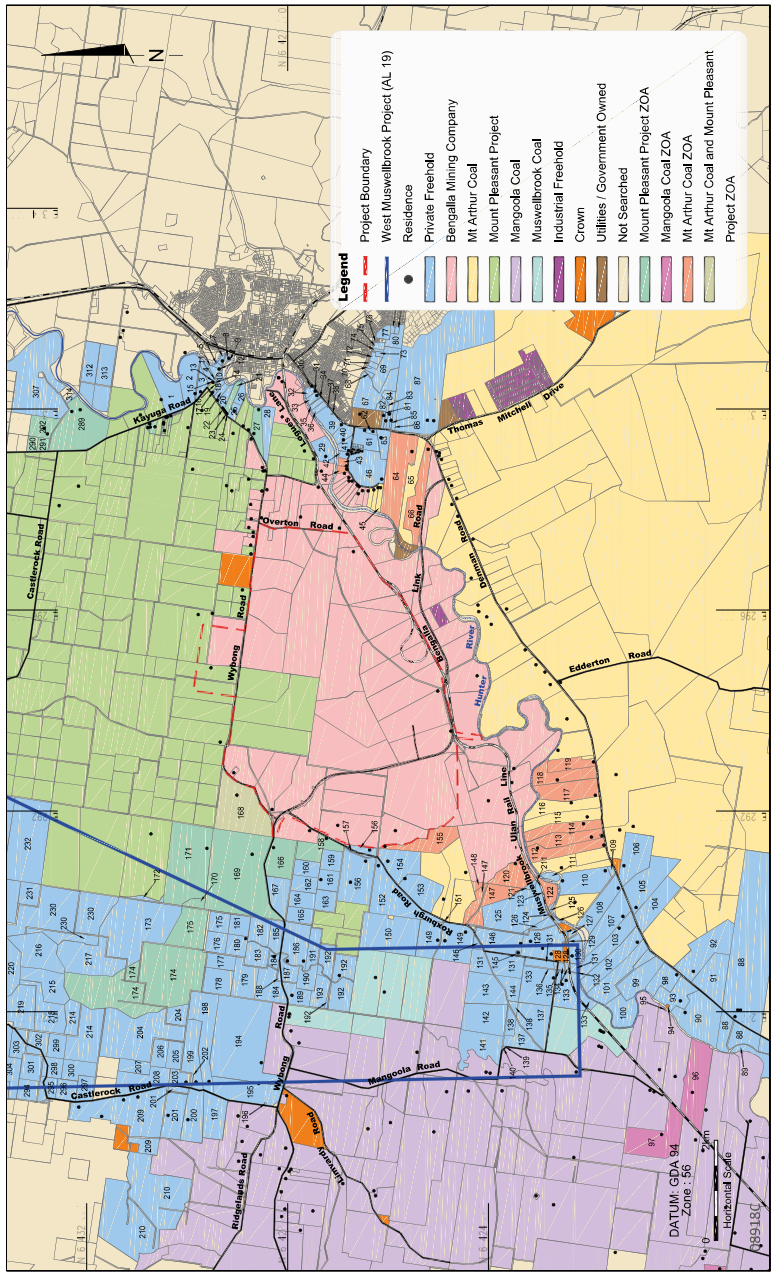


Figure 3.2 | *Land Ownership*

3.4.1 Hunter River Floodplain VCU

The Hunter River Floodplain dissects the PVC, running generally from south-west to north-east. Visually, this VCU is dominated by the river flats, which as a result of soil type and irrigation, support pasture and croplands that create vivid rectilinear patterns in the midst of dry land grass and woodlands on adjoining slopes.

The Hunter River Floodplain unit creates strong contrast and visual interest to surrounding landscapes. Perhaps its greatest significance is its flatness and grass / crop cover that allows for long views from distant locations such as Aberdeen and distant highway locations.

There are some residences within this unit that have visual contact with Bengalla (see Figure 3.3). These include a cluster of houses on Kayuga Road to the north of Wybong Road.

While there are also houses on Denman Road, most of these have been acquired by BMC or Mt Arthur Coal. Parts of Muswellbrook, including the Racecourse Area are also within the Hunter River Floodplain Unit. Due to flooding, rural dwellings within the unit are generally restricted to raised knolls that are less prone to flooding.

The Hunter River Floodplain Unit supports parts of the New England Highway and Main Northern Railway Line to the north and east of Bengalla and the Project. To the south, Denman Road skirts between the Floodplain and the Southern Hills. In addition, the Hunter River Floodplain supports numerous minor rural roads. See Figure 3.3.

Historic houses on Hunter River Floodplain

The historic homesteads of Bengalla itself and Edinglassie and Rous Lench, Figure 3.1 are located on the edges of the floodplain. They are small visual focal points as currently seen from public roads and are under the ownership of Bengalla and Mt Arthur Coal. Bengalla and Rous Lench are single houses with a limited number of outbuildings and sheds, while Edinglassie is a much larger complex of main house, extensions to it and a series of outbuildings. All houses share the landscape concept of enclosing gardens of exotic trees and hedges with views beyond this in various directions to the landscapes beyond.

3.4.2 Foothills VCU

The foothills include the Southern Foothills south of Denman Road and Northern Foothills north of Denman Road around Bengalla and are adjacent to the Hunter River Floodplain, Figure 3.3. These hills are generally gently sloping with the Northern Foothills in the vicinity of Roxburgh Road having the greatest elevation (240 -260 m) within proximity of the Project

The Eastern Hills are generally low elevation hills to the east of Thomas Mitchell Drive. The land cover is a mixture of grasslands, woodlands and open forest, see Figure 3.4. The hills only have low elevations, generally in the order of 250 m with Little Grass Tree Hill having an elevation of 258 m. These hills generally continue to the east of Muswellbrook where Skelletar Stock Route has an elevation of 333 m.

The Southern Hills again have similar elevations but are flanked by the higher elevation ridges and hills that include Mt Arthur and Ogilvie Hill. These hills for the greater part have been cleared for grazing purposes and support grasslands with scattered trees with woodland or open forest on steeper areas and along some gully lines. The gentle slopes with a mixture of grasslands, woodlands and open forest create the typical rural landscapes of the region. An area adjacent to South Muswellbrook and to the east of Thomas Mitchell Drive, Ironbark Estate has been developed as a park land living estate.

The Foothills, although not highly populated, do support a limited number of private rural residences that to varying degrees have views of the Project (as shown on Figure 6.1). Most significant of these are a limited number of residences along Roxburgh Road and some residences on Denman Road. In addition, there are some houses to the north of Wybong Road, which are within the approved Mount Pleasant Project.

Figure 3.3 | *Hunter River Flood Plain VCU*

Cropland and grassland dominate this VCU, forming strong rectilinear patterns in an open landscape

Figure 3.4 | *Foothills VCU*

The foothills are generally hills with low elevation, with a landscape mix of grassland, scattered trees and open forest. Foothills have generally been cleared for grazing purposes.

3.4.3 Town Areas

Town VCUs vary in size and visual character between one town and the next (i.e. Muswellbrook and Aberdeen). They share common elements of residences, streetscapes, commercial areas, and recreation areas. The mix of these factors creates visual character of the towns. The significance of the towns is the concentration of sensitive receivers in the form of residential development areas, Figure 3.5.

The township of Muswellbrook is located on foothills to the east of Bengalla. Some parts of the town are on or adjacent to the Hunter River Floodplain. The most significant area in this regard is the Racecourse Road Precinct that contains the racecourse and some residences in close proximity to Bengalla. In the Racecourse Road Precinct there are residences to the north and east of the racetrack itself, with the race club and associated facilities to the west of the track.

A significant part of the town is located on foothills with views to Bengalla. This includes North Muswellbrook on the eastern side of the New England Highway and South Muswellbrook to the south-east of Denman Road. This includes the residential estate of Ironbark Ridge. The commercial areas of the town centre on lower slope areas that are generally not visually affected by Bengalla. However there are some views from more elevated commercial areas, such as Muswellbrook Market Place on Sowerby Street which has existing views.

Another significant feature of the town is the transport corridors of the New England Highway and the Main Northern Railway Line, both of which run through the town, Figure 3.1.

The township of Aberdeen is located some 12 km to the north-east of Bengalla. Some parts of the town are on elevated slopes with easterly and south-easterly aspects. These town areas would have some views to Bengalla as well as other mine areas such as Mt Arthur Coal Mine, Dartbrook Underground Mine facilities and approved (but yet to be developed) Mount Pleasant Project.

3.4.4 Surrounding Ranges

The surrounding ranges define the edges of the Hunter Valley and occur on both the eastern and western sides of the valley. These mountain ranges have significant elevation above the valley and foothills, are steep and forest covered however are located at significant distances from Bengalla.

The visual significance of the Ranges is that they often create the background to valley views from a full range of view locations. Areas that experience views to these distant ranges over existing mine developments include elevated areas in the foothills, and those residential areas on the western edge of Muswellbrook, Figure 3.6.

3.4.5 Mine and Industrial Uses VCU

This VCU consists of the existing Bengalla operations, as well as the larger Mt Arthur Coal Mine to the south, and the Thomas Mitchell Drive Industrial Estate. It will during the life time of the Project also include Mount Pleasant to the north. Beyond the PVC, there are also further extensive mining operations to the south-east.

Mt Arthur Coal to the south of Denman Road and Bengalla, within the Southern Foothills contributes to the ‘mine’ visual character in this section of the foothills. From various locations such as Aberdeen and the adjoining areas within the Southern Foothills, Mt Arthur Coal mine operations are also seen in the context of Bengalla.

The Thomas Mitchell Drive Industrial Estate is an industrial area that also occurs in the Southern Foothills. Although the area would have views to Bengalla the area is not visually sensitive or significant because of its industrial use.

Bengalla

Currently Bengalla consists of the active mining area and associated Main OEA, with the latter being the element that is visually prominent from off-site areas to the north, east and south. The CHPP and other infrastructure are visually evident only from a limited number of locations to the south and west. The site has a strong industrial visual character due to its established use as a coal mine and coal handling area.

The OEA has two profiles: the first being the outer edge that has been progressively rehabilitated as works are completed and the active edge to which new waste material is deposited, Figure 3.7. The rehabilitated side of the OEA integrates with the existing landscape of rolling hills within the Northern and Southern Hills VCUs. The active face remains a high contrast and with low visual integration into the existing landscape. This face is dominated by the steep back slope of the OEA. These faces retain the light earth colours of the removed overburden, Figure 3.7.

The existing Main OEA has both of these faces and visual features, and sections of the OEA have an approved maximum elevation of RL 270 m. at the eastern end of the OEA.

Although clad in natural tones (greens and creams), the CHPP is a large scale industrial facility that is large in both vertical and horizontal dimension. The largest scale horizontal elements are the rail loop and the coal stockpiles. The vertical elements of the plant are also significant as these can be seen, to varying degrees, from neighbouring areas. The major vertical elements include the CHPP main building, the rail loading bin and various elevated conveyors.

Both the existing OEA and CHPP are a significant part of the existing visual setting of the proposed Project to the mine plan and works on the site. Alterations to the existing mining activities that will result in changes to the OEA are part of the current Project and are discussed in Section 4.

Figure 3.5 | *Town Area VCU*

Town areas have differing densities to support various functions, and the variety of landscapes also reflects this.

Figure 3.6 | *Surrounding Ranges VCU*

The surrounding ranges have higher elevations and steeper slopes than those of the foothills, and are often more densely forested. The surrounding ranges are often the backdrop to views across and within the valley

Figure 3.7 | *Mine & Industrial Uses VCU*

The Bengalla existing OEA rehabilitated face (top) has colours and textures that are beginning to take the form of Foothills VCU. The Bengalla OEA active face (bottom) still has colour and texture indicating active mining

4. THE PROJECT

4.1 Introduction

This section, together with Section 1 describes the proposed changes to the mining operations at Bengalla. More specifically, it considers those changes that are significant to the visual values of the environment.

Although not discussed further in this section, it is important to recognise that throughout the life of the Project there is ongoing rehabilitation of the overburden emplacement. This is a key component of the implementation of any OEA, which is the most significant element in relation to visual effects and impacts on the surrounding landscape.

4.2 Project Components

Specifically the Project involves the following key components relevant from a visual impacts assessment perspective:

- Open cut coal mining at up to 15 Mtpa ROM for 24 years;
- Temporary out of pit OEA to the west of Dry Creek;
- Continue mining to the west of current operations;
- Continuous rehabilitation of OEA areas from east to west.
- Continued use, expansion and upgrades to existing site infrastructure;
- An additional CHPP coal stockpile and ROM coal stockpile;
- Realignment of Dry Creek through rehabilitated areas;
- Realignment of Bengalla Link Road; and
- An additional temporary OEA to the west of Dry Creek.

These proposed changes have to be considered in the context of mine features within the broader Mine and Industrial Uses VCU and more specifically within the context of Bengalla.

In terms of the broader Mine and Industrial Uses VCU there would be minor change to the visual effect created by this character unit by the Project. The visual effect and potential impacts within the context of Bengalla itself are considered below.

4.3 Existing & Proposed Project Condition

The existing and approved OEAs are the major mine components visible from surrounding viewing locations. The OEA has two faces, the active face and the outer edge. The active face is unshaped, steep, angular, and contains raw overburden material creating a high visual contrast and low integration with the environment, due to colour, form and scale. The outer edge has both rehabilitated and ongoing rehabilitation faces. Rehabilitated faces are graded to a slope of approximately 10 degrees and covered with grass and trees and have less visual impact on the existing landscape environment. Some pre-rehabilitated faces have been graded to their future shape, but are still in the process of gaining the vegetation cover that will be their future colour and texture.

The approved OEA at Bengalla as at 2012 is illustrated in Figure 4.1. The Project primarily relates to a continuation of the existing mining operations extending to the west.

The existing OEA will expand in a westerly direction as the pit moves west. The height of the final landform of this emplacement will not increase above the currently approved maximum elevation of 270 m, however additional area at the approved maximum height will be greater as the pit and resulting OEA expand west, Figure 4.1. If required to be constructed, the additional OEA (the Western OEA) will become a part of this overall emplacement as mining activities move west, until it is mined through.

4.4 Visual Character

A significant part of the visual environment in this locality is the existing mines areas, especially existing OEAs. Any existing approvals for mining activity also need to be considered as part of the existing visual environment. This includes the existing OEA and how it is proposed to develop over time. These elements provide an immediate backdrop to the Project and because they have similar visual character, contrast and visual effect levels minimised.

The visual effects of the Project are shown in plan on Figures 4.1 - 4.6 and the illustration of the visual effects in photomontages (see Figures 6.1 - 6.7). Visual effects will result from:

- The extension of mining activity to the west;
- Extending the existing OEA to the west;
- Rehabilitation of OEA areas from the east;
- The temporary OEA located to the west of mining; and
- Changes to infrastructure, mainly the upgrade of the CHPP, development of an additional coal stockpile and a new explosives storage area.

The extension of mining activity to the west

Extension of mining activity to the west will maintain the current visual effect experienced by surrounding areas. As the extension is on the western side of the existing OEA, the eastern rehabilitated faces will not be affected and will screen activities to the west from sensitive receivers to the north east, east and south east.

Views from these locations therefore, will not be different to those currently experienced. Even those views from elevated locations will not be altered from existing visual character. Rather, these views will be improved as the approved rehabilitation patterns of forest and grassland are established.

The extension of the OEA to the west

The visual effect of moving mining toward the west means that the active face of the OEA will be closer to some viewing locations, especially Roxburgh Road and some western viewing locations. Visual character resulting from this migration, despite being in a different view zone will be maintained with the current visual character. The scale of the OEA will decrease when compared to the existing OEA active face from 270 m gradually down to approximately 180 m in the west.

This decrease in scale will ensure that the rehabilitated OEA to the east will dominate the skyline and that the active face of the OEA will be contained in a framework of rehabilitated landscape. Also with time the intervening ridges to the west will assist in screening the west moving OEA as these areas have elevations greater than 200 m.

The visual effect of the extension to the OEA to the west will have high to low visual effects on the various viewing sectors. Visual effects on easterly viewing locations will be low as the eastern face of the OEA is rehabilitated and screens views to the mine pit and active face of the OEA.

Conversely those to the west will continue to be high, but of reduced elevation and with rehabilitated OEA visible above it.

Rehabilitation of OEA areas from the east

As mining progresses to the west, the OEA will be progressively completed to the east of the mining pit. This will allow for progressive rehabilitation of OEA areas. This will reduce the amount of the OEA that is in a pre-rehabilitated state. It will also over time create a rehabilitated rural landscape of grass and tree cover that will be greater in elevation than the active face of the OEA, thereby dominating it and assisting in achieving improved visual integration outcomes of this active face.

Temporary Western OEA

The Western OEA may be required in the early stages of the Project. The replacement Western OEA will have a limited effect on the current visual character of the Project, as it will be adjacent to an existing approved OEA. The OEA will also be mined through as the pit moves west.

This area will be against the background of the larger mine and, as was the case with the approved Western OEA, the visual character and effect of the OEA is diminished significantly due to this background character. The elevation of the Western OEA and its possible expansion will not exceed RL210 m.

The visual effect of the out of pit area will be low.

Infrastructure Relocations and Upgrades

This element of the Project involves minor changes to the mine infrastructure. These include the CHPP, water infrastructure, additional infrastructure areas, relocated explosives storage area, and upgrades to some of the existing buildings. These elements will be contained within the existing visual setting of the current CHPP and infrastructure area.

The additional coal stockpiles will also comply with the visual character of the mine. The scale of the stockpiles relative to the mine pit and OEA, and their similarity to existing stockpiles will result in no change in visual character of the mine.

The proposed radio tower will be in an isolated location in the south Western Sector of the development boundary. While its size will be minimal relative to other mine elements, the location and differing visual characteristics of the radio tower can contribute to the visual effect from certain viewing locations however its proximity to other mine infrastructure such as the CHPP can reduce this visual effect. It is expected the construction of the radio tower will have minimal visual effect on surrounding viewing locations.

The visual effect of the Infrastructure alterations will be low.

New Explosive Storage Area

A new explosive magazine and reload facility will be constructed on the rehabilitated OEA after Year 1 of the Project, Figure 4.2. These facilities and associated roads will be constructed along with access roads linking these elements to the infrastructure area. These elements will include built form with elevations no higher than 10 m and will be surrounded by screening vegetation at appropriate safety distances.

The visual effect of these elements will be low due to their limited scale, the distances from which they are viewed, the screening effect of the OEA itself, Figure 6.10 and 6.11, and screening/integration effect of vegetation planted as part of the OEA rehabilitation.

4.5 Bengalla Road Relocation

This road realignment will create new line in the landscape with minor form and shape elements being created by road cut and fill batters. The road will replace 6 km of the existing road and have similar visual effects. The road will have little effect on external sensitive views and have a low visual effect when seen from external view locations

Bengalla Road Relocation will have a low visual effect.

4.6 Proposed Tree Planting

The final design of the Project involves progressive tree planting once rehabilitation of the OEA has stabilised. The Landscape Management Plan to be developed in consultation with relevant regulators will determine the location and density of the tree stands.

In this context, indicative tree planting patterns have been defined in the first instance from a visual impact assessment objective only. The need for tree plantings to be responsive to other considerations remains, and will be defined in the Landscape Management Plan to be revised to incorporate the Project.

These indicative planting patterns are illustrated in the photomontage sets to indicate how planting could look as seen from various locations.

The visual effect of the tree planting will be to reduce the visual effect from Type 2 to Type 3 and should achieve visual integration of OEA structures into the landscape.

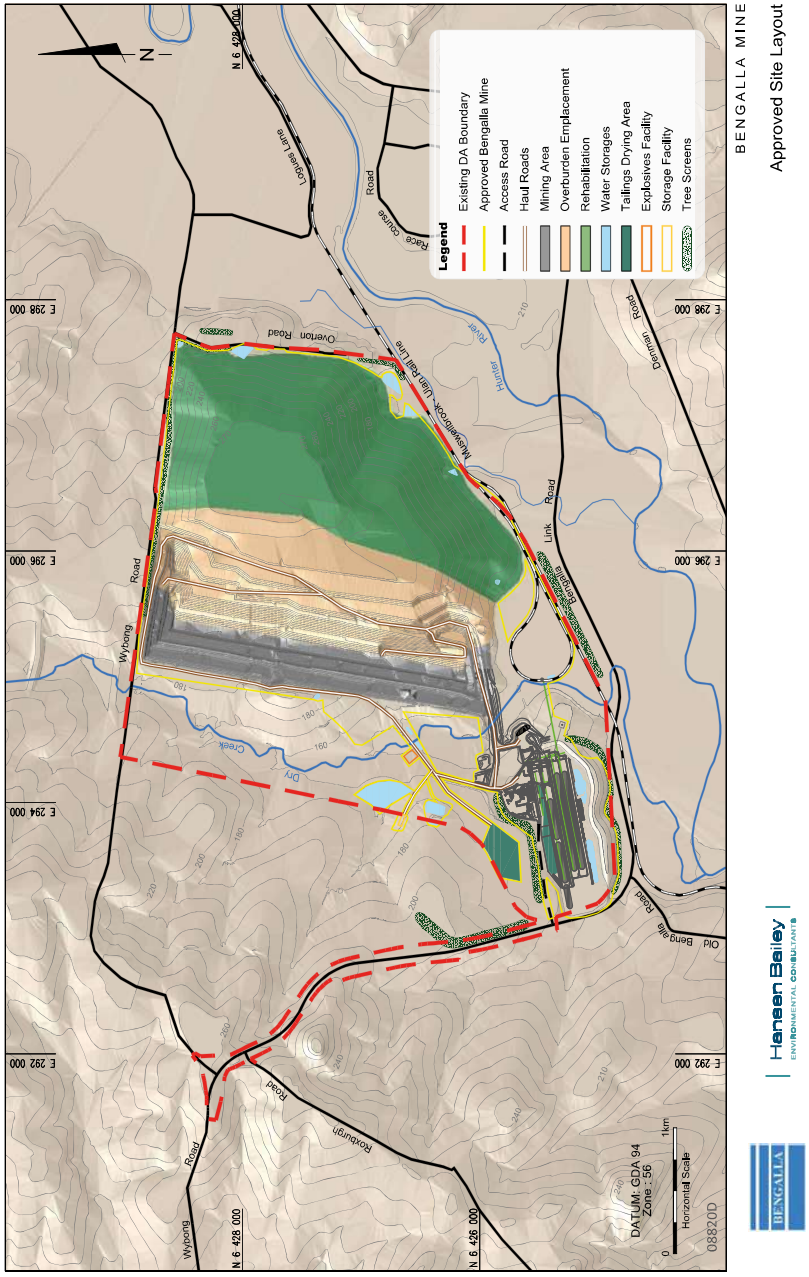


Figure 4.1 | *Approved Site Layout*

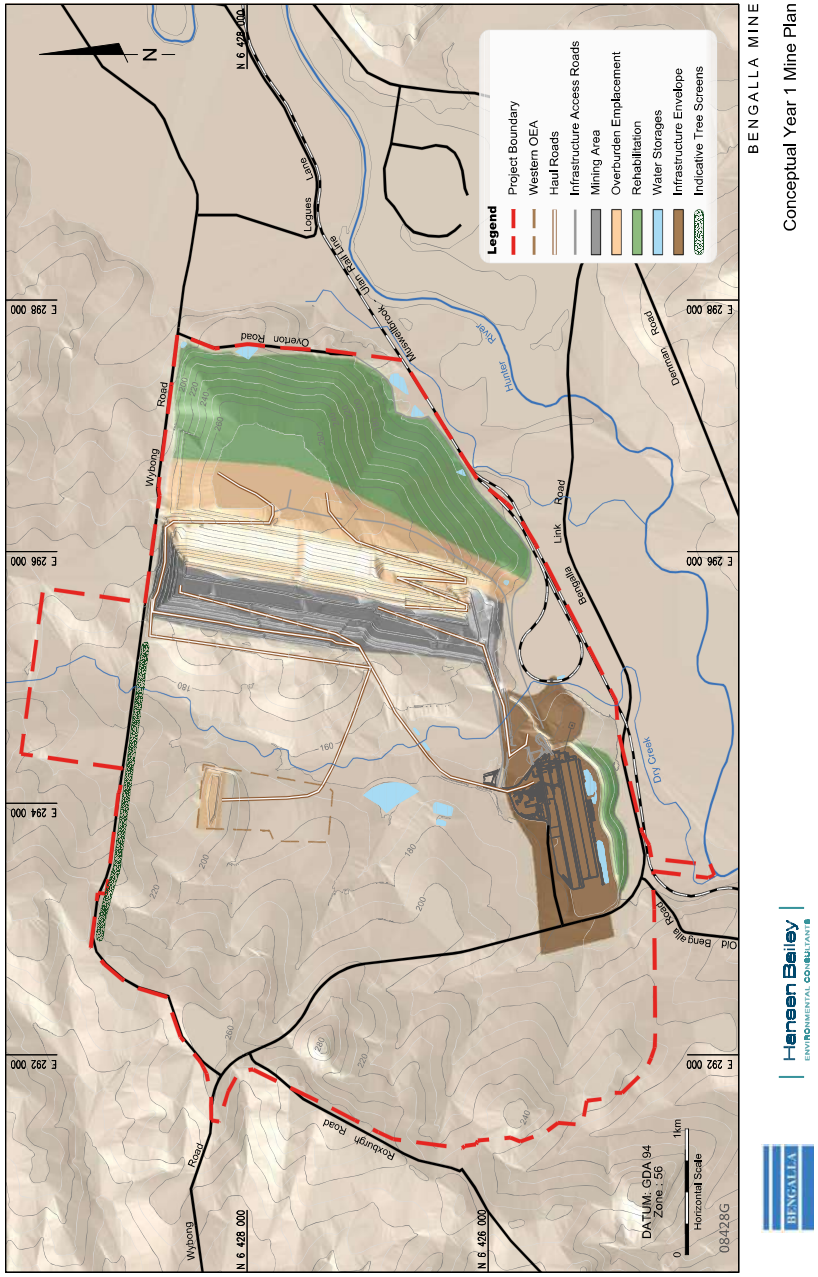


Figure 4.2 | *Conceptual Year 1 Mine P*

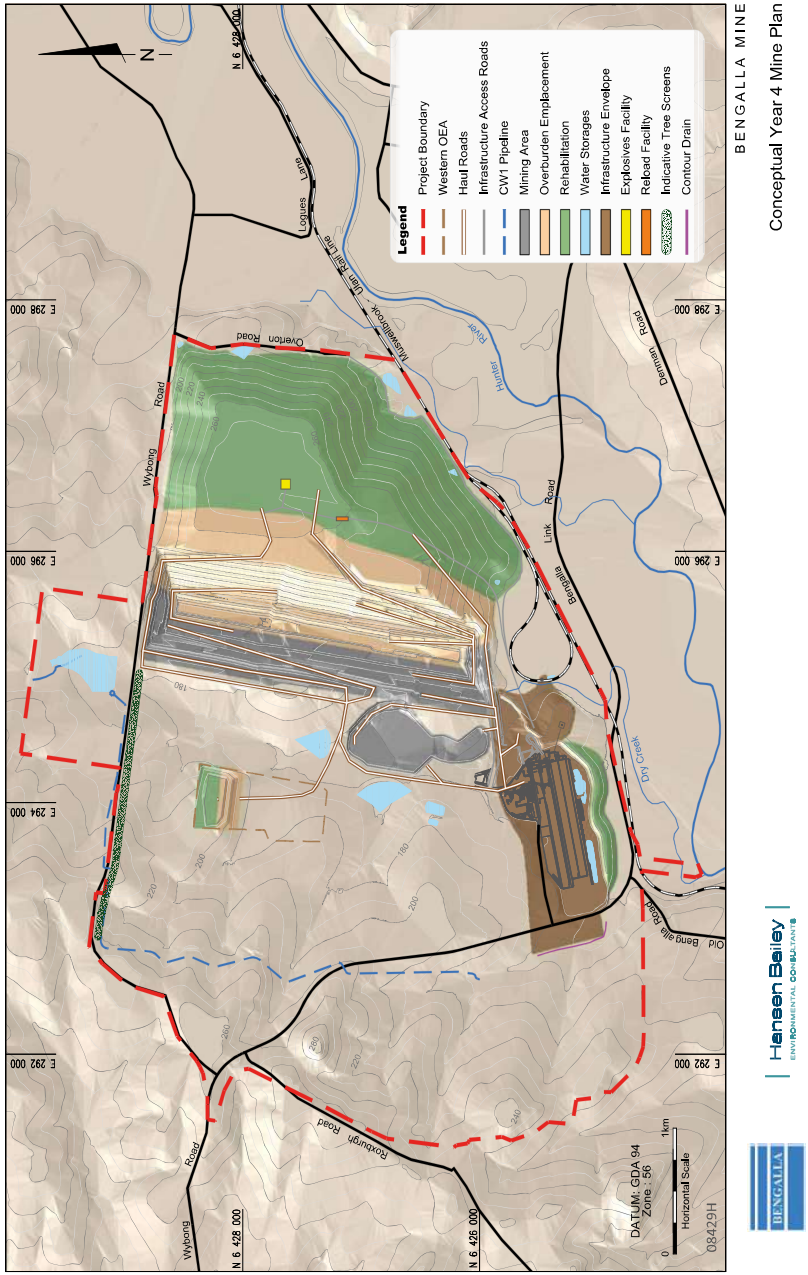


Figure 4.3 | *Conceptual Year 4 Mine Plan*

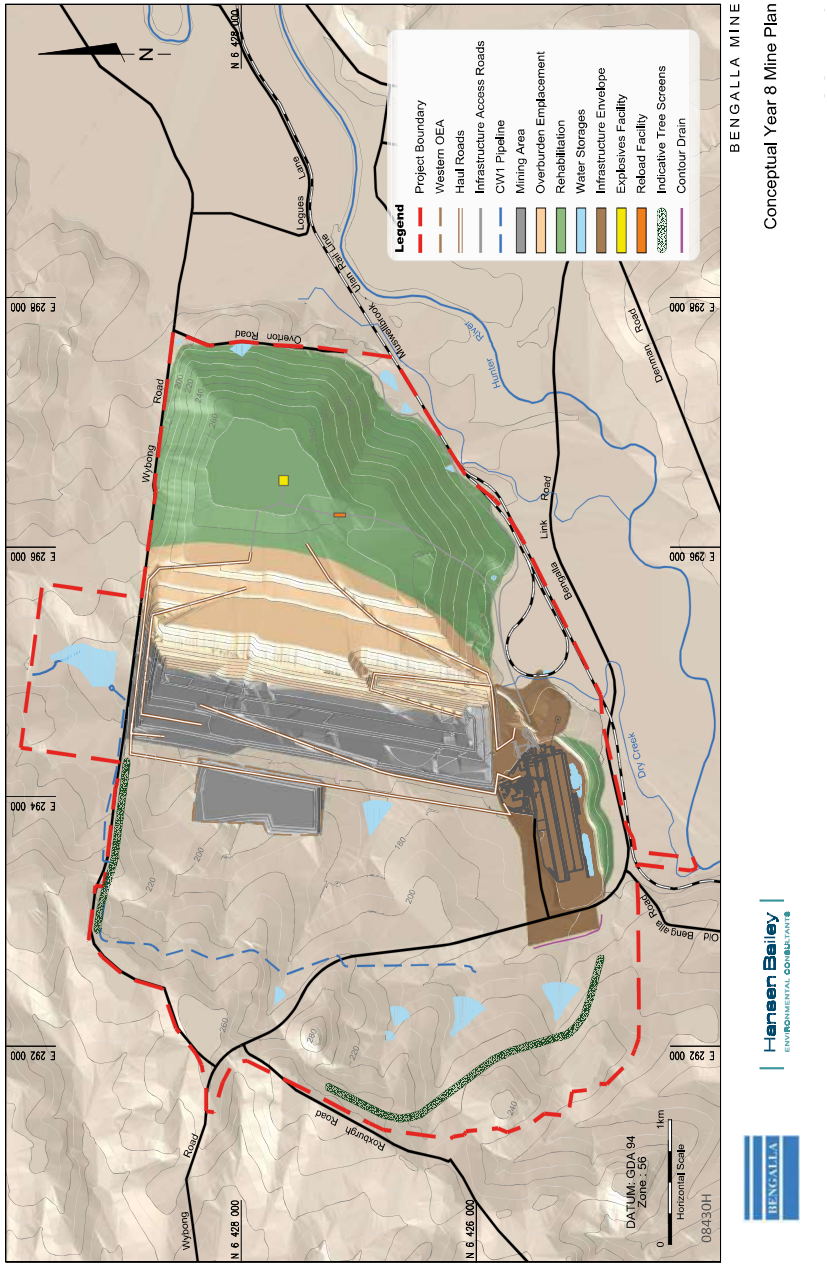


Figure 4.4 | *Conceptual Year 8 Mine Plan*

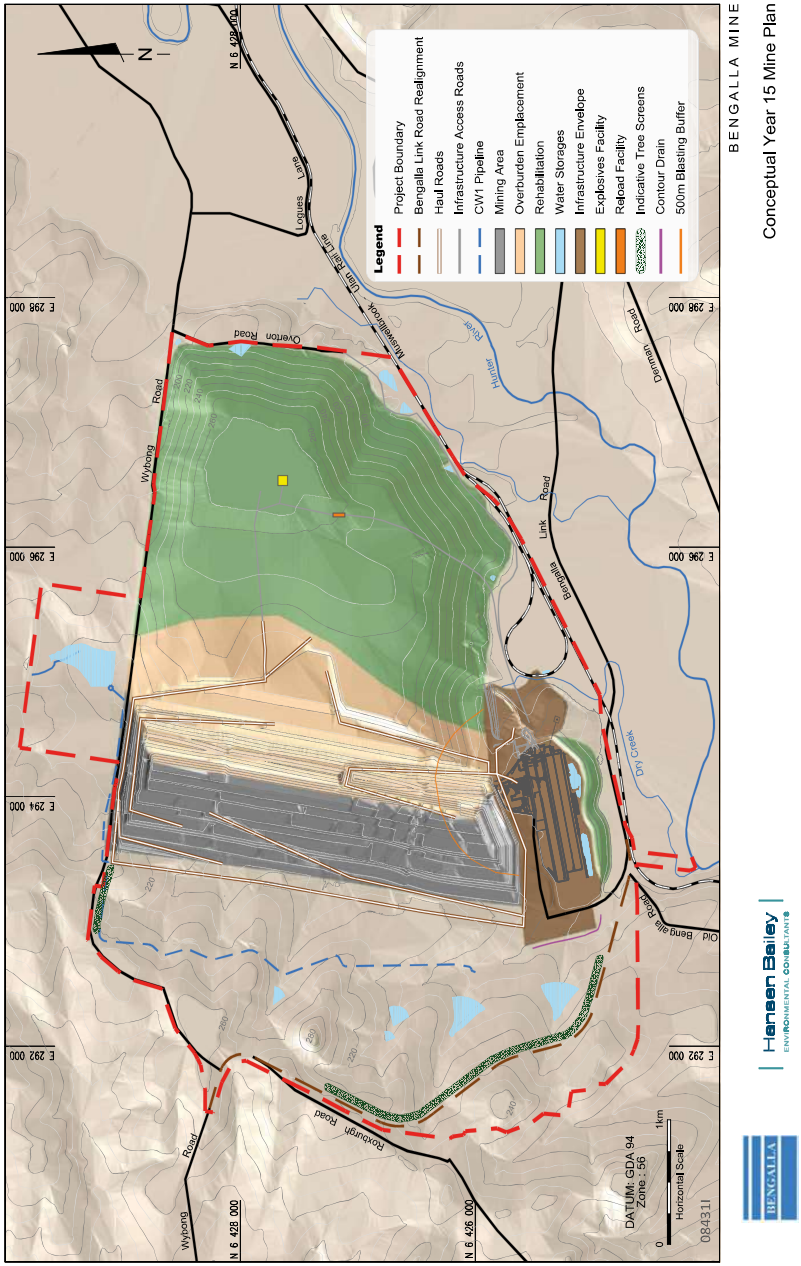


Figure 4.5 | *Conceptual Year 15 Mine Plan*

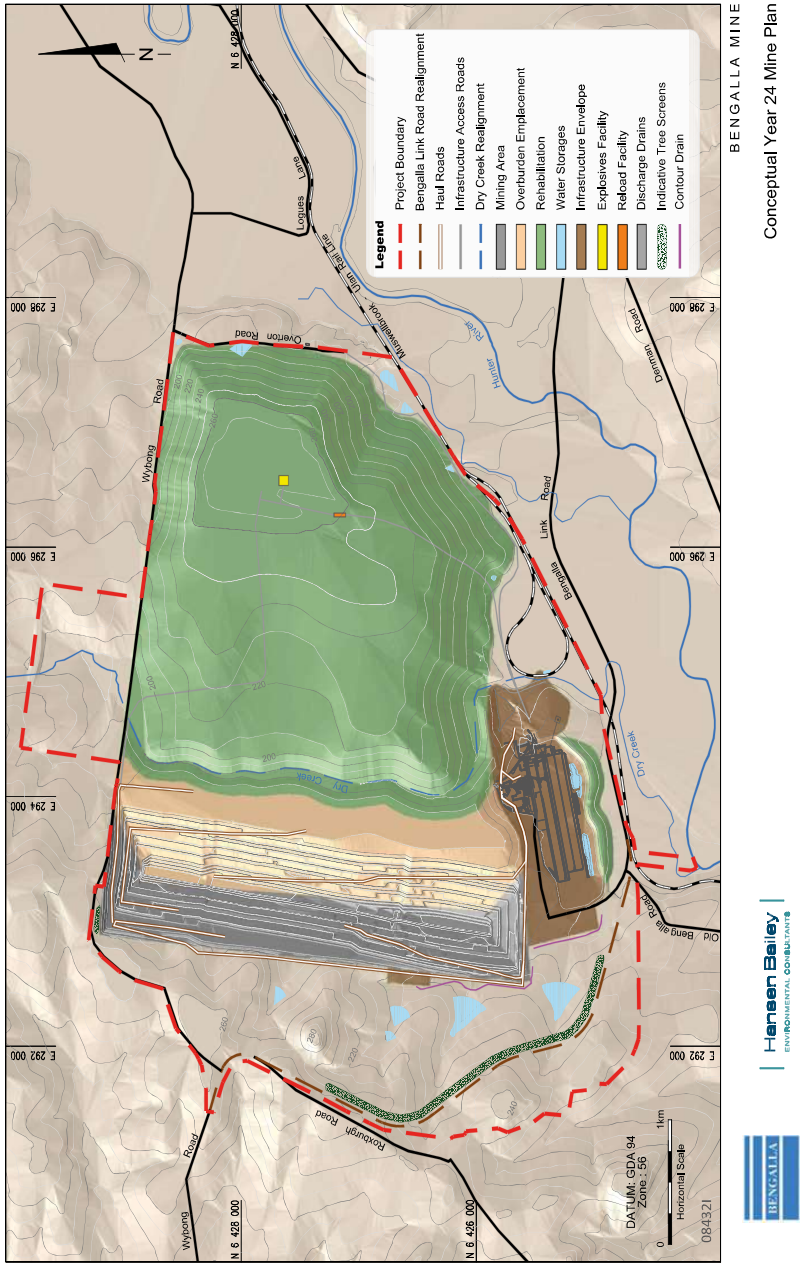


Figure 4.6 | *Conceptual Year 24 Mine Plan*

5. VISUAL SENSITIVITY

5.1 Introduction

This section of the report evaluates the visibility of various elements of the Project from various viewing locations. Visibility to the Project will depend on factors such as topography and vegetation as well as existing and approved development components of Bengalla, especially the OEA, existing visual bunds and infrastructure components.

The sensitivity of these viewing locations will depend on the land use of that location. Land uses that utilise the view (i.e. residences and recreation areas) will have a high sensitivity, whereas areas such as rural lots (without a residence) have a low sensitivity as they do not gain value by utilising the view.

5.2 Primary Visual Catchment

The boundary of the Primary Visual Catchment (PVC) for the Project and various view sectors are illustrated in Figure 5.1 and defined below:

- The Northern View Sector that includes the town of Aberdeen;
- The Eastern View Sector that includes the town of Muswellbrook and adjoining foothills;
- The Southern View Sector that includes the foothills south of the Hunter River Floodplain; and
- The Western View Sector that includes the ridge line of the foothills in the vicinity of Roxburgh Road.

5.3 Viewing Locations – General

Around the Project Boundary there are a number of potential viewing locations. These include:

- Town Areas such as Muswellbrook, Aberdeen, and from outside the PVC and to a lesser extent Denman;
- Rural residences. These are usually more isolated properties scattered throughout the PVC, and sometimes elevated to take advantage of views across the Hunter River Floodplain;
- Recreation areas and Tourist Facilities such as: Muswellbrook Racecourse; and Pukara Estate olive grove; and
- Roads. The Major road through the PVC is the New England Highway. Regional roads are Wybong Road, Bengalla Link Road and Denman Road, in addition to smaller local roads.
- Historic homesteads of Bengalla, Edinglassie and Rous Lench.

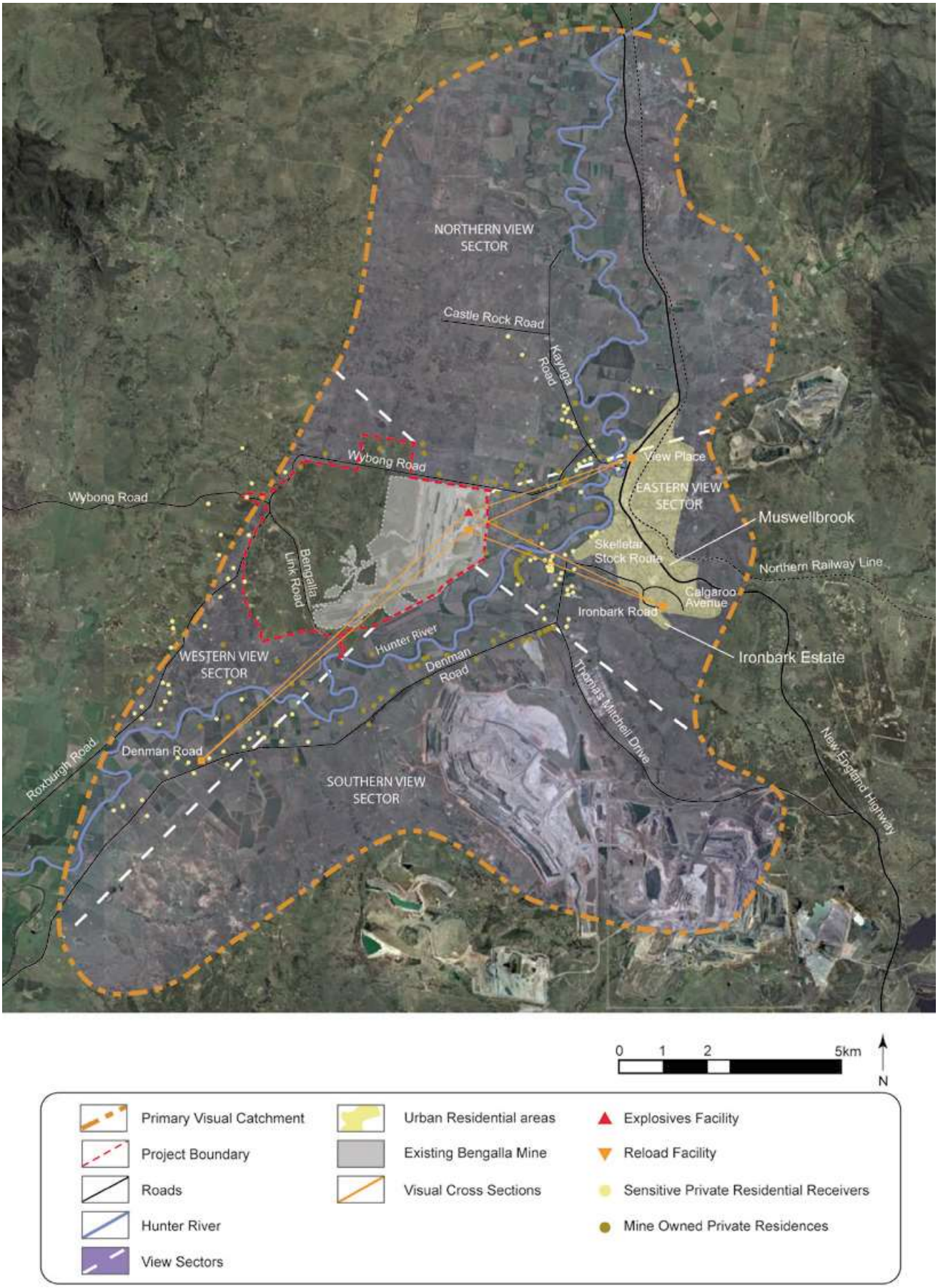


Figure 5.1 | *View Sectors & Private Receivers*

5.4 Visibility Considerations

5.4.1 Visibility

Factors influencing visibility vary around the Project Boundary, creating different visibility patterns. Usually the occurrence of topographic and vegetation elements close to the point of viewing are most influential in limiting visibility than elements of similar scale close to the Project itself.

However in relation to the Project, the screening influence of existing and approved mine components, especially the existing OEA are significant screening elements, see Figure 5.2. In relation to vegetation, tree cover at the point of viewing has the potential to screen views to Project areas (Figure 5.3). Vegetation close to the Project Boundary has limited effect in influencing visibility, see Figure 5.4.

In nearby towns, viewing opportunities of the Project may be limited to the outer edges as areas within are screened by adjoining buildings, gardens and street trees. This screening effect can also be important in relation to individual rural residences where adjoining sheds and/or homestead gardens and trees adjoining gardens and sheds can create foreground screens. This screening effect may be diminished when viewing locations are situated in elevated locations, Figure 5.5.

5.4.2 Land Use Sensitivity

Surrounding the Project Boundary, land use varies which then influences the sensitivity patterns towards the Project. Land use activities include a range of agricultural pursuits, rural residences and urban residential areas, tourism and recreation locations, road and rail corridors, as well as coal mining. These land use features contribute to the visual character of the landscape as well as influence visual sensitivity. (Land uses are discussed in more detail in Section 3 of this report).

In this context, residential areas such as Muswellbrook or rural residences will have sensitivity to larger scale changes to the landscape. As such, these have been assigned a high sensitivity up to 7.5 km away with a moderate sensitivity resulting for homesteads further away. In the same way, recreation and tourist facilities, as well as tourist roads and highways have been assigned a high sensitivity to up to 2.5 km away. Other significant roads have been assigned a moderate sensitivity up to 2.5 km with minor roads and rural production areas receiving a low sensitivity, see Figure 2.2.

Figure 5.2 | *View of main OEA from East*

The existing OEA will screen the Project.

Figure 5.3 | *Tree cover at point of viewing*

Trees alongisde a viewing location can provide more effective screening/filtering to distant views.

Figure 5.4 | *Tree cover at site*
Tree plantings alonside project elements, while achieving landscape pattern outcomes, lack the size to screen large scale elements such as an OEA.

Figure 5.5 | *View from elevated location*
Elevated viewing locations bypass the effects of foreground screens of vegetation or other buildings, to obtain views to distant elements.

5.5 Visibility and Visual Sensitivity of the Northern Sector

The Northern Sector, 5.6, includes a number of sensitive receivers in the form of rural residences along Wybong, Kayuga, and St. Heliers roads and other minor roads off these roads as well as the New England Highway and Aberdeen. Much of the Northern Sector within the PVC consists of lands that are part of the Mount Pleasant Project (see Figure 1.1).

Views to the Project from the Northern Sector will be limited due to the screening of the current Project by the extent of the existing OEA and its rehabilitated outer edges and slopes.

The Northern Sector contains parts of:

- Hunter River Floodplain VCU;
- Foothills VCU; and
- Town Areas VCU (Aberdeen).

5.5.1 Hunter River Floodplain

The Hunter River Floodplain supports a number of rural lots with improved pasture and cropping land, along with scattered rural residences along roadways. Many are screened by the adjoining foothills to the north of Bengalla. The open nature of the floodplain and associated rural lots in other areas means views in any direction are unobstructed by topographical features.

The residences are usually associated with rural lots. While the lots have low sensitivity, the residences have high sensitivity to any potential views to the proposed Project areas.

This could create a high sensitivity to views of the proposed Project areas. However views for any residence that is orientated toward Bengalla would be onto the north eastern and eastern faces of the rehabilitated OEA that are part of the current approval, meaning that visibility to Project elements is minimal. Further, intervening topography and a future Mount Pleasant Project would create further screening of Bengalla Operations.

Residences with views would have a high sensitivity. Those that are screened from the Project by rehabilitated OEA have been ascribed a low sensitivity due to lack of visibility to the Project.

5.5.2 Foothills

There are a limited number of residences in the foothills. Most are screened by the adjoining topography to the west of Kayuga Road. Closer residences adjacent to Wybong Road are owned by BMC or Coal & Allied and only have views onto rehabilitated eastern face areas.

5.5.3 Aberdeen

The Town Area VCU of Aberdeen marks the northern most point of the PVC. The southern edge of the town is over 10 km away from the Project, with most of the town being at greater distances. This distance makes for a lessening of visibility and hence sensitivity, however, as the views toward the Project are across the open floodplain, any views toward the Project will be unobstructed by middle ground topography or vegetation.

Again, views from the town are over the existing rehabilitated OEA and views onto proposed changes are negligible.

Residences over 10 km away from the Project Boundary are ascribed a low sensitivity on the basis of distance and lack of visibility to the Project.

5.5.4 Roads

The only major road in this sector of the PVC is the New England Highway which travels south through Aberdeen, heading toward Muswellbrook. As this road runs alongside or within the Hunter River Floodplain, the views in a southerly direction from the road are often unobstructed. At its closest point within the Northern View Sector it is over 5 km away.

Again, despite distance to the Project Boundary, elements of the Project will be visible while heading south. Views are limited to the rehabilitated eastern and northern faces with very minor views to the north western edge of the OEA.

As the road travels closer to the Bengalla, its sensitivity level will increase. Within the Northern Sector it will remain low due to distance and lack of visibility to the Project.

5.6 Visibility and Visual Sensitivity of the Eastern Sector

The Eastern Sector contains the highest number of potentially sensitive receivers. This sensitivity relates to the residential nature of Muswellbrook and the tourist/main road function of the highway and parts of the commercial centre.

Visibility in the Eastern Sector is high to the existing approved mining operations, but low to proposed Project areas. This is due to the western orientation and direction of the Project. Eastern Sector visibility largely focuses on the eastern part of the existing and approved OEA that has been rehabilitated and will have advanced regrowth on it by the proposed start of this Project.

The sector is dominated by Muswellbrook, the river floodplain along with some foothills to the east of Muswellbrook, Figure 5.7.

5.6.1 Hunter River Floodplain and Foothills

This VCU contains: parts of the New England Highway; some minor roads such as Wybong, Kayuga, McCullys Gap, and St Heliers roads as well as minor roads off them. These roads support rural residences.

The residences in the vicinity of Racecourse Road are the closest to the Project in the VCU (approx from 2.5 km). However the more distant residences (approx from 6.0 km) at the new Ironbark Estate have both a more critical angle of view and an elevated location. While the houses in this locality are part of Muswellbrook, the visual relationship of these areas differs from the majority of Muswellbrook. Racecourse Road to Bengalla experienced views as the rest of the floodplain, whereas Ironbark Estate experienced views similar to the foothills. The residences at Racecourse Road and rural residences on the floodplain will have a high sensitivity depending on the extent of visibility to the Project. Visibility to the Project from this sector is for the greater part screened by the existing, approved OEA. Views will be restricted to the south west edge of the OEA, which is generally in a rehabilitated state.

Other rural residences in this VCU are those isolated residences directly to the east and north. Those residences along Wybong Road and Kayuga Road and parts of Denman Road as well as those to the east of the highway (that are not mine owned) have been ascribed a high sensitivity due to their proximity to the Project Site, as well as their sensitive land use type. However these residences would have minimal views to the Project due to their orientation, and the screening effect of the existing approved and rehabilitated OEA.

The Racecourse itself is also ascribed a high sensitivity as it is a recreation area, although views to the Project are non-existent due to the screening effect of the existing approved OEA. Viewing locations are located on the eastern edge of the track, looking west. Figure 6.7 shows the view from the track.

Residences and recreation uses in this location are given a low sensitivity rating due to lack of visibility of the Project.

The Project will not be visible from Bengalla homestead which increasingly will be flanked by the rehabilitated landscapes of the OEA, complete with the landscape patterns of the surrounding hills.

5.6.2 Muswellbrook

On the basis of land use, residences in Muswellbrook are generally assessed as having moderate to high sensitivity depending on the viewing distance to the Project. However the rehabilitated Main OEA will screen the Project from most of Muswellbrook.

The exceptions are parts of South Muswellbrook, in the vicinity of the Skelletar Stock Route and Calgaroo Avenue that have a southerly aspect and view. These areas while being screened for the greater part will have views onto small parts of the southern edge of the mine pit that is not screened by the existing OEA.

The density of town development means that views from the majority of residences are screened by adjacent housing, associated structures, and garden and streetscape vegetation. Other residences on the western and southern edges of South Muswellbrook as well as some elevated residences would be most sensitive to the Project. Where these houses are less than 7.5 km away from the Project, sensitivity is high. Where there is adjacent screening, the sensitivity level of these residences may decrease to moderate and low.

Residences along and around Ironbark Road will have some visibility to the Project as foreground vegetation is limited. These residences are less than 7.5 km away from the Project. The elevation of this area also places viewing locations higher than the proposed Project. As such, their sensitivity levels will be high.

Residences with a view to the southern parts of mine extraction area and south western edge of the OEA will have a high sensitivity. Residences in north Muswellbrook would generally have a low sensitivity because of lack of visibility to the Project due to the view obstruction by the Main OEA.

5.6.3 Roads

Views from the New England Highway as it travels into Muswellbrook from the south-east will be screened from the Project by the existing rehabilitated OEA in the eastern part of the Project Boundary. Denman Road within the sector is further than 2.5 km and will have limited views from the western part of the road in the sector, creating a moderate sensitivity.

Other roads in this sector are local, rural and urban roads within the sector including Wybong and Kayuga roads, and Thomas Mitchell Drive which are screened from, or have limited views (being further than 2.5 km away) from the Project. These roads would have a low sensitivity.

Local roads will have a low sensitivity. Denman Road will have a moderate sensitivity with limited views and the existing rehabilitated OEA screening views from the New England Highway.

Figure 5.6 | *View from the north*
Views from Wybong Road will be onto the north western end of the emplacement.

Figure 5.7 | *View from the east*
Views are onto the outer rehabilitated face of the existing OEA.

5.7 Visibility and Visual Sensitivity of the Southern Sector

5.7.1 Hunter River Floodplain & Southern Foothills

The VCUs contains a number of view locations. Denman Road as well as parts of Thomas Mitchell Drive and Edderton Road occur within this sector, and there are residences toward the western end of Denman Road. The sector also contains the historic homesteads of Edinglassie and Rous Lench

The most sensitive view locations in the Southern Foothills VCU include a limited number of residences, see Figure 5.1, approximately 6 km away from the Project, on the western edge of the PVC. These areas and ones similar to them that have open views to the Project will be highly sensitive up to distances of 7.5 km away. From greater distances in the background, a moderate sensitivity will be experienced.

5.7.2 Pukara Estate

Pukara Estate olive grove (Pukara) is located on Denman road approximately 5 km south-west of the Project. Pukara was established in 1999 and in addition to the olive oil products produced, Pukara supports several tourist-based elements. Tourist activities are mostly confined to tasting rooms, associated selling centres and adjoining outside patio areas, however these are visually contained within the grove and are screened from the Project by them.

There are also tours of olive grove areas. The flat levels of the terrain allow for long views. However the trees in the olive groves have the effect of creating enclosed landscapes with the exception of views from the edges of the plantation to the Project.

There are views towards the Project from the entrance to the estate on Denman Road, if travelling from the west. These views are 5 km away from the Project's western edge. Views onto the Project will not alter from current views. These views are presented in Figure 6.6 (view from Denman Road).

Views from the Pukara will have a high sensitivity; however there is a lack of visibility from many Pukara areas, due to screening from surrounding olive trees.

5.7.3 Edinglassie and Rous Lench

These homesteads are located on Denman Road approximately 4km from the Projet. These homesteads would have some views to the Project but not from primary view zones around the main homesteads. The Edinglassie main view zone is to the south and Rous Lench is to the east. Further, the 2007 European Heritage plan for the properties recommended landscape treatments to screen any view from the homesteads and their curtlidge towards the Project. These homesteads would have high sensitivity to the Project, but screening takes out views to it

5.7.4 Denman Road Rural Residential

The properties along Denman Road within this sector which are not owned by the mining companies and are approximately 4.5 km away from the Project Boundary and active mining areas would have some visibility toward the Project. As these properties are primarily on the edge of the Hunter River Floodplain, the landform is flat and open, allowing long views towards the Project. Properties oriented north-east have direct views, and these views can only be moderated by screening elements at the point of viewing. The majority of properties already have dense foreground vegetation around the residences and this may limit views to the Project.

Their sensitivity levels would therefore be moderate to high for those properties less than 7.5 km away, depending on individual levels of screening that may limit visibility. Houses in this location are generally less than 4 km away from the western edge of the Project.

5.7.5 Roads

The main road running through this sector is Denman Road. Other roads include Edderton Road and Thomas Mitchell Drive.

Both Thomas Mitchell Drive and Edderton Road will have a low sensitivity due to lack of visibility of the Project and usage type. Denman Road will have a high sensitivity up to 2.5 km and a moderate sensitivity up to 7.5 km, after which sensitivity would reduce to low. This increased level of sensitivity is due to the road supporting numerous residences and Pukara.

Denman Road is more than 2.5 km away from the Project and orientated generally parallel to the Project and therefore has a moderate sensitivity. The sensitivity for other roads is moderate to low.

5.8 Visibility and Visual Sensitivity of the Western Sector

The potential view locations within the Western Sector are associated with Roxburgh Road and parts of Wybong and Denman Roads. Residences along these roads are also potential viewing locations.

5.8.1 Bengalla Link Road, Roxburgh Road, Wybong Road and Denman Road

View locations include elevated sections on Roxburgh and Wybong Roads and a limited view corridor from the relocated Bengalla Link Road to the west of the CHPP.

The Project Boundary will align with Roxburgh Road and will be approximately 1 km away from mining operations in Year 24 of the Project. The proximity of operations will create high potential visibility, although topography and roadside vegetation will screen views toward the mine.

Views from Roxburgh Road to the Project are generally limited by topographic features. Potential views are confined to the more elevated parts of the road for approximately the first 1 km from the intersection between Roxburgh Road and Wybong Road as well as from elevated parts of Wybong Road itself before the intersection.

While the Project Boundary is generally aligning with Roxburgh Road, the active mining areas will be approximately 1.5 km away from Roxburgh Road itself. This will result in a moderate sensitivity, and Wybong Road and Bengalla Link Road will also have moderate sensitivity adjacent to Bengalla.

Denman Road in the sector will be further than 2.5 km away. There will be views from the Road travelling east. This is especially from hill areas west of Pukara. Views will also be obtained from the Road within the floodplain areas.

Sensitivity levels for roads within the sector will be moderate. The higher sensitivity of Denman Road is modified by the distance the road is from the Project that create the moderate sensitivity. In a similar way the lower sensitivity of Wybong and Roxburgh Roads is increased by the proximity of the roads to the Project with Wybong road being adjacent, creating the moderate sensitivity.

5.8.2 Rural Residences in the Western Sector

Roxburgh Road

There are several rural residences along Roxburgh Road; however most are screened from the Project elements by topography and vegetation, Figure 5.1.

The exception is the Receiver 158 as shown on Figure 3.2. This residence currently has views to the active face of the OEA. As this face progresses west it will come closer although lower in elevation and to varying degrees be dominated by rehabilitated OEA further to the east. Even though this property is entitled to acquisition by mining companies, while the property remains as private freehold, its sensitivity to changes in the landscape is high. However visibility will be restricted to a portion of a topographic dip in the ridge line to the east that currently allows for views to the existing active face of the Main OEA and to a larger extent Mt Arthur Coal.

Other residences along Roxburgh Road are in elevated positions have potential views in an easterly direction of the Project. The distances to views will become less over the life of the mine; however the elevation of the OEA of the mine will progressively decrease from 270 m to 180 m. This may mean that visibility is screened by the intervening elevated topography and vegetation which will inhibit overlooking onto the active extraction area.

A limited number of houses along the lower part of Roxburgh Road will have high sensitivity if there is strong visual orientation and exposure to the Project and its elements. These residences will have visibility and high sensitivity.

Denman Road

Residences on Denman Road, especially the elevated Receiver 93 (Figure 3.2) could have views to the Project. These residences are within 7.5 km of the Project and would have a high sensitivity. Not all residences are orientated to or have open views to the Project, but such visibility would create high sensitivity.

Sensitivity to the Project would generally be low due to a lack of visibility. However, there is one location high on Roxburgh Road (Receiver 158, Figure 3.2) where a high visibility to the current and the proposed Project would result in a high sensitivity. Similarly, some lots at the lower end of Roxburgh Road and Denman Road could have similar visibility and high sensitivity.

5.8.3 Denman

Although this town is outside the PVC it does have potential views to Bengalla across the Hunter River floodplain. However due to the distance, over 18 km, the sensitivity of such views would be low.

Figure 5.8 | *View from the south-west*
Views are onto the south eastern and south western faces of the existing OEA.

Figure 5.9 | *View from the south-west*
Views are onto the active face of the existing OEA.

5.9 Visibility of Explosive Facility and Reload Facility

The Explosive Storage Facility and Reload Facility are both located on the top of the OEA, with an elevation of approximately 270 m. This location meets operational and safety needs for the Project. The prominent location created concerns regarding potential visibility from sensitive locations, especially eastern locations at Muswellbrook and South Muswellbrook.

To investigate the potential for this, inter-visibility diagrams were done with section lines from critical view points at (Figure 5.1):

- North Muswellbrook at View Place;
- South Muswellbrook at Ironbark Road for eastern and southern views ; and
- Denman Road for western views.

These view lines are illustrated at Figure 5.10, 5.11 & 12.

These visual cross sections indicate views from View Place of the Reload and Explosive Facility are not possible from this location due the shielding provided by the OEA shoulder to the east of the facilities.

Results from Ironbark Road indicated that the Reload Facility and to a lesser extent the Explosives facility would be visible from this location.

Results from Denman Rd indicate that both the Explosive Storage Facility and Reload Facility are visible from this location however are located over 8 km away.

From the above results, mitigation measures will be recommended (section 9) in terms of screening and backgrounding to minimise the potential views to sensitive receptors.

These view lines indicate that there is not a significant visual issue associated with the location of the Explosive Storage Facility and Reload Facility that cannot be overcome by simple mitigation strategies such as micro-land shaping and tree planting that would be part of normal rehabilitation strategies.

5.10 Changes to Visibility/Sensitivity Created by the Project

The visibility and sensitivity to the Project varies within the sectors. The Northern Sector is dominated by the approved (but not yet active mining) Mount Pleasant Project creating low sensitivity based on land use.

The Eastern Sector has high sensitivity towns in the form of Aberdeen and Muswellbrook. Aberdeen is screened from the Project by the Main OEA and foothills within the Mount Pleasant Project. Muswellbrook is similarly screened for the greater part by the Main OEA. A small section of South Muswellbrook including the new Ironbark Estate will have views onto small parts of the southern edge of the mine extraction area and the progressively rehabilitated OEA to the east of it. These areas with views will have a high sensitivity.

The Southern Sector is dominated by Denman Road and some residences along it that will have views to the southern edges of the extraction area and OEA creating moderate to high sensitivity for residences and moderate sensitivity for Denman Road.

There are limited sensitive receivers within the most exposed Western Sector. However some residences will have high visual exposure and sensitivity. Roads within the sector have moderate sensitivity based on distance and usage type. Significantly, views of the Project for the Western Sector will be smaller in scale (OEA elevation of less than 180 m) but in closer proximity than the current view (OEA elevation of 270 m).

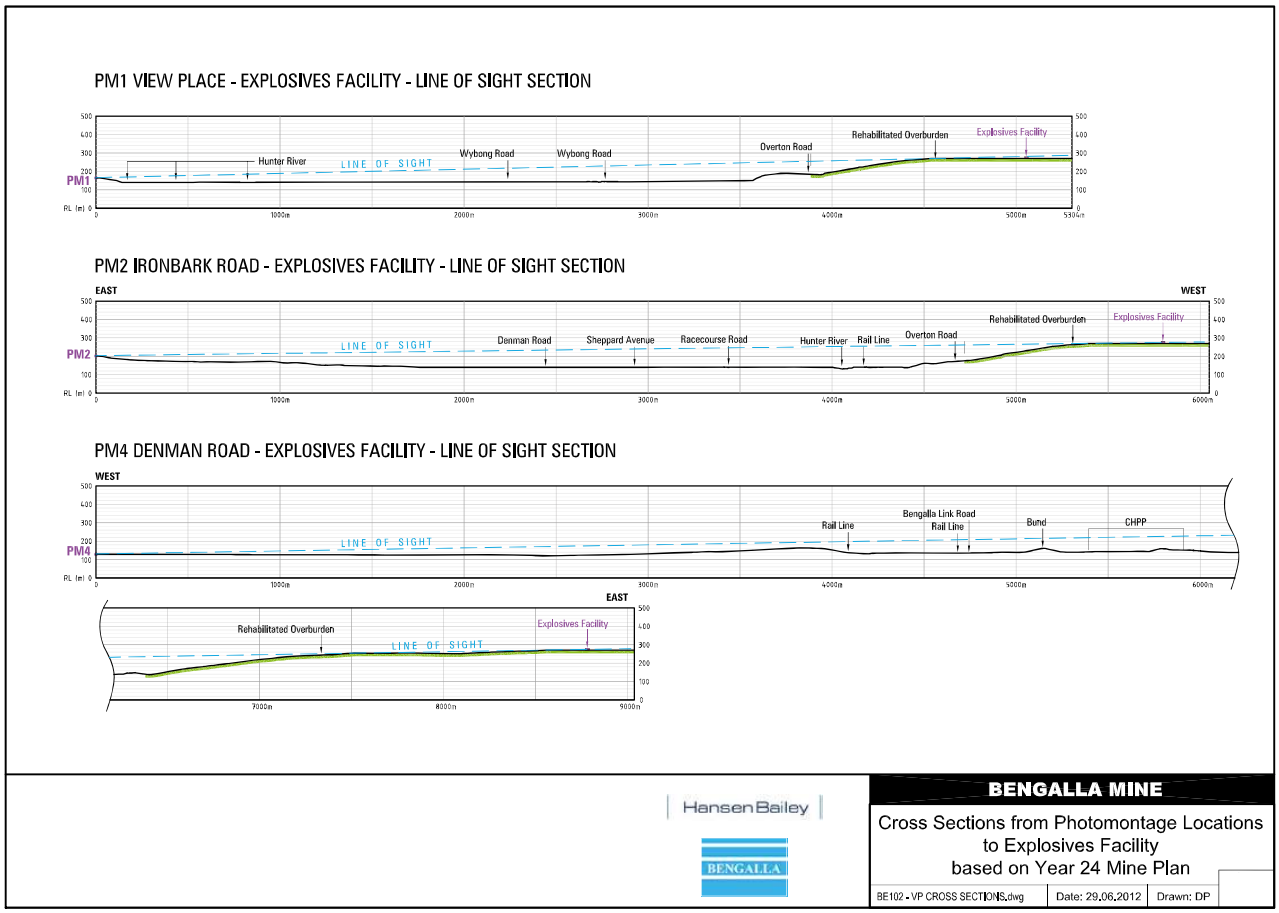


Figure 5.10 | *Cross Sections - Explosives Facility*

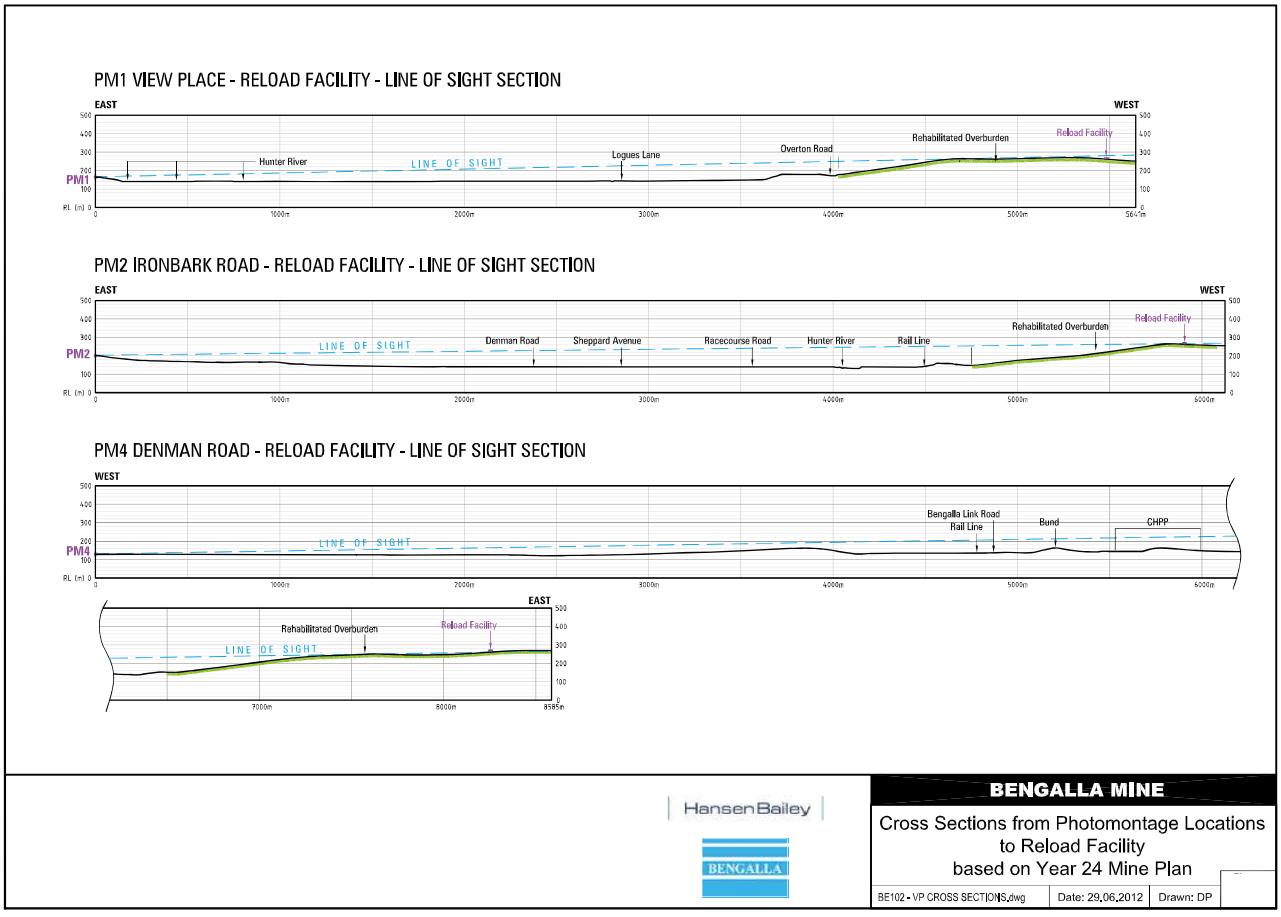
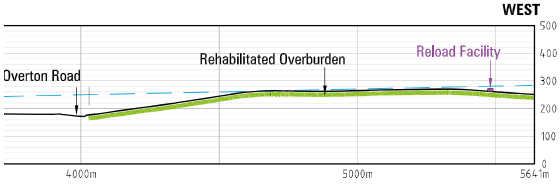
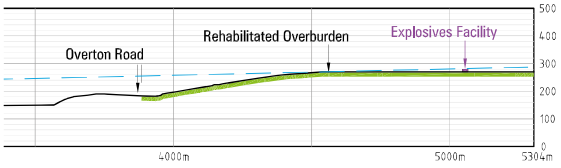


Figure 5.11 | *Cross Sections - Reload Facility*

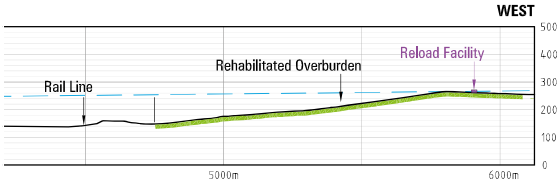
PM1 VIEW PLACE - RELOAD FACILITY - LINE OF SIGHT SECTION



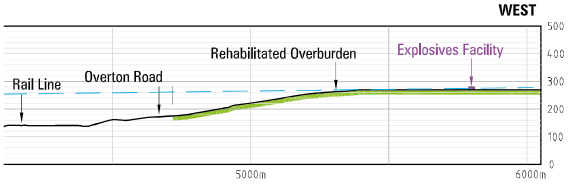
PM1 VIEW PLACE - EXPLOSIVES FACILITY - LINE OF SIGHT SECTION



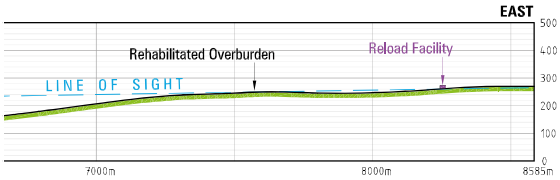
PM2 IRONBARK ROAD - RELOAD FACILITY - LINE OF SIGHT SECTION



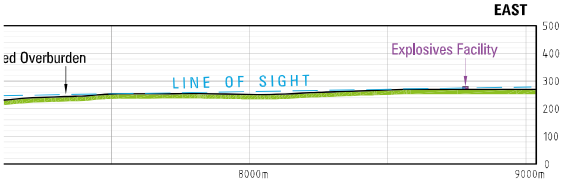
PM2 IRONBARK ROAD - EXPLOSIVES FACILITY - LINE OF SIGHT SECTION



PM4 DENMAN ROAD - RELOAD FACILITY - LINE OF SIGHT SECTION



PM4 DENMAN ROAD - EXPLOSIVES FACILITY - LINE OF SIGHT SECTION



BENGALLA MINE

Cross Sections from Photomontage Locations to Reload and Explosives Facilities based on Year 24 Mine Plan

BE102 - VP CROSS SECTIONS.dwg | Date: 29.06.2012 | Drawn: DP

Figure 5.12 | *Cross Sections - Detail*

6. VISUAL EFFECTS

6.1 Introduction

In this section the visual effects of the various Project elements are considered. These effects represent the visual interaction between the various elements of the Project and the visual setting within which they occur and are seen.

The visual effect of the Project will vary as seen from various locations around Bengalla.

To illustrate these effects on view locations around the site, views were considered from the Northern, Eastern, Southern and Western Sectors. The visual effects were considered from a number of potential viewing locations and have also been assessed through photomontage development, as described above (Section 2). These viewpoints are representative of worst case scenario views that will be obtained of the Project from the various sectors. Figure 6.1 shows the location of these viewpoints.

6.2 Northern Sector

The Northern Sector is dominated by rural land used for cattle grazing on rolling hills with some improved pasture cropping along the Hunter River flood plain in the eastern part of the sector. There are some residences along Kayuga Road. Of significance is the approved, but yet to become operational, Mount Pleasant Project that dominates the sector. This will create a strong visual effect that will screen Bengalla.

The visual effect on the eastern part of the Northern Sector is generally unchanged as views for the greater part are onto the existing OEA. There are minor changes to the OEA as viewed from the north eastern parts of the Sector. These changes largely relate to an extension of the mining program to the west (across the approved but not yet commenced Mount Pleasant Project), with minor views onto the north western edge of the pre-rehabilitation OEA.

The visual effect of these changes, are in part illustrated in the photomontage from View Place. Although this is a north easterly viewing location, it is possible to interpret the visual effects on northern views from this location.

The visual effect of the Project on the Northern Sector will consist of the rehabilitated faces having a low visual effect on the north eastern part of the sector and increasingly the northern part of the sector. The north western parts of the sector will be exposed to the active face of the OEA to varying degrees and will experience moderate to high visual effects as a result. However areas of high visual effect are largely located within the Mount Pleasant Project area.

In the Northern Sector there were two photomontage locations

- New England Highway (PM1); and
- View Place (PM2)

Photomontage New England Highway (PM1)

As seen from Figure 6.2a, the existing view contains small portions of the OEA north eastern face that are still active. This area remains active and is slightly enlarged in the first year of the Project, Figure 6.2b. By Year 4 much of the visible OEA has been rehabilitated, but a sliver of active OEA is still visible, Figure 6.2c. By Year 8 the eastern face as seen from the highway is completely rehabilitated and from that time there is no further active mining activity visible from this location, Figures 6.2d & e.

Photomontage View Place (PM2)

As seen from View Place, Figure, 6.3 & Year 1, Figure 6.3a shows the extension of the OEA to the north east of the existing rehabilitated area. This extension from this viewing location is minor, and partially hidden by foreground vegetation. By Year 4, this extension has been rehabilitated and no further views toward the active OEA are visible, Figures 6.3b – e.

Visual effects will be low in the north east, and high to the north and the north west. However northern land is within the Mount Pleasant Project area and sensitive receptors in the north west on Wybong Rd are screened by the ridge in the vicinity of Roxburgh Rd.

6.3 Eastern Sector

Immediately adjoining Bengalla to the east are the rural lands of the Hunter River floodplain. The Eastern Sector contains the most sensitive land uses and is dominated by the township of Muswellbrook. The rural lands adjoining Bengalla support a number of rural residences along Kayuga Road.

This sector has the most critical view locations and is representative of the greatest population, therefore contains most of the photomontage points. Further, these points assist in illustrating potential visual effects from locations in other sectors by reference to the view points in the extremities of the Eastern Sector (e.g. consideration of potential visual effects to the north sector) by reference to a more critical view point to the north east (View Place) within the Eastern Sector. Despite the sensitive nature of these viewing locations, the visual effect of the Project will have minimal visibility from the east, as the Project is active on the western edge only.

Photomontage locations within the Eastern Sector include:

- Ironbark Estate (PM3); and
- Racecourse Road (PM4).

The Eastern Sector contains the most critical view locations, including Muswellbrook and the New England Highway. From these locations the visual effects of the Project are not visible or are low. Further, the maturing of the tree planting on the eastern side of the OEA greatly improves the visual outcomes towards the Project.

Photomontage Ironbark Estate (PM3)

The photomontage from Ironbark Road shows the rehabilitation of the existing southern faces of the OEA, Figures 6.4a & b, while mining activities toward the west becomes visible from Year 8, Figure 6.4c. Year 8 also sees the completion of rehabilitation of the existing OEA which is closer to this viewing location. Year 15 shows the progression of mining activity toward the West, Figures 6.4c & d. Year 24 sees the majority of visible mining activity rehabilitated, although there are some remnant parts of the active mining area still visible in Year 24. The proportion of view that the proposed mining activity occupies between Years 8 – 24 is minimal and less than currently visible and would create a moderate to low visual as discussed further below.

Photomontage Racecourse Road (PM4)

The view from Racecourse Road toward new mining activity is also screened by the existing OEA, Figure 6.5a. The rehabilitation of the existing OEA is completed by Year 4, Figure 6.5b, and there is only a minor view toward new mining activity above the rehabilitated OEA. This has been reduced by Year 8, Figure 6.5c and continues to remain out of sight for the life of the Project.

Visual Effects in the east will be generally screened from view by the existing and rehabilitated OEA with low visual effects occurring as seen from the southern part of this sector.

6.4 Southern Sector

The Southern Sector is dominated by rural lands. Along the river flood plain, improved pasture cropping and some grazing dominate with an olive tree orchard also occurring in this locality. The rolling rural hills to the south of Denman Rd support vineyards and open grazing lands. There are a limited number of private residences within this sector and they occur in the western edge of the sector along Denman Rd.

The visual effects on the Southern Sector vary. In the eastern portions of the sector the views are onto the rehabilitated OEA creating a level 2/3 visual effect, Figure 2.4. In the western portion of the sector the initial view will be onto the active face of the OEA creating a level 1 type visual effect. This view will progressively become rehabilitated to type 2/3 visual effects as discussed in Figure 2.4 and as illustrated by Figure 6.6.

The visual effects of the Project on the Western Sector are illustrated in photomontage form at:

- Denman Rd (PM5)

Denman Rd (PM5)

Figure 6.6a illustrates the existing view from Denman Road adjacent to the Pukara. The view from this location onto existing operations creates a moderate to high visual effect. As time progresses this visual effect is decreased as views onto the active face are decreased and rehabilitated areas of the OEA increase and visually dominate the pre-rehabilitation areas, Figure 6.6b - e. In addition intervening hills screen views past Year 15 and possibly before from this location.

Visual effects to the south will vary from low to high reflecting views onto rehabilitated OEA (low visual effects) and views onto the active face of the OEA (high visual effects). Low effects will occur in the south east with initial high to moderate visual effects in the south west modified to low by year 15.

6.5 Western Sector

The Western Sector is also dominated by rural lands, but significantly supports rural life style blocks in the elevated parts adjoining Roxburgh Road. Along the river flood plain and Denman Road there are a limited number of residences and the commercial/tourist Pukara Olive Estate.

The visual effects of the Project on the Western Sector are illustrated in photomontage form at:

- Roxburgh Rd (PM6)

Roxburgh Rd (PM6)

The view from Roxburgh Road, Figure 6.7, to the west of mining activity is currently onto the active face of the OEA. This view will continue throughout the proposed mining period. The progression of mining activity toward the west will alter the position of the active mining face, and the rehabilitated OEA over time. New mining activity will still be visible from this location during the life of the Project and visual effect levels will remain high.

The visual effect in the Western Sector will be Type 1 (Figure 2.4) and will be high in certain locations such as the higher elevation areas on Roxburgh Road. This level of visual effect is similar to existing levels, but will be closer and of larger scale at a lower point in the view. That is, the current views of OEA have a top elevation of 270 m, and as the OEA progresses to the west, its top elevation will decrease to 180 m, lowering its position in the receiver's view.

6.6 Visual Effect Summary

The visual effects of the Project vary. The Project elements will create the highest visual effect when viewed from the west. From this sector views will be onto the active face of the OEA and will create a Type 1 (Figure 2.4) Visual Effect and depending on proximity, create a high visual effect. When viewed from the east, views will be onto rehabilitated OEA that will create Type 2 & 3 visual effect that will have moderate to low visual effect levels from most view locations.

The OEA created by the Project will be of smaller scale than the current working OEA being of significantly lower elevation (180 m) compared to (280 m) in the eastern and existing OEA, so that visual effects will decrease over time.

The visual effects of the OEA and the Project as a whole when viewed from the north and the east will be low. Many areas within these sectors will be screened by the existing OEA. Where views are obtained, they will only be limited views of the southern or northern area of the mine extraction area. The exception is the North West corner as seen from Wybong Road.

The visual effects of the Project are generally low with the exception of a limited number of viewing locations in the western and south western view sectors.

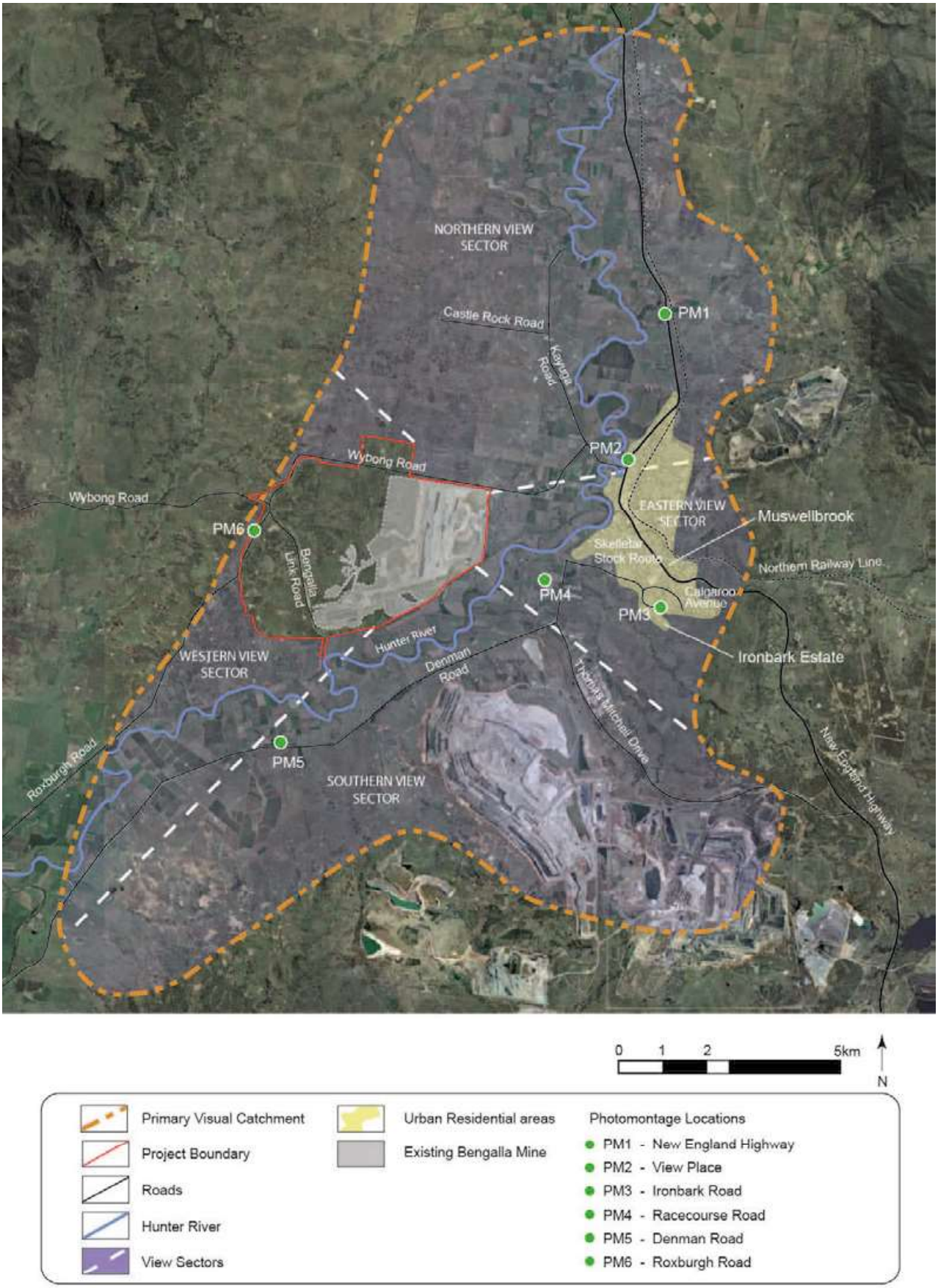


Figure 6.1 | *Photomontage Locations*

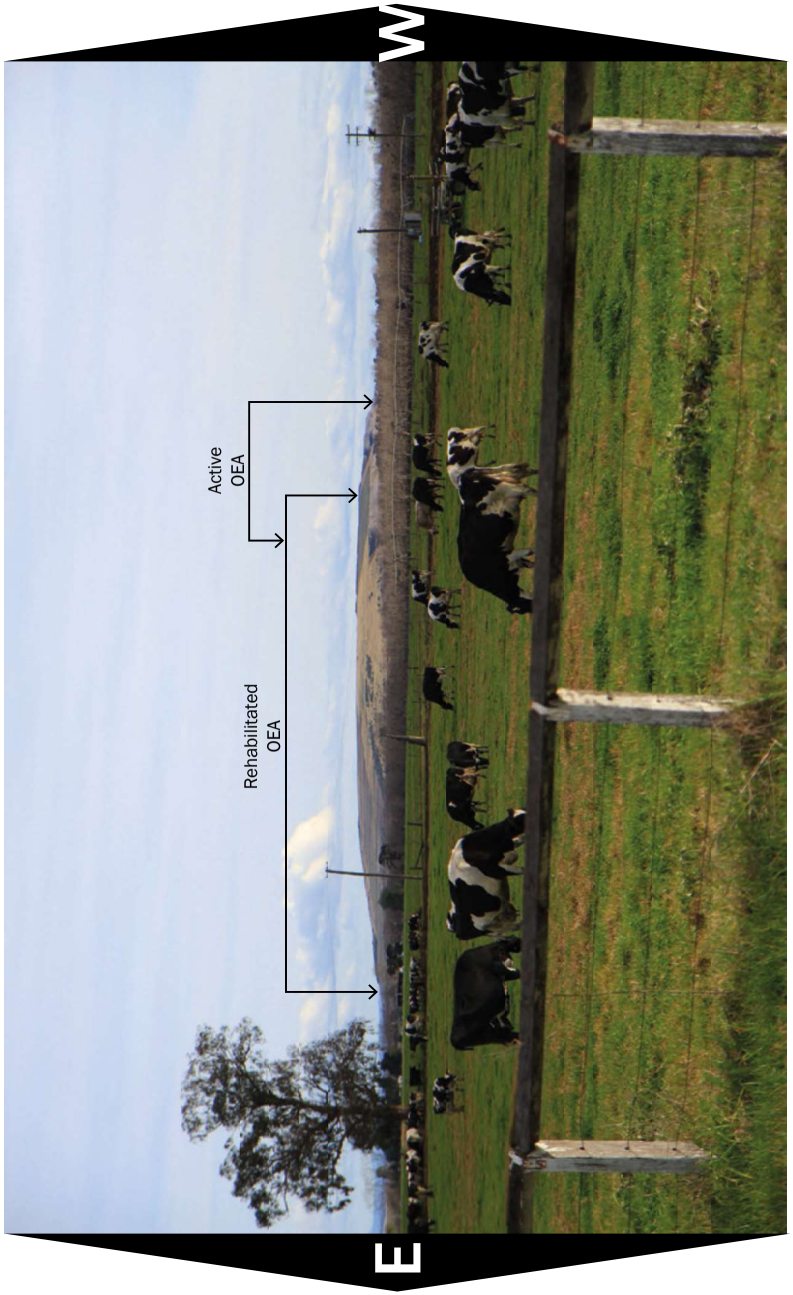


Figure 6.2a | *Location 1 - New England Highway - EXISTING*

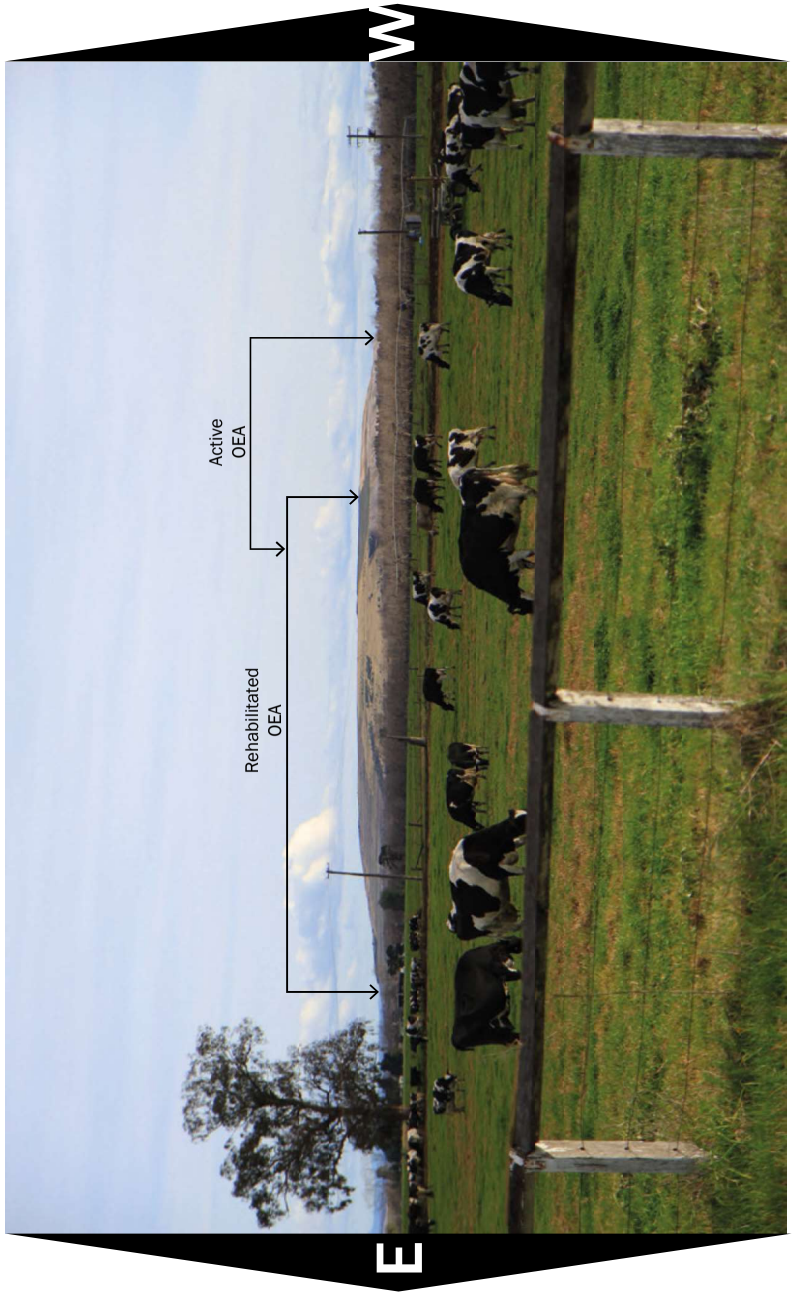


Figure 6.2b | *Location 1 - New England Highway - PROPOSED YEAR 1*

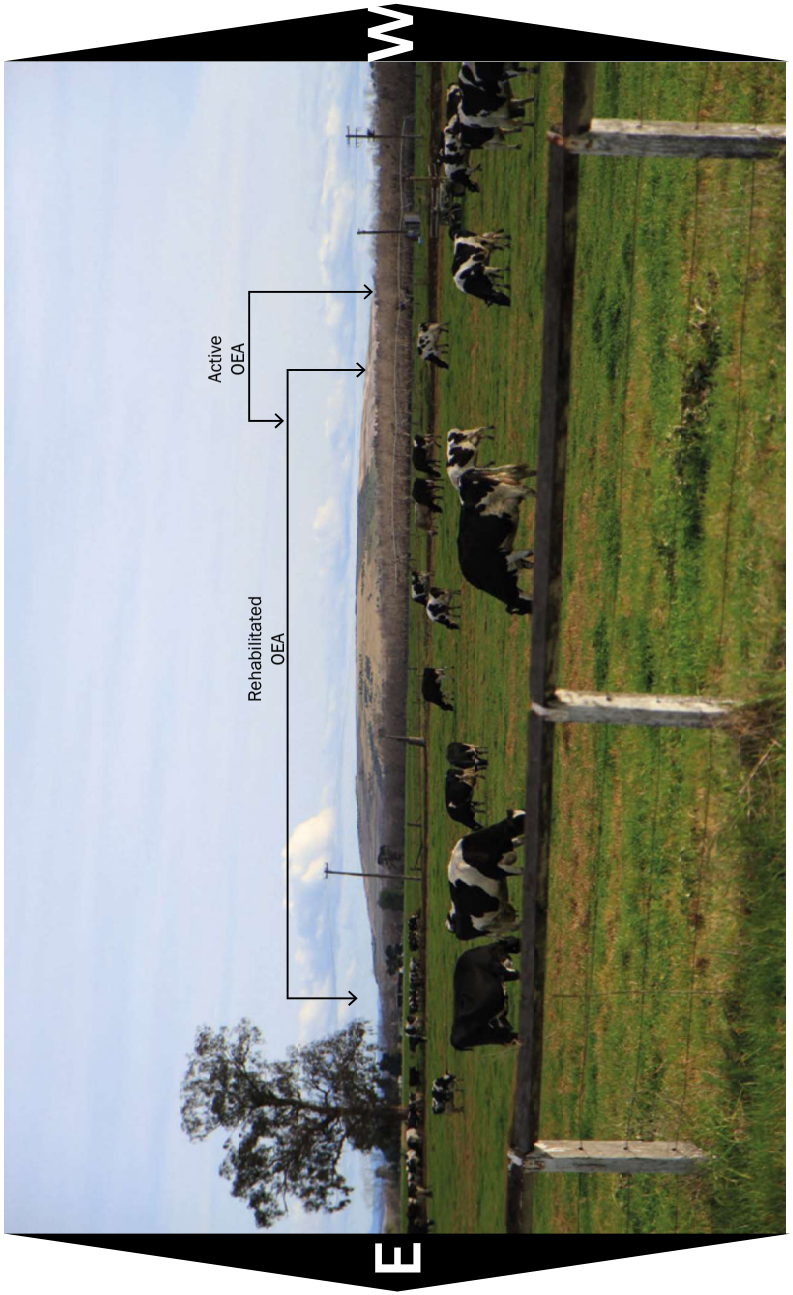


Figure 6.2c | *Location 1 - New England Highway - PROPOSED YEAR 4*

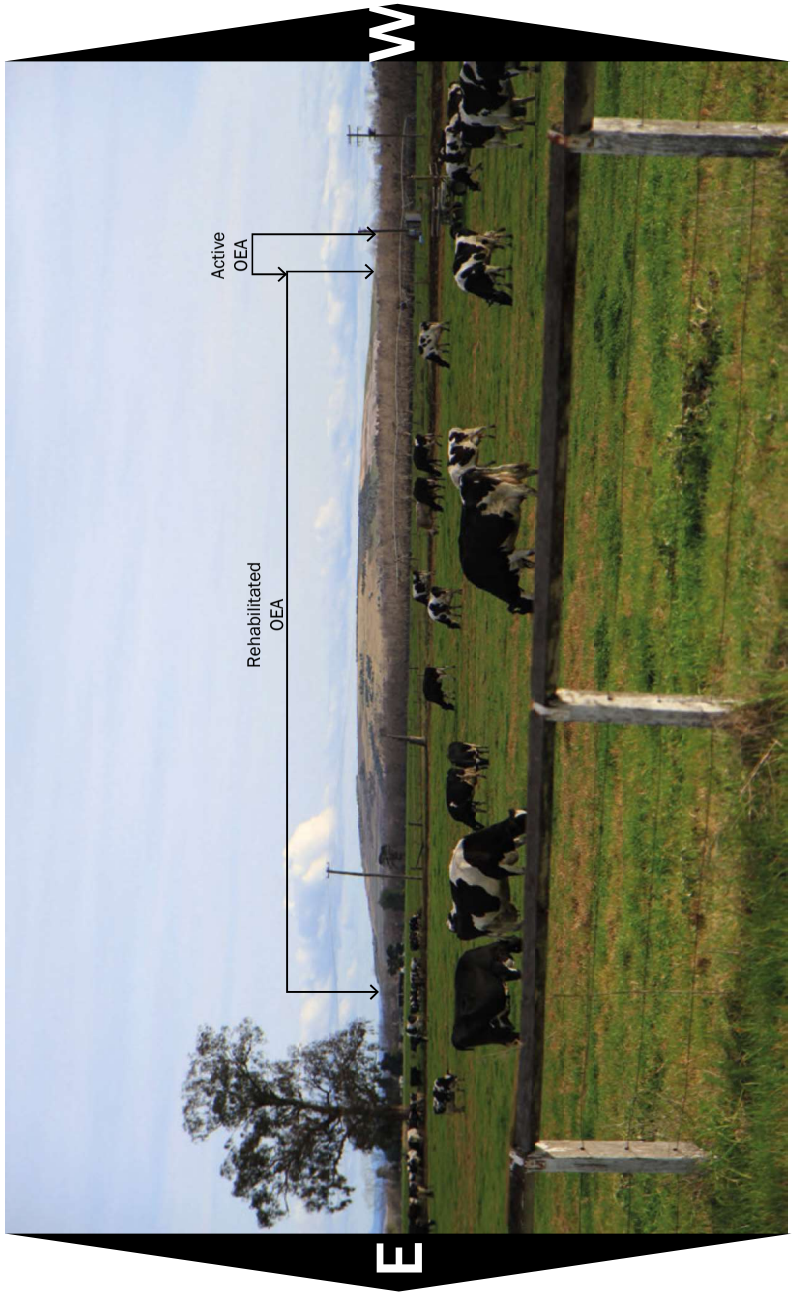


Figure 6.2d | *Location 1 - New England Highway - PROPOSED YEAR 8*

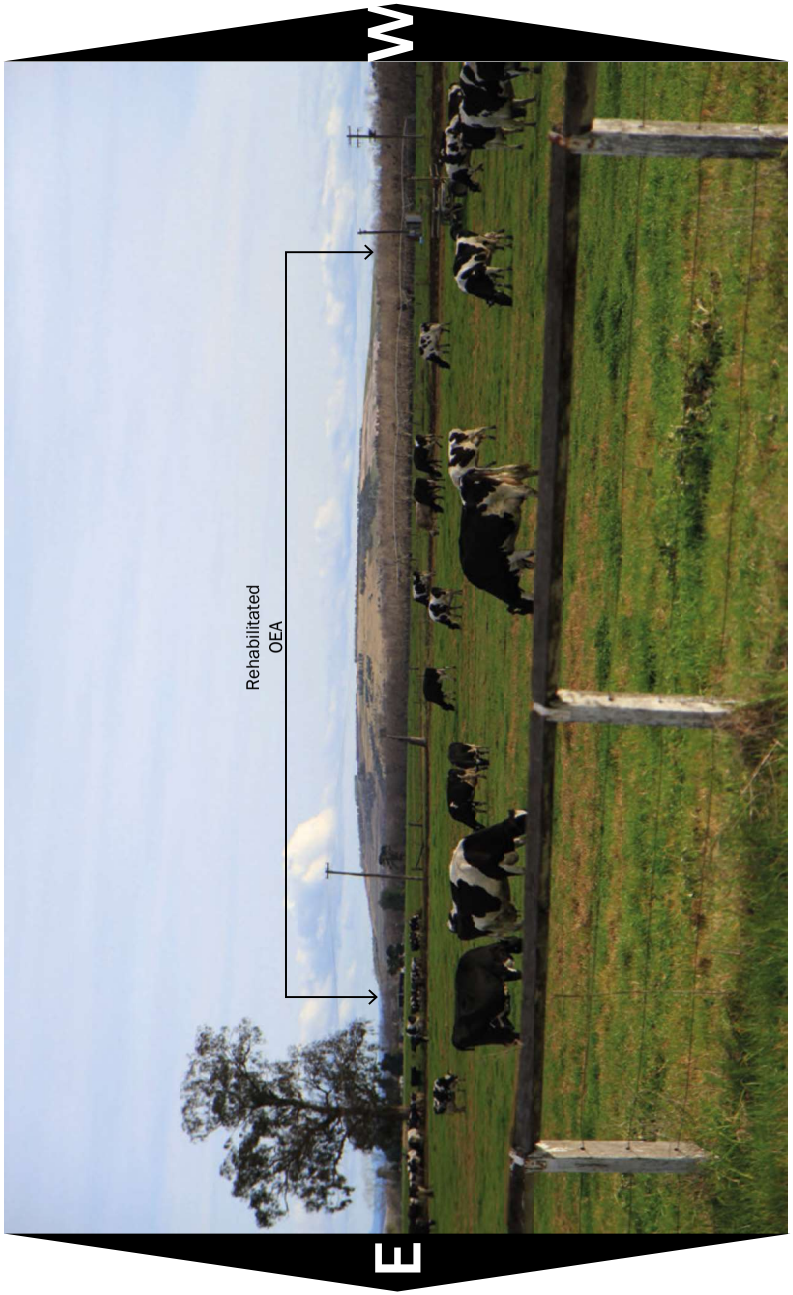


Figure 6.2e | *Location 1 - New England Highway - PROPOSED YEAR 15*

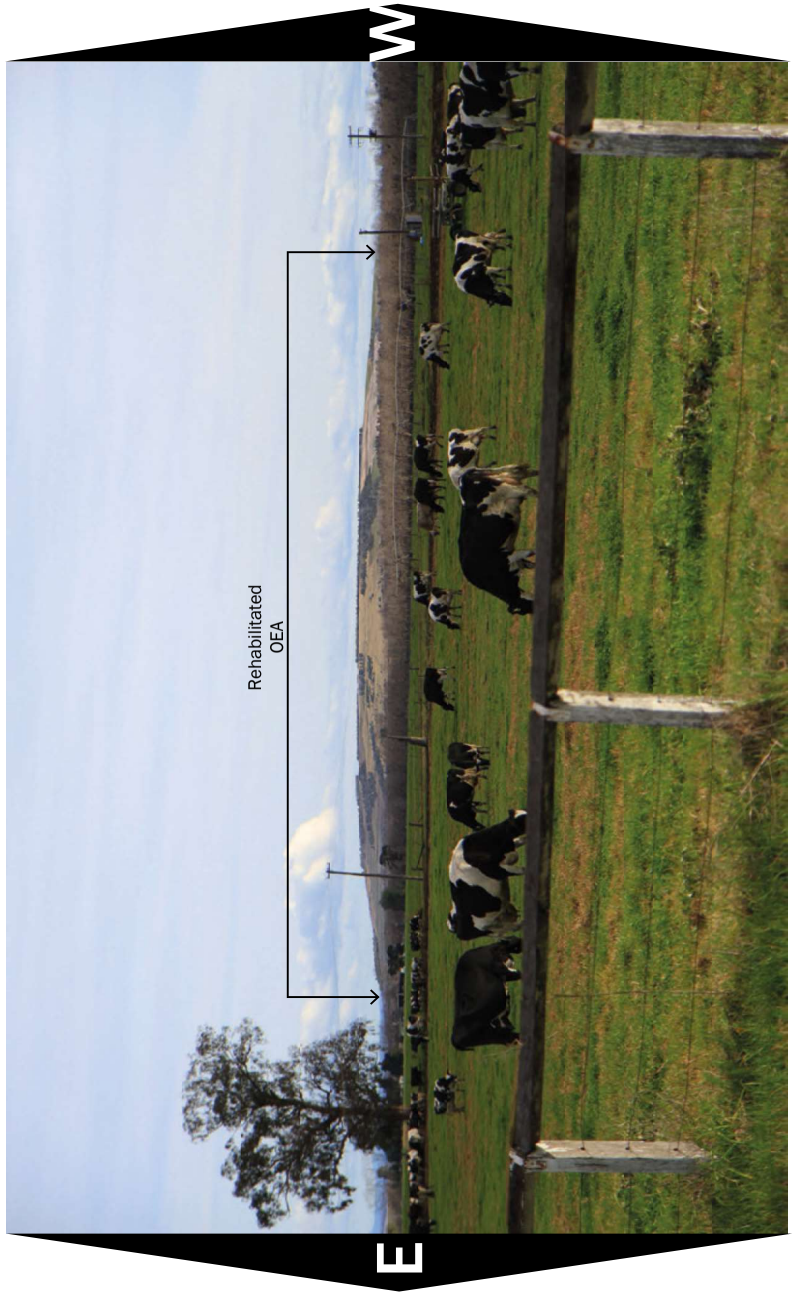


Figure 6.2f | *Location 1 - New England Highway - PROPOSED YEAR 24*

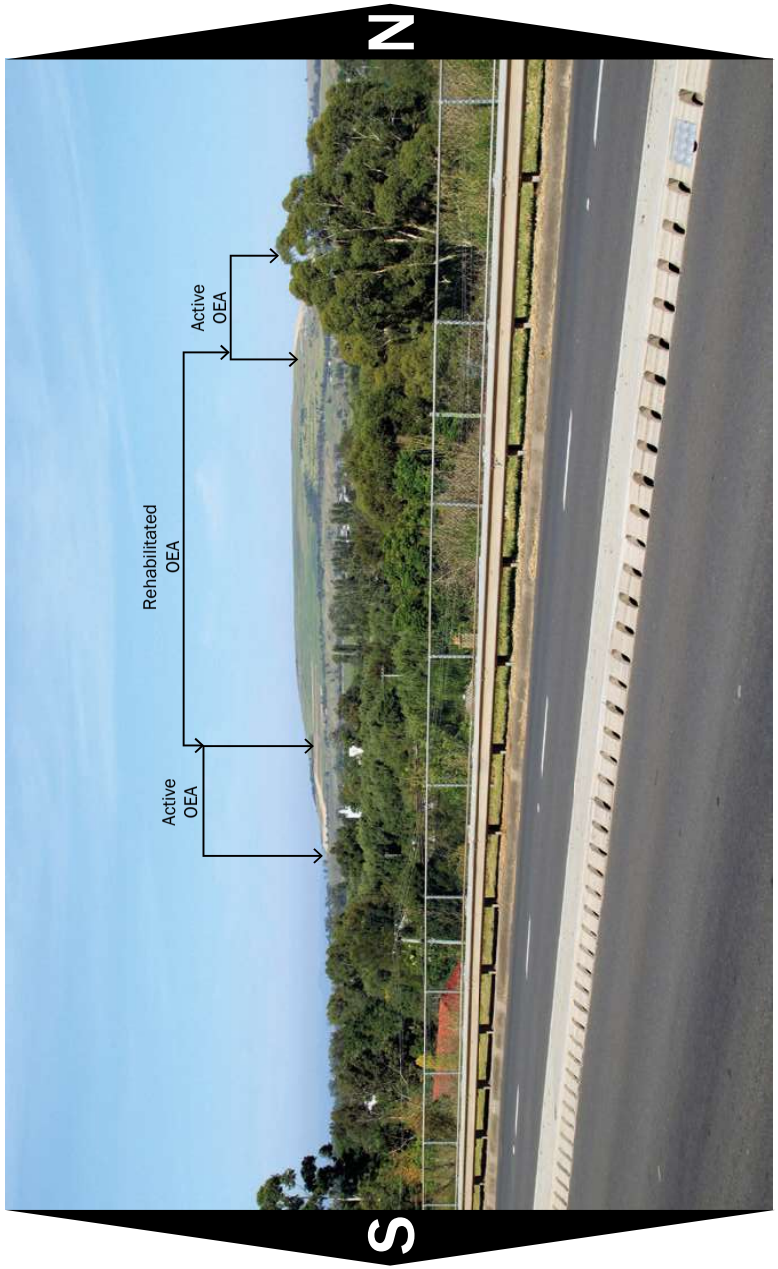


Figure 6.3a | *Location 2 - View Place - EXISTING*

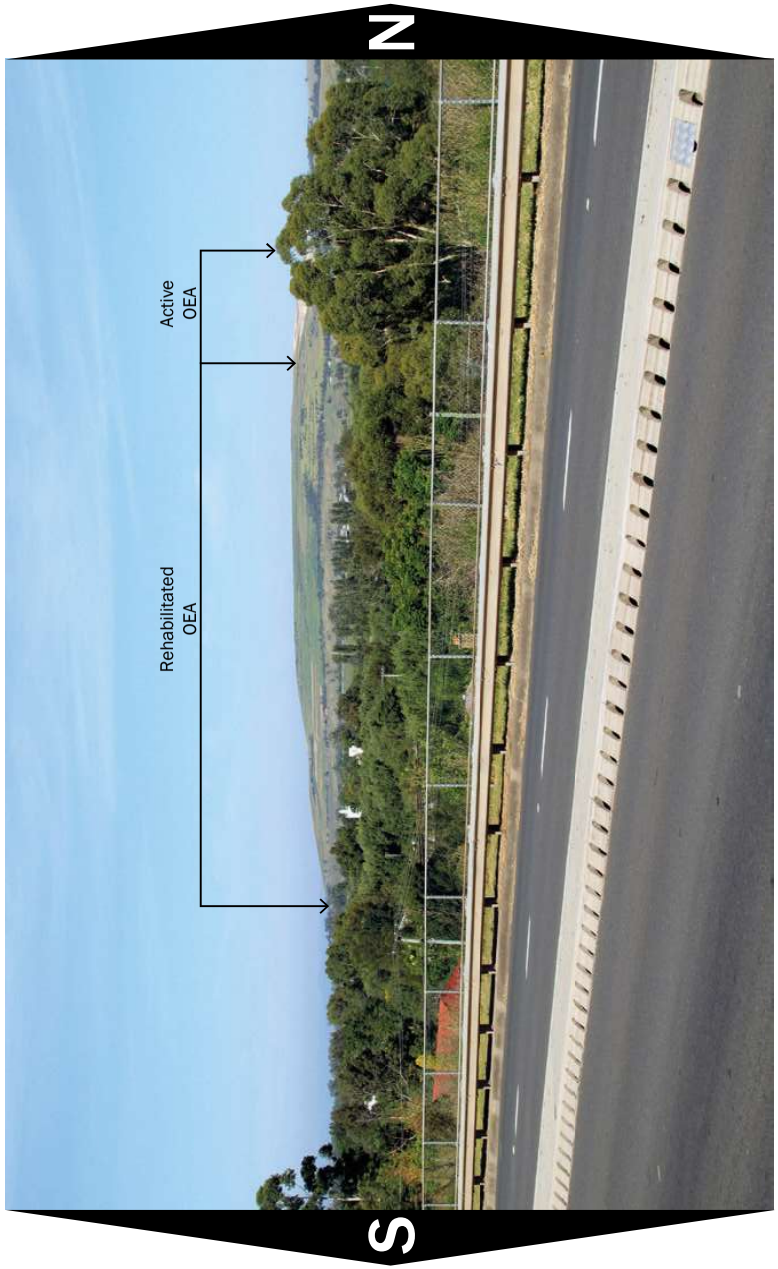


Figure 6.3b | *Location 2 - View Place - PROPOSED YEAR 1*

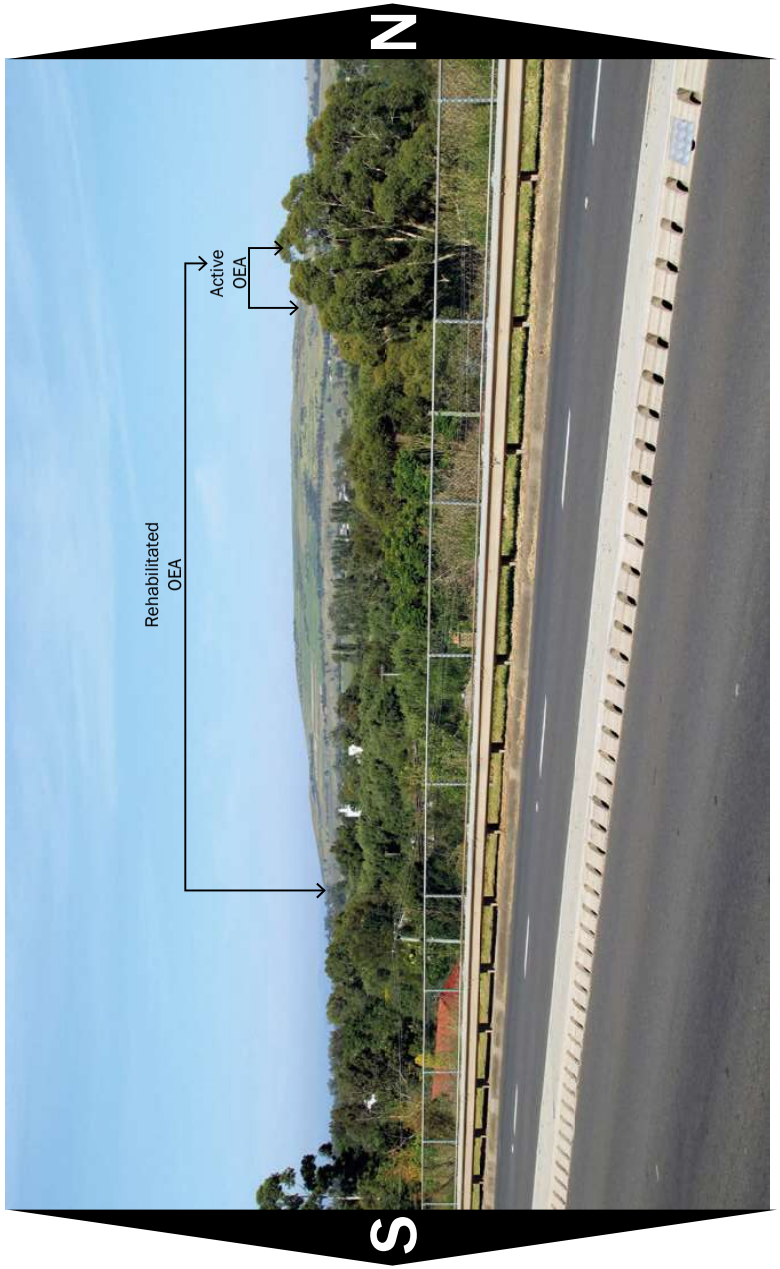


Figure 6.3c | *Location 2 - View Place - PROPOSED YEAR 4*

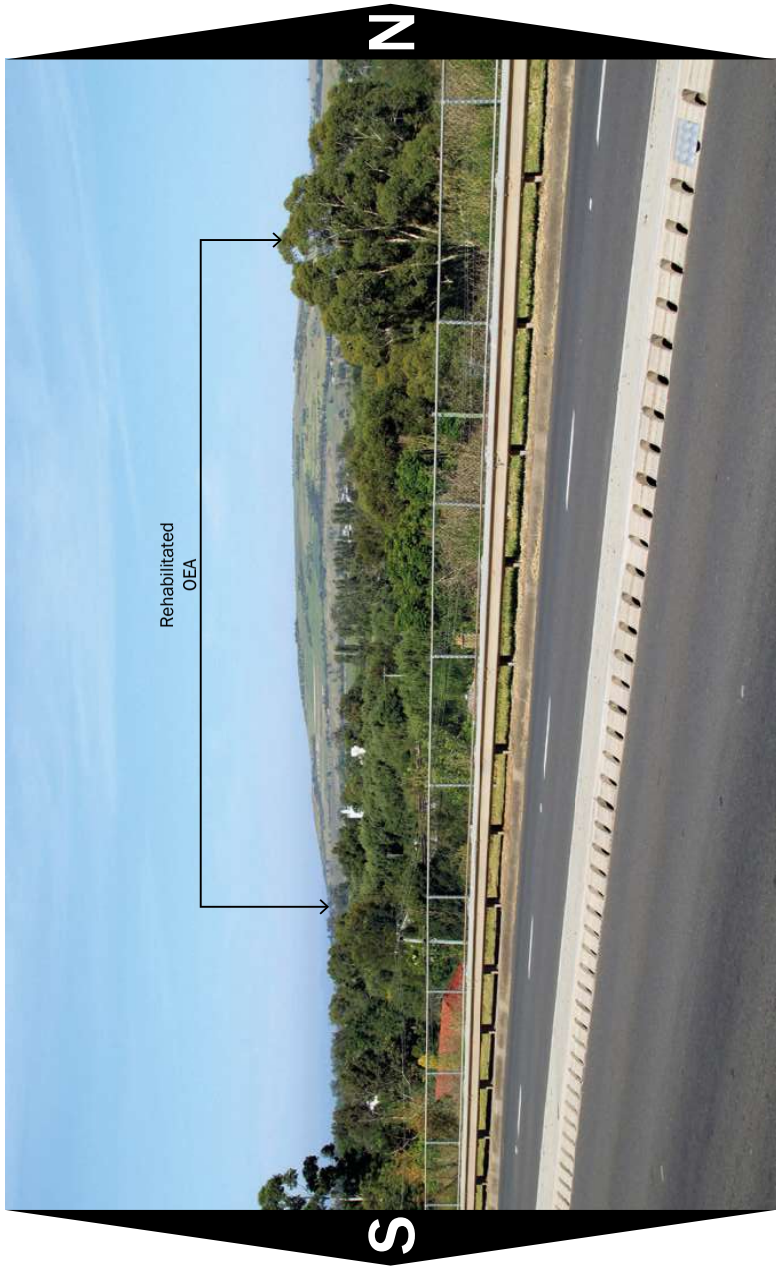


Figure 6.3d | *Location 2 - View Place - PROPOSED YEAR 8*

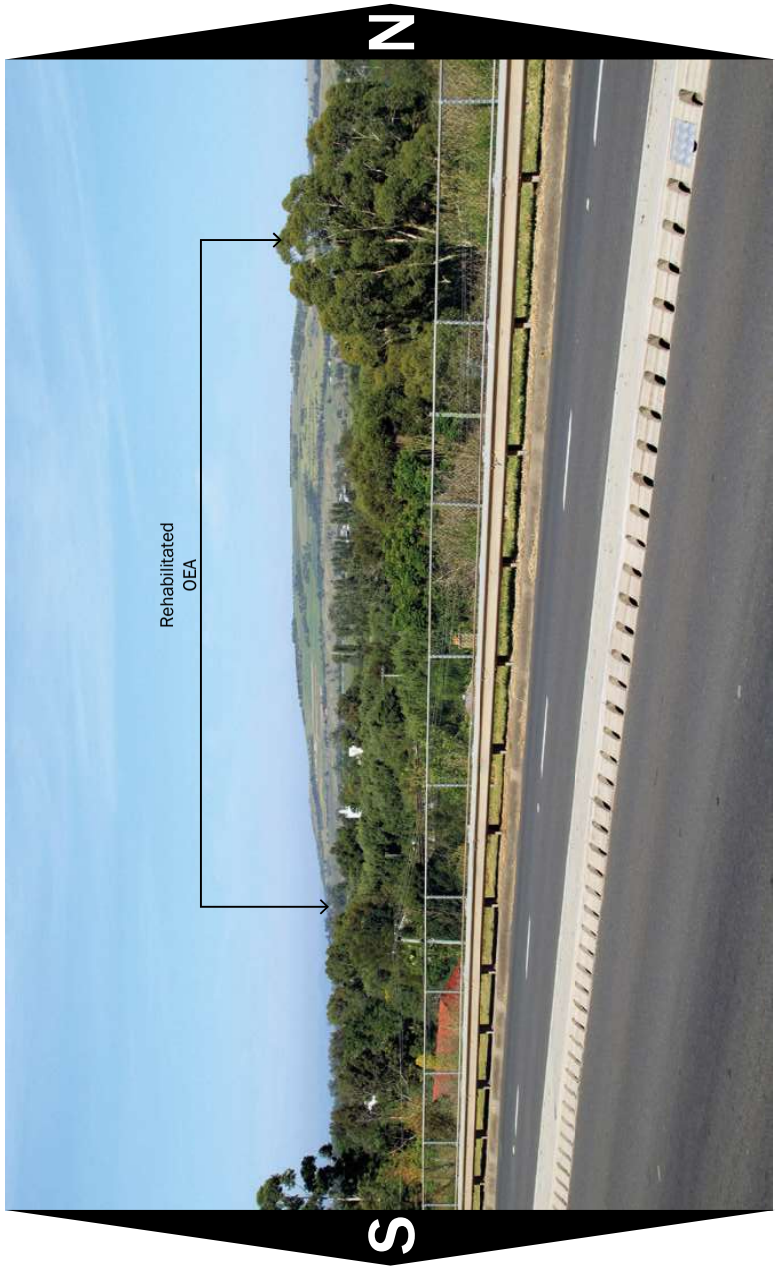


Figure 6.3e | *Location 2 - View Place - PROPOSED YEAR 15*

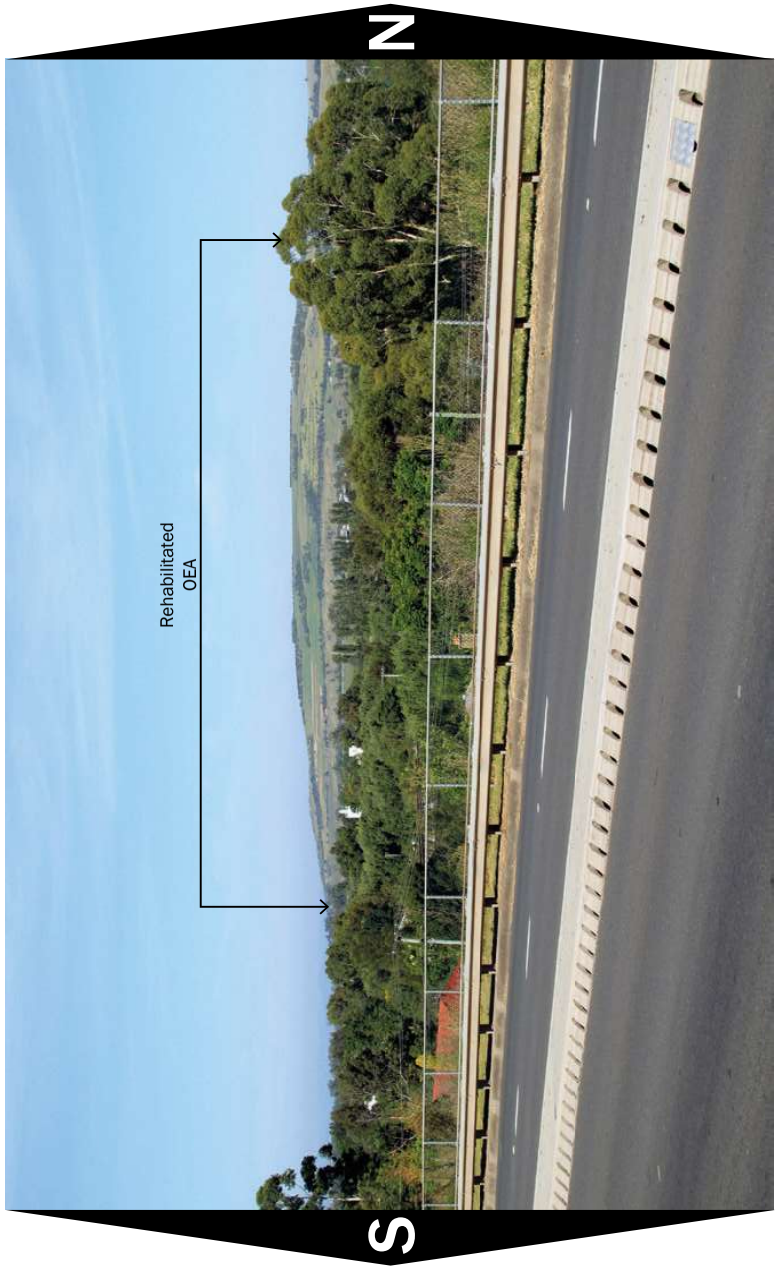


Figure 6.3f | *Location 2 - View Place - PROPOSED YEAR 24*

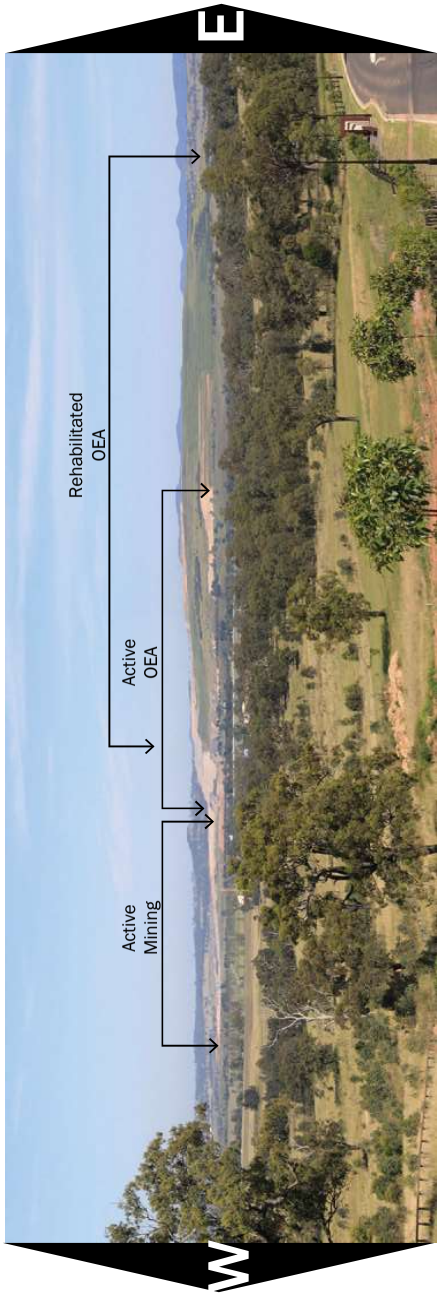


Figure 6.4a | *Location 3 - Ironbark Road - EXISTING*

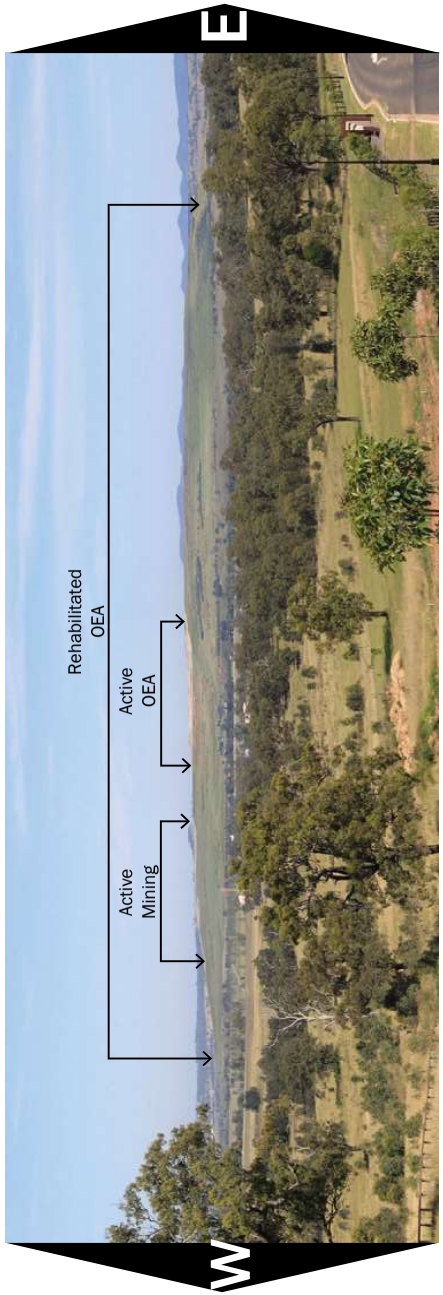


Figure 6.4b | ***Location 3 - Ironbark Road - PROPOSED YEAR 1***

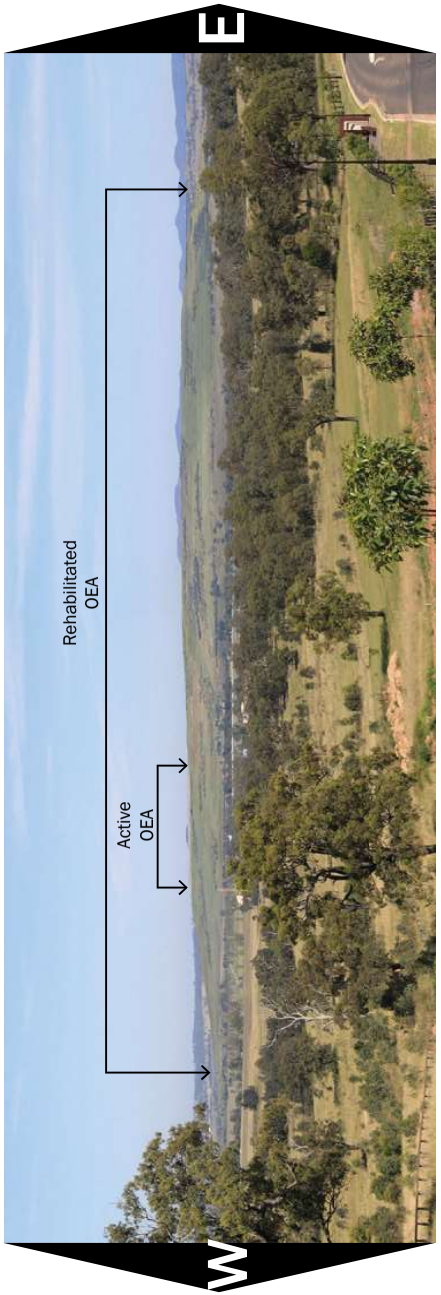


Figure 6.4c | *Location 3 - Ironbark Road - PROPOSED YEAR 4*

Figure 6.4d | *Location 3 - Ironbark Road - PROPOSED YEAR 8*

Figure 6.4e | *Location 3 - Ironbark Road - PROPOSED YEAR 15*

Figure 6.4f | *Location 3 - Ironbark Road - PROPOSED YEAR 24*

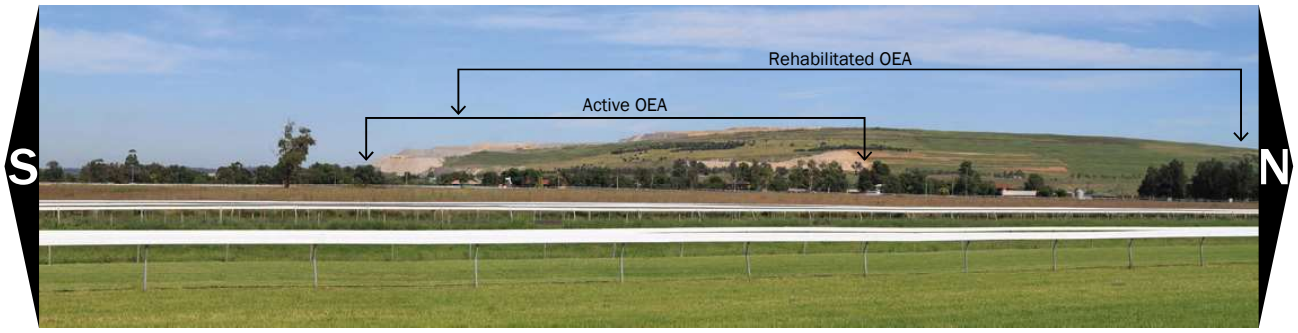


Figure 6.5a | *Location 4 - Racecourse Road - EXISTING*

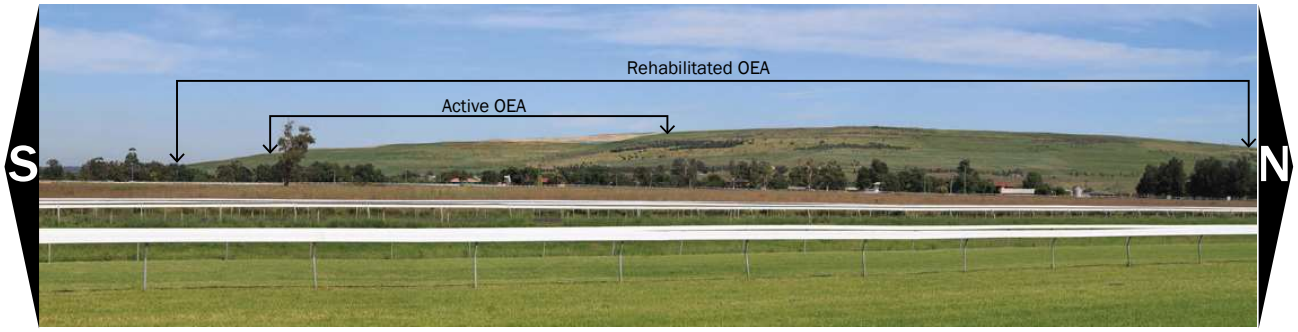


Figure 6.5b | *Location 4 - Racecourse Road - PROPOSED YEAR 1*

Figure 6.5c | *Location 4 - Racecourse Road - PROPOSED YEAR 4*

Figure 6.5d | *Location 4 - Racecourse Road - PROPOSED YEARS 8-24*

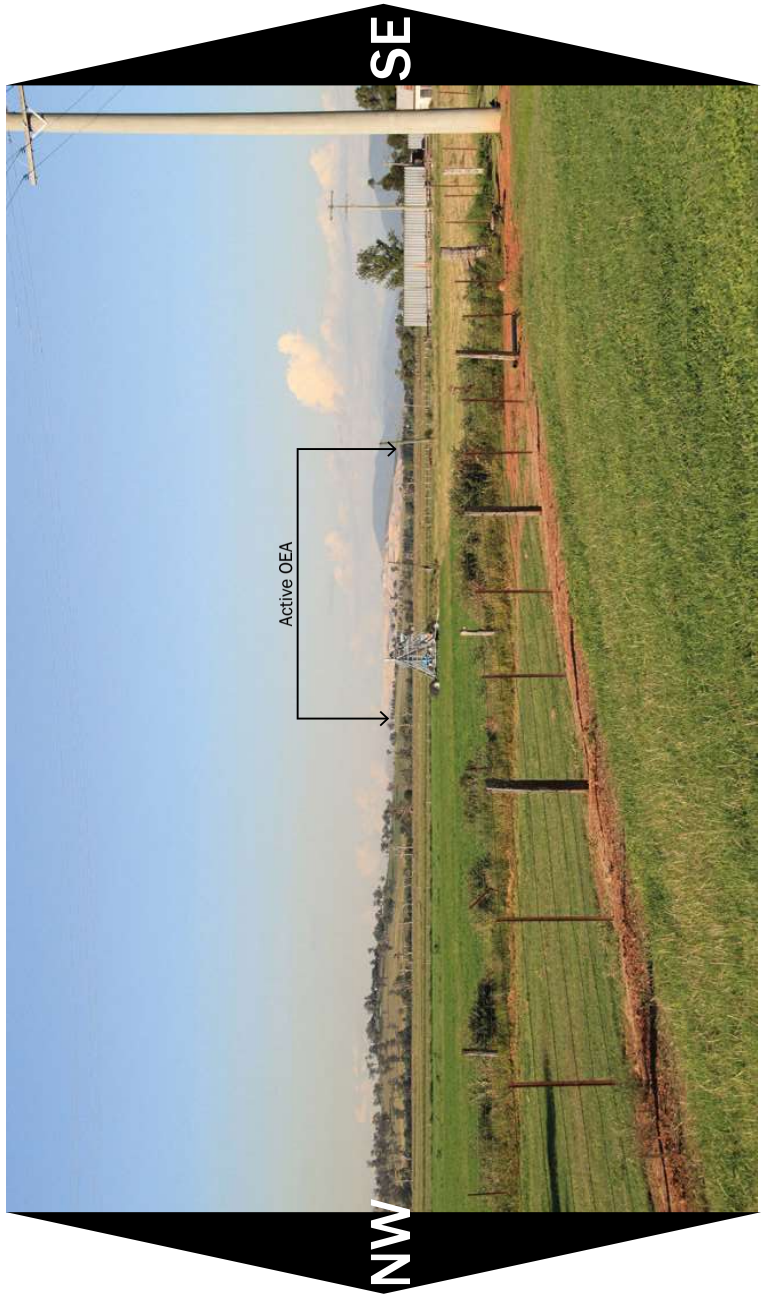


Figure 6.6a | *Location 5 - Denman Road - EXISTING*

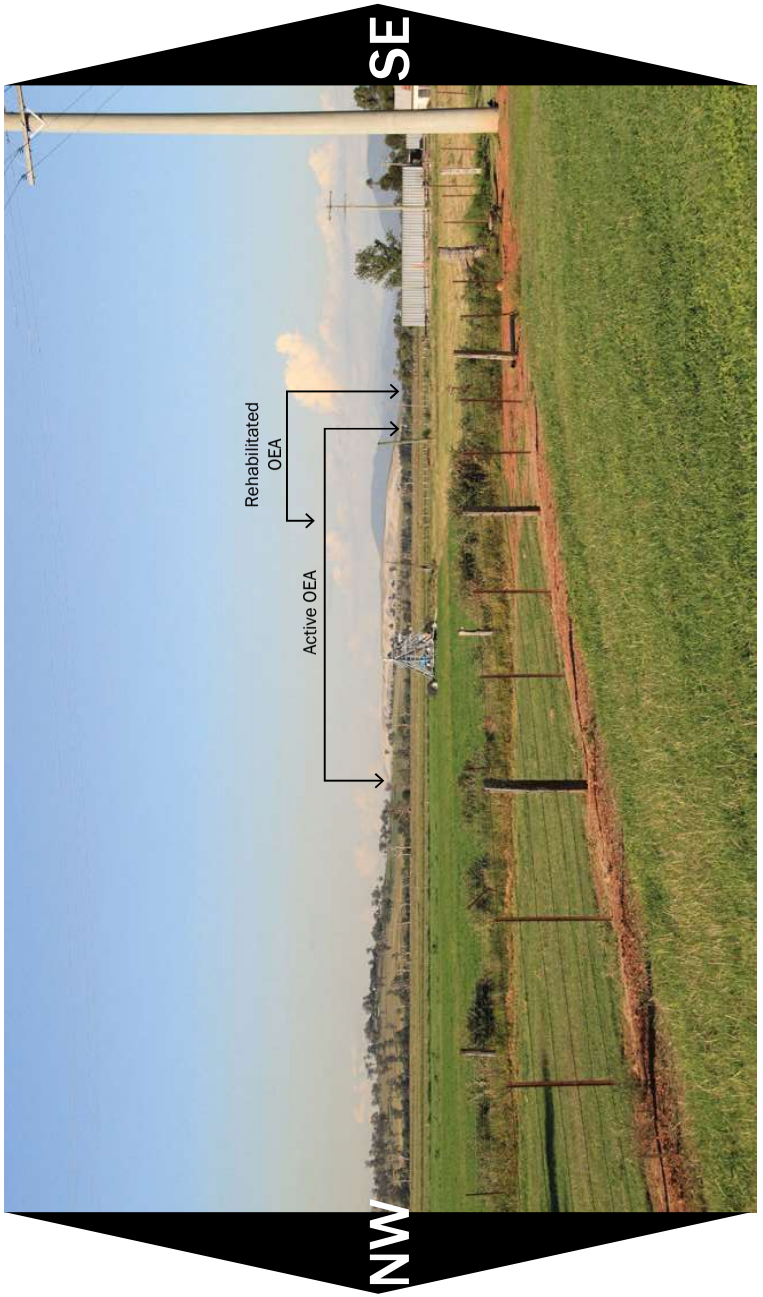


Figure 6.6b | *Location 5 - Denman Road - PROPOSED YEAR 1*

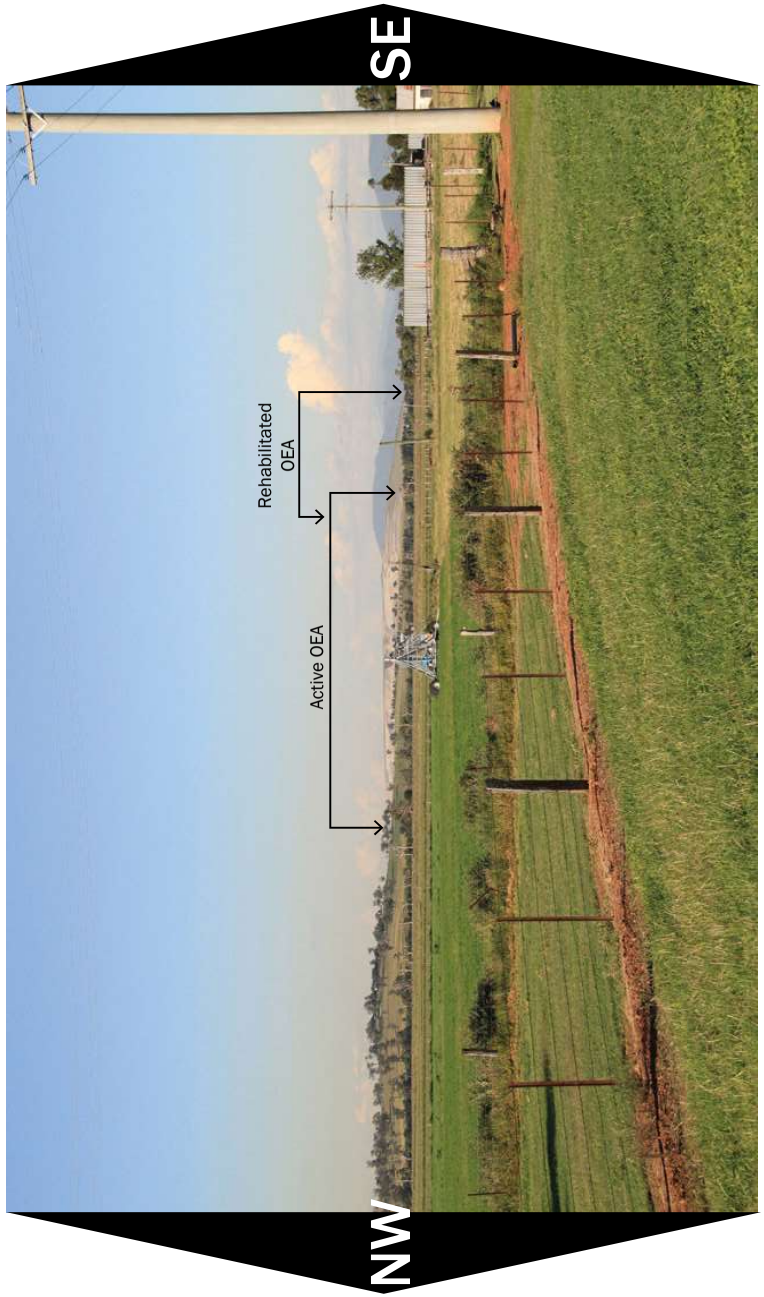


Figure 6.6c | *Location 5 - Denman Road - PROPOSED YEAR 4*

Figure 6.6d | *Location 5 - Denman Road - PROPOSED YEAR 8*

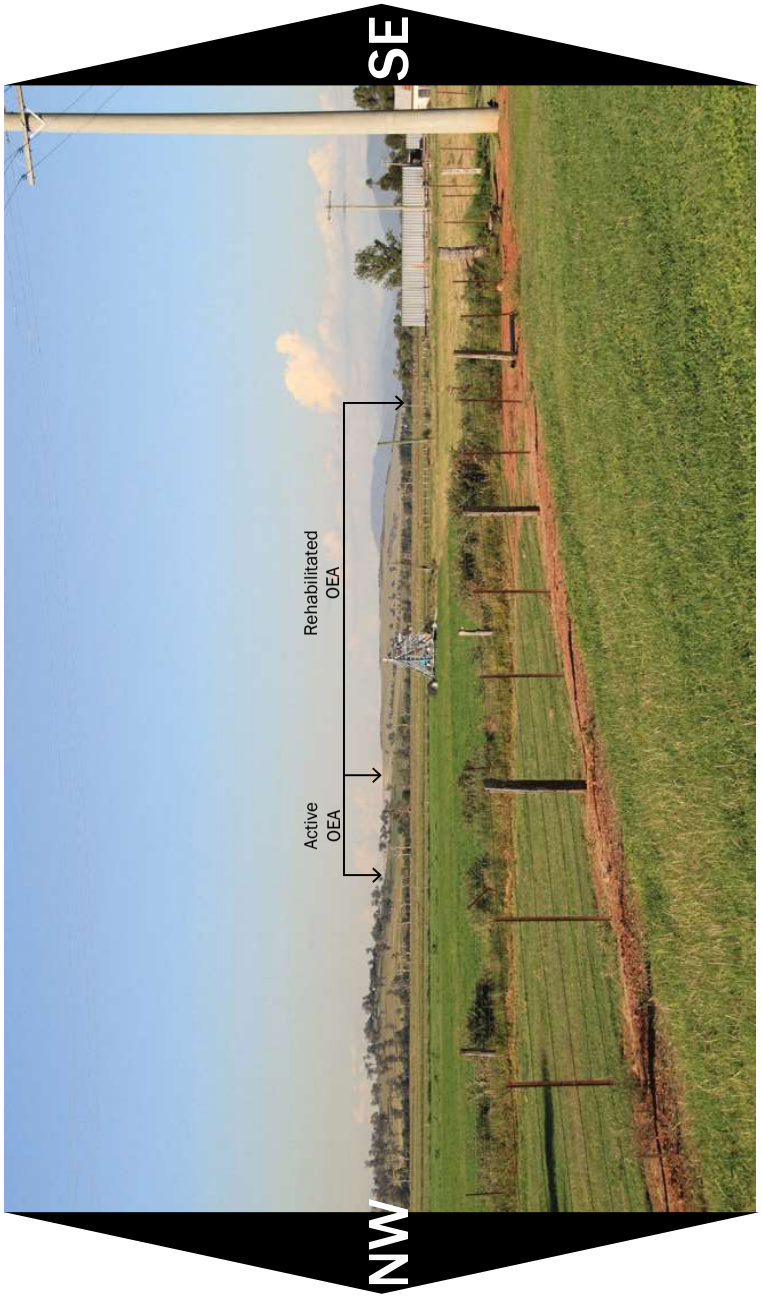


Figure 6.6e | *Location 5 - Denman Road - PROPOSED YEAR 15*

Figure 6.6f | *Location 5 - Denman Road - PROPOSED YEAR 24*

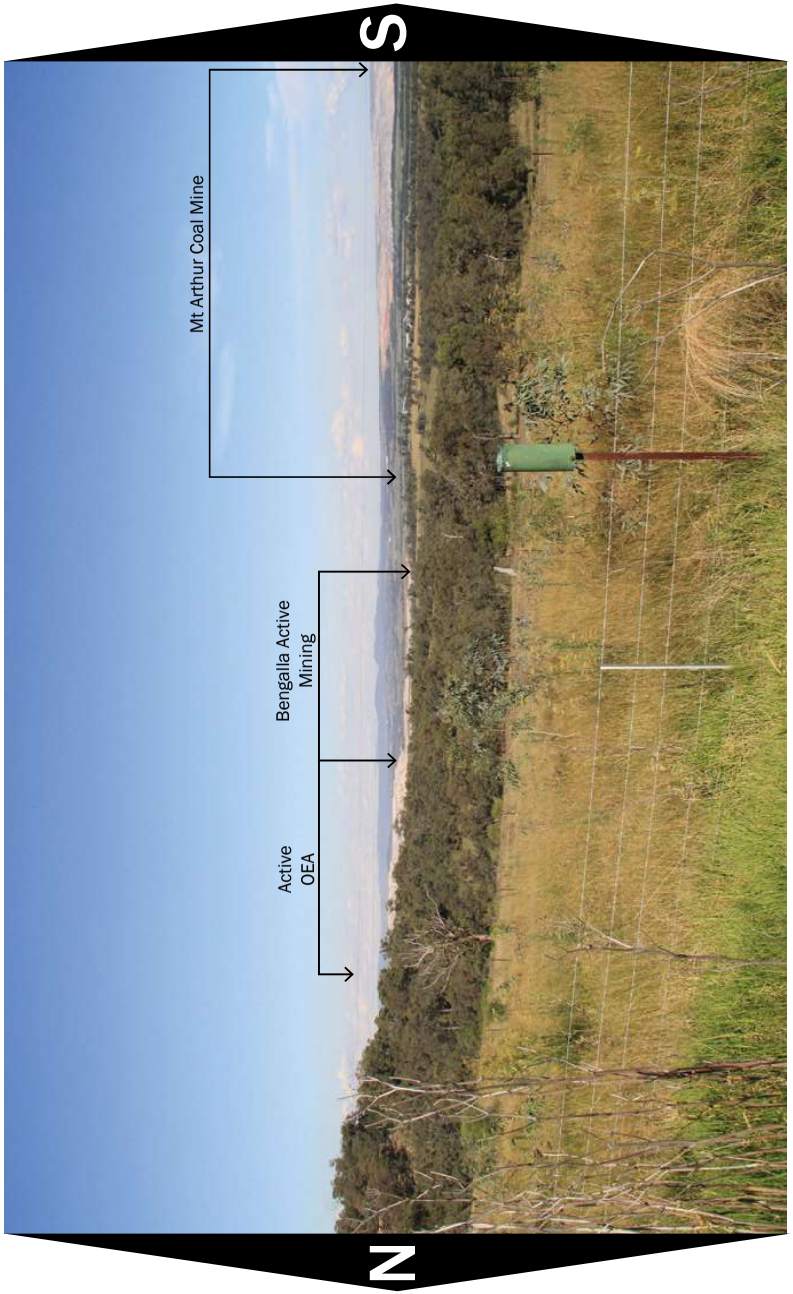


Figure 6.7a | *Location 6 - Roxburgh Road - EXISTING*

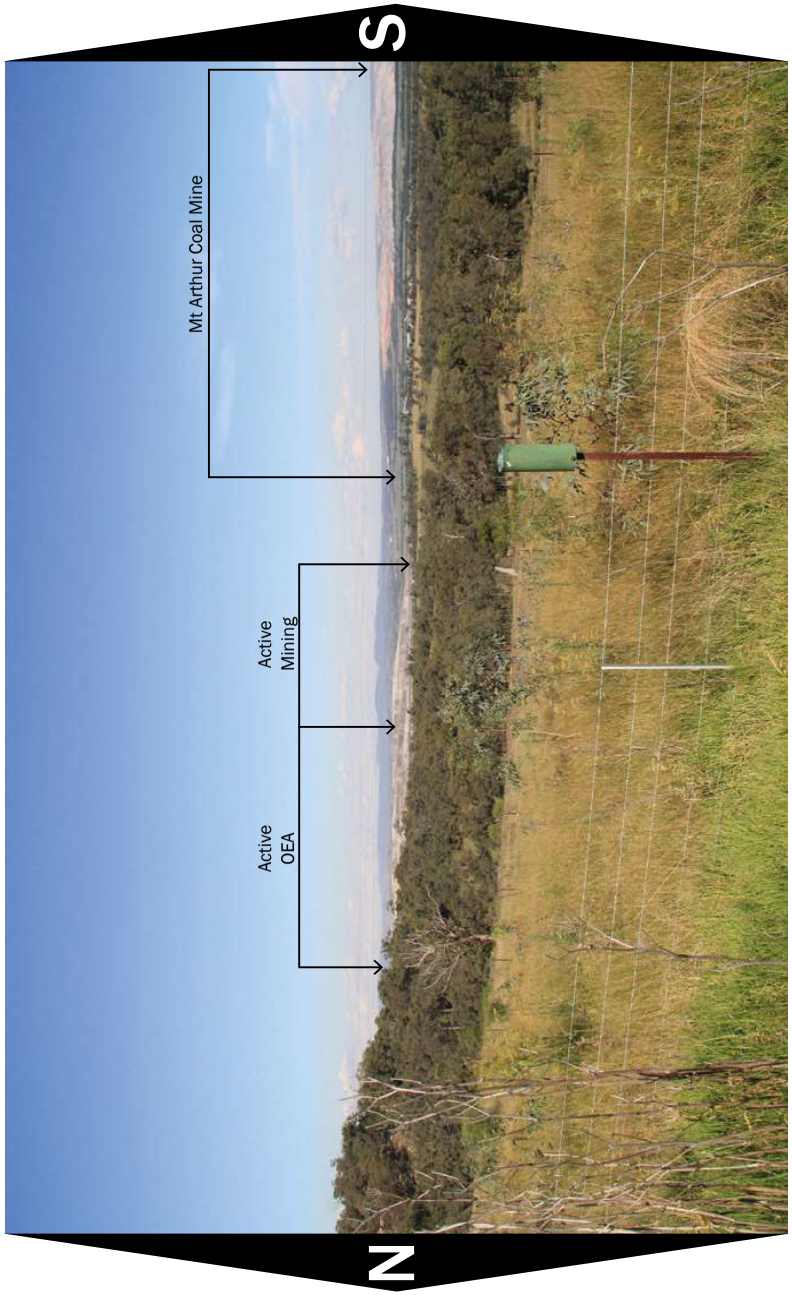


Figure 6.7b | *Location 6 - Roxburgh Road - PROPOSED YEAR 1*

Figure 6.7c | *Location 6 - Roxburgh Road - PROPOSED YEAR 4*

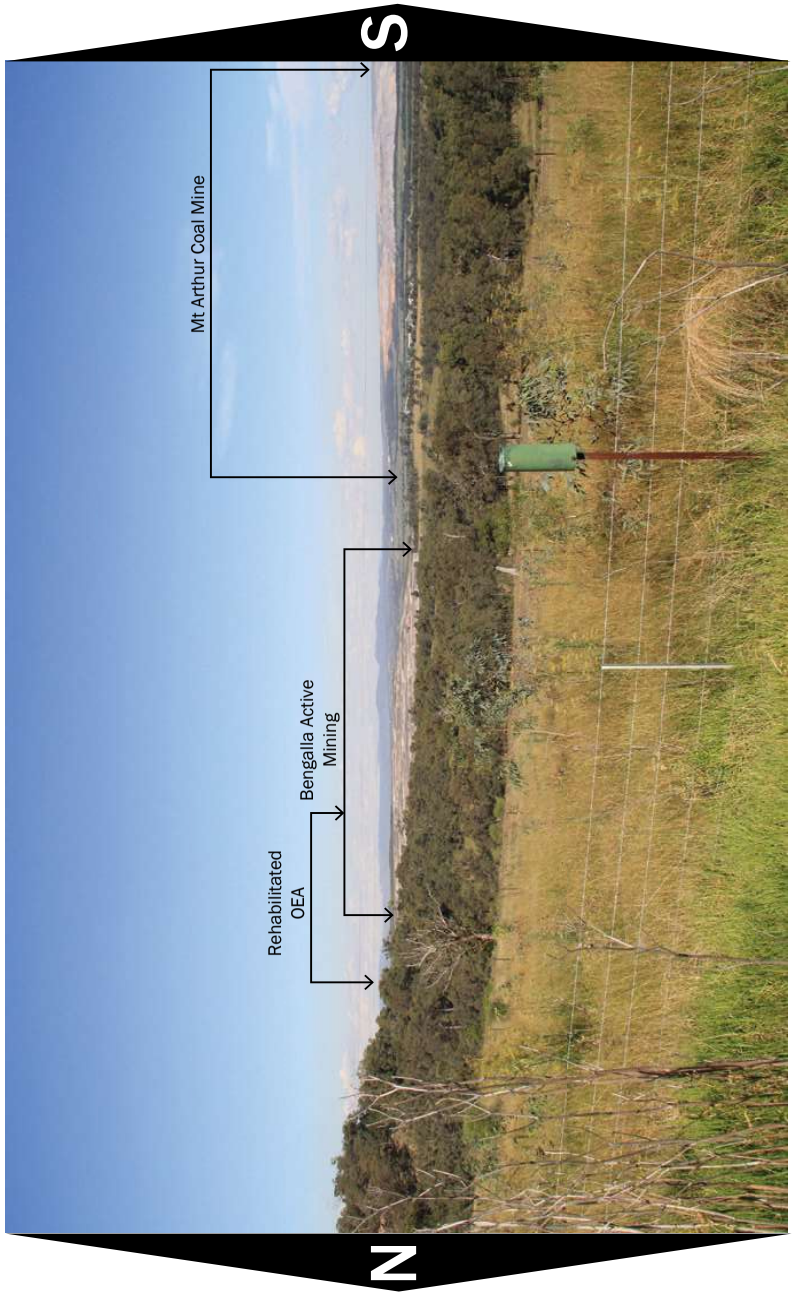


Figure 6.7d | *Location 6 - Roxburgh Road - PROPOSED YEAR 8*

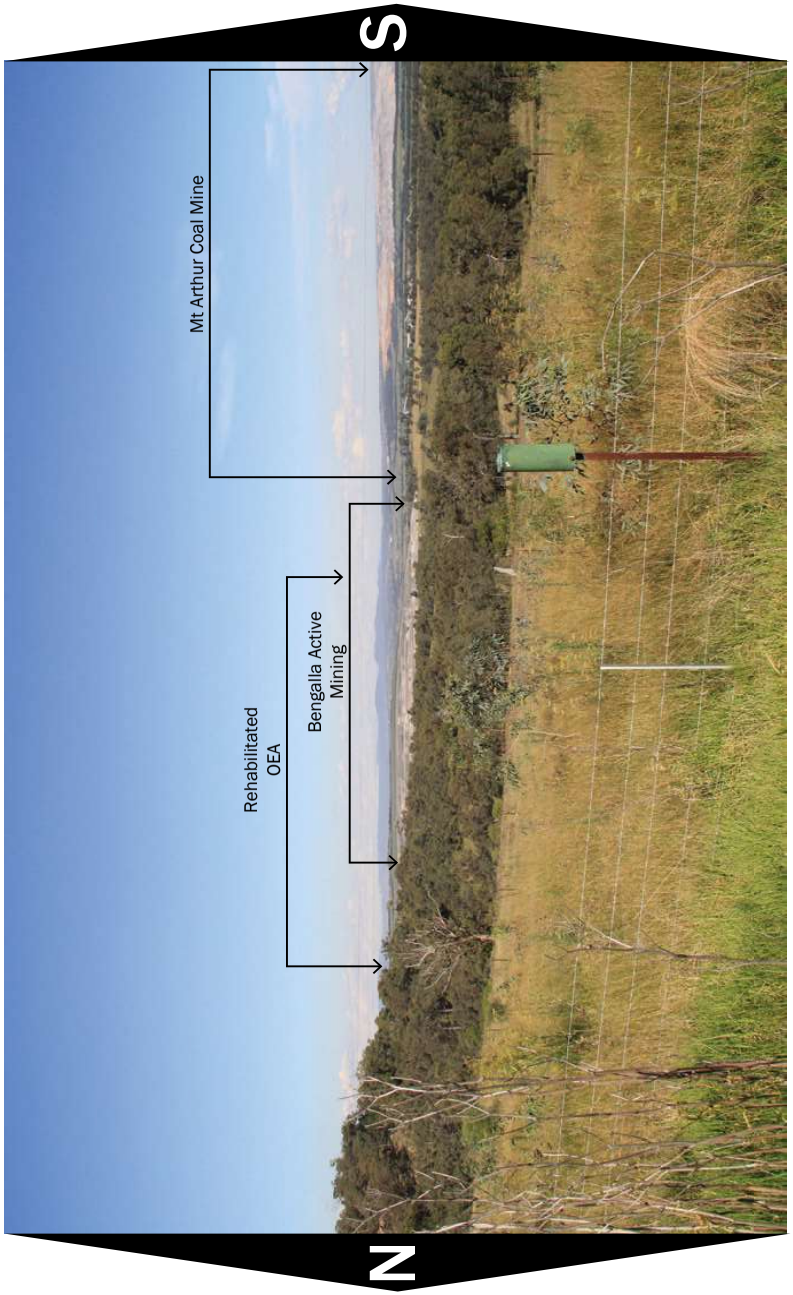


Figure 6.7e | *Location 6 - Roxburgh Road - PROPOSED YEAR 15*

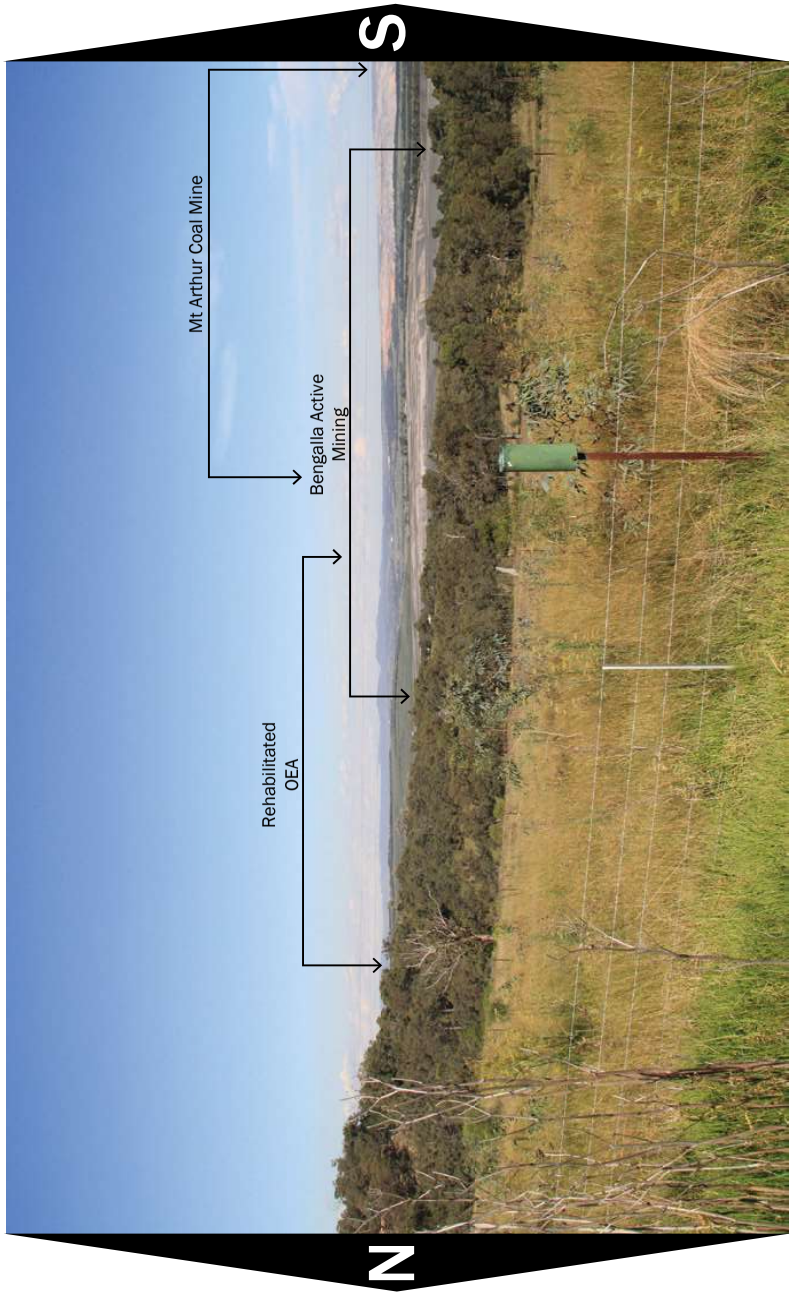


Figure 6.7f | *Location 6 - Roxburgh Road - PROPOSED YEAR 24*

7. VISUAL IMPACTS

This section defines the visual impact and mitigation that is anticipated from various viewing locations around the Project. The visual impact levels are a determinant for mitigation strategies.

The visual impact will vary according to the visual effect of the Project (Section 2.4.1), its visibility and the visual sensitivity of areas from which it is seen (Section 2.4.2).

The potential sensitive viewing locations (receivers) around the Project, including towns, rural residences, roads and tourist locations have been defined above in terms of visibility, with the potential impacts discussed below.

7.1 Towns

There is a range of visual impact on the towns within the PVC of Bengalla. This is based on visibility and distance.

Muswellbrook

Most parts of Muswellbrook are unsighted by the rehabilitated eastern face of the approved OEA and will experience no additional visual impact from the Project.

A small number of areas in South Muswellbrook south of Calgaroo Ave and including parts of Ironbark Estate will have limited views onto the southern edge of the extraction area of the Project. Such areas have a high sensitivity.

However the visual effects for areas with views would be low due to the limitation of exposed areas and the dominance of the rehabilitated Main OEA. The visual impacts therefore would be low and less than are experienced in establishing the existing mine plan.

The visual impact on these small parts of south Muswellbrook, generally occur on the edges of the urban areas and some elevated areas that have current and extensive views over the approved rehabilitated Main OEA. Sensitivity levels remain similar to those experienced for the approved mine plans, except where extent of visibility is altered.

There will not be additional visual impacts on most of Muswellbrook and low impacts on those areas that have limited views to the Project that will for the greater part be screened by the approved, rehabilitated OEA of the existing Bengalla.

Aberdeen

The distance of the town from Bengalla creates low to moderate sensitivity. There is little to no visual effect due to reduced visibility and screening created by the existing OEA. There is no visual impact on Aberdeen.

Denman

Most of the town is unsighted to the Project and is approximately 18 km from the Project. However the eastern edge of the town does have views on to the southern part of the active face of the existing OEA. Views to the south eastern corner of the OEA remain but will be reduced in scale (elevation of OEA 180 m) when compared to that of the approved OEA (270 m elevation).

However at a distance of greater than 12.5 km, the visual sensitivity is low. The visual effect of colour contrast created by the exposed overburden is lessened, and the Project occupies an even smaller part of the total view than that created by the existing Bengalla. Visual effect levels of the Project are low at this distance; visual sensitivity is low.

This creates a low and imperceptible visual impact at Denman.

7.2 Rural Residences

Rural residences are located throughout the local setting within the area of PVZ. The residences are located within the Foothills VCU and the Hunter River Floodplain VCU and take advantage of views in various directions.

Northern Sector

There is generally no impact of the Project on rural residences in this sector as the Project areas are screened from view. Residences in this sector are screened by the approved Main OEA and existing topography and many are mine owned.

There is generally no visual impact on residences in this sector. Any visual impacts on rural residences in the Northern Sector that have any views would be low.

Eastern Sector

In the Eastern Sector, rural residences along Wybong and Kayuga Roads are for the greater part screened from the Project by the approved rehabilitated Main OEA.

Although sensitivity is potentially high the visual effects are screened and therefore there is no impact. Any residence that did have some views to the north-west or south-west edges of the mine extraction area would experience low visual effects and impacts.

This sector contains the historic Bengalla Homestead. Although this homestead has a potentially high visual sensitivity, it will be screened from the Project by rehabilitated OEA and will therefore experience a low impact.

Southern Sector

The significant rural residences in this sector are south of the Project and generally along Denman Road with adjoining lots largely owned by Mt Arthur Coal. These residences would continue to have a high sensitivity if they have views to the Project. Residences in the south east of the sector will have limited views onto the southern edge of the mine extraction area, but views would be dominated by the rehabilitated OEA areas and visual effects would be low.

Residences in the south west in the vicinity of Pukara would have more open views onto the active face of the Main OEA. However this view is similar to that of the existing approved OEA but smaller in scale and with the dominant areas rehabilitated, lessening the visual effects progressively as the dominant elevation of the OEA decreases in RL.

A combination of restricted views and low visual effects would create low visual impacts to residences in the south west of the sector and moderate in the south western part of the sector.

This sector contains the historic homesteads of Edinglassie Homestead and Rous Lench Homestead. Both of these homesteads are owned by Mount Arthur North. These residences would have potential views to the Project and have high sensivity, but landscape treatments recommended in the 2007 European Heritage Management Plan would screen the houses and their curtilage from views to the Project, removing potential visual impacts.

Western Sector

The residences in this sector that are impacted may continue to be impacted. The pre-rehabilitated face will be closer but will decrease in elevation from 270 m to 180 m. The view will continue to be onto the active face of the OEA. However as discussed previously it will decrease in scale and upper slopes as seen from the west will increasingly be rehabilitated through time, decreasing visual effects over that experienced currently. Visual Sensitivity will remain high so that impacts will be moderate to high for residences with open views onto the Project.

The visual impact on residences with views to the Project in this sector will continue to be moderate to high.

7.3 Roads & Rail

The roads and rail in the locality are:

- Minor Roads;
- The New England Highway;
- Denman Road; and
- Main Northern Railway.

Minor Roads

Bengalla is visible from a number of minor roads in the locality. These include Roxburgh Road, Wybong Road, Bengalla Link Road (including Relocation around Year 20), Kayuga Road, Thomas Mitchell Drive and Edderton Road. Generally, visual impacts on these roads will be screened or low. However some views from Roxburgh Road and other local roads will continue to experience high visual effects in close proximity to the Project creating moderate to high impacts. More distant views will create moderate to low visual impact.

New England Highway

The Project will continue to be visible from two locations on the New England Highway: from just north of Muswellbrook travelling south, illustrated in part by Figure 6.3, and for a short period travelling north into Muswellbrook from the south, as illustrated in part by a view from Ironbark Road Figure 6.4.

From north of Muswellbrook, the views are for the greater part on to the approved rehabilitated OEA with areas further west screened by topography north of Wybong Road. The sensitivity at these distances is generally moderate creating a low visual impact.

From south of Muswellbrook, the New England Highway would have moderate sensitivity, however again Project areas are screened and views are onto the existing rehabilitated OEA, avoiding visual impact.

Denman Road

This road experiences potential visual impact to the east, south and west of Bengalla.

From the east, impact is potentially experienced from the Denman Road in South Muswellbrook with the views onto the existing Main OEA. From the south, impact is experienced generally between Thomas Mitchell Drive and Edderton Road, and to the west from Edderton Road.

From all these locations, the visual effect of the Project will be low from the east, low to moderate to the south and moderate to high from the west.

The visual sensitivity of Denman Road given its tourist use would be moderate at distances greater than 2.5 km.

The visual impact on this road will be low to the east and moderate to low on the southern and Western Sectors.

Main Northern Railway

The greatest visibility of the Project from the railway is north of Muswellbrook for trains moving south. Visibility characteristics are similar to those of the adjacent New England Highway and will be generally screened. Any views will have a moderate sensitivity at this distance and visual effects will low creating low impact levels.

7.4 Tourist Localities

The Hunter Valley generally has a high tourist usage level. In this locality, the town of Denman and Denman Road in addition to the New England Highway are significant tourist locations. Within this broader fabric, special locations such as Pukara attract tourists to the area.

There are potential views from Pukara however such views are screened by olive trees from the sensitive tourist centre/coffee shop. The visual sensitivity at this location would be high, but views to the active face are screened except from the working northern and eastern edges of the orchard that would have a low sensitivity and high visual effect.

In terms of impact on tourism venues, the visual effects impacts will decrease for areas such as the Muswellbrook Racecourse and surrounding training facilities, which will continue to view the rehabilitated OEA. The Project is generally not visible from the sensitive thoroughbred horse studs south of the Golden Highway.

The visual impact from tourist areas within Pukara would be low while from outer edges this could be high, however it is assumed that tourists are not taken to these vulnerable view locations.

7.5 Cumulative Visual Impact

The Project will not add significantly to the cumulative visual impact created by open cut mining in the locality. The high visual effect mine face and active face of the OEA will be similar in extent to the approved Project. Rather, the high visual effect will move west while the visual effects and impacts on eastern areas will decrease.

To consider the cumulative impact of the Project, it is necessary to consider its visual effect in the context of other mines that are seen within the one view from sensitive receptors, and also as part of a progression of different views as one moves through the landscape from one visual catchment to another.

In the context of the Project's visual catchment, Mangoola Coal is not considered, as it is to the west of the Project, and would not fall into any views containing the Project. In terms of this catchment the visual impact is decreased for sensitive receptors in north eastern areas, e.g. Aberdeen, south eastern areas, e.g. Racecourse Road and eastern areas e.g. Muswellbrook, as rehabilitation of OEA areas in the east takes place as mining moves west. Visual effect is increased to the west, but is of a similar character to that currently experienced. However, there are a limited number of sensitive receptors in this location on Roxburgh Road who have views to Mt Arthur Coal and parts of the existing Project. To other areas the visual effect will decrease as the overall elevation of the active face of the OEA decreases in elevation from 270 m to 180 m. The rehabilitated OEA will dominate the active face creating a better visual integration of this element into the landscape.

In terms of sequential visual experiences, the Project as well as all mines in the locality would be seen when travelling along Wybong Road and Denman Road and to varying degrees lesser roads. In this context the overall effect of the Project would be similar to or less than is currently experienced by the existing mining at Bengalla. The reasons for this are a general lowering of visual effect compared to the existing mining operations and secondly, the significant decrease in visual exposure to sensitive receptors of active mining areas at Bengalla.

7.6 Visual Impact in context of Regional Plans

In the context of the NSW Strategic Regional Land Use Plan – Upper Hunter and the local Land Use Development Strategy (Coal Mine Land Use Component) September 2012, the Project does not impact significantly on strategic tourist locations over and above that of the existing approved mine. Rather in general, the Project improves the outcomes of mining on sensitive eastern areas including Muswellbrook and Aberdeen as well as the New England Highway. The visual effect and impact on Denman Road and western view areas will remain similar to existing impacts. Although the Project will move mining closer to Pukara, the visual impact on this facility is low due to screening of the mine from most areas within the grove, including the cafe/shop and driveway by the grove of trees itself and intervening topography. The exception to this is the outer edge of the grove that is not screened by adjacent olive trees.

The Project is a continuation of an existing mine and is contained in a small visual catchment with limited extent from sensitive preceptors in the critical western areas. It is also a visual catchment that currently supports mines at Bengalla and Mt Arthur Coal.

7.7 Lighting Impacts

7.7.1 Introduction

The visual effect of lighting surrounding the Project will remain similar to that experienced as part of the current operation, except that operational lighting in pit areas will move further west. This could marginally increase lighting effects to the west while decreasing them in the east.

Light effects will be influenced by the locality of operations on-site at any one time, the relative level at which the viewing location is situated and the presence of any off-site barriers such as topographic features and / or vegetation.

There are two types of lighting effects that could be experienced from the Project. The first effect is where the light source is directly visible, and will be experienced if there is a direct line of sight between a viewing location and the light source. The second effect relates to the general night-glow (diffuse light) that results from light of sufficient strength being reflected into the atmosphere. This type of effect will create a strong local focal point and the effect will vary with distance and atmospheric conditions such as fog, low cloud and / or dust particles which all reflect light.

7.7.2 Direct Light Effects

The only locations that will have direct line of sight to night lighting are elevated locations such as Roxburgh Road that overviews any screening topography and vegetation. Such lighting from Bengalla is currently experienced at these locations.

As is currently experienced, any direct night lights in this viewing zone may also include Drayton Mine and Mt Arthur Coal lighting.

7.7.3 Diffuse Light Effects

At the Project, operational areas and machinery night lighting will not be directly visible to most locations due to the screening effect of OEAs and adjoining topography and vegetation.

Rather, a diffuse effect of light and its interaction with atmospheric conditions may from time to time create a glow around the Project. Again, the other mines including Mt Arthur and Drayton contribute to this diffuse lighting effect.

7.8 Visual Impact Summary

The visual impacts associated with the Project are generally low on the Northern, Eastern and Southern Sectors. This is mainly as a result of the visual effects being low due to the western extension of the OEA being screened by the approved and rehabilitated eastern and southern OEA areas.

Views from the west are onto the active face of the OEA. However, the OEA is decreasing in scale (180 m) and becomes backgrounded by the larger, more dominant Main OEA (270 m) that will be rehabilitated. This will progressively lessen the visual effect and impacts as experienced from the west with the exception of Roxburgh Road.

7.8.1 Lighting Impacts

The visual effect of lighting associated with the Project would be at a similar level to that currently approved and experienced at Bengalla.

Some direct lighting impacts will occur when operational areas located on the southern parts of the OEA are not screened by overburden or topography. Existing night time operations have direct views to lighting from various locations around Bengalla and as such the proposed operations will be similar to the existing environment.

8. MITIGATION

Mitigation measures in relation to reducing visual impact relevant to the Project include:

- On-site treatments to reduce visual effects; and
- Treatments at viewer location to reduce visual sensitivity (off-site treatments).

On-site treatments involve rehabilitation of landforms and land cover, while viewer location treatments could involve a range of treatments to screen views, filter views and or re-orientate primary views should this be needed. It should be noted that on-site treatments have already been carried out as they relate to Main OEA establishment and rehabilitation.

The existing Landscape Management Plan will be updated to include commitments in this Visual Impact Assessment and include detailed landscape plans for on-site and off-site treatments in consultation with a landscape architect.

8.1.1 On-Site Treatments

The following on-site treatments will be implemented for the Project. They are in keeping with ecological mitigation recommendations which in part state:

"Ongoing progressive rehabilitation of mining areas will take place across the Disturbance Boundary and will reinstate agricultural land with open woodland corridors following mining. Although the Disturbance Boundary will be returned to agricultural land, there is still opportunity to achieve some biodiversity outcomes. This is because the agricultural matrix will include treed areas that can provide some fauna habitat and movement corridor values for a number of locally occurring fauna species. These treed areas will comprise at least 10% of the post-mining landscape and will be located principally on either side of the retained part of Dry Creek frontage, along paddock fencelines and as copses in paddocks. In addition, the eastern face of the OEA will be revegetated with high density tree plantings.

Rehabilitation and revegetation work will aim to restore grassland and tree cover on mined land throughout the course of the Project and will be conducted in accordance with the Biodiversity Management Plan for the Project. The Project will be staged such that vegetation clearing will be conducted progressively over the life of the Project in concurrence with rehabilitation and revegetation works, so that the impacts can be minimised as far as practicable at all stages of the Project."

- Prepare detail landscape plans to achieve outcomes that emulate the grassland open woodland/ scattered tree landscapes of surrounding hills, as generally illustrated in Figure 8.1 and the photomontage at Figures 6.3a-f, to achieve a minimum of 10% tree cover as recommended in the ecological impact assessment;
- As part of above, complete landscape design for Dry Creek along with the OEAs, incorporating the ecological mitigation strategies for the Project to achieve a more natural riparian setting;
- Early, progressive establishment and rehabilitation of the outer faces of the OEA, especially in relation to the southern slopes adjacent to the Main Northern Rail Line and CHPP to minimise pre-rehabilitation areas to external sensitive view locations;
- Continuation of the rehabilitation of the outer faces of the Main OEA with planting patterns to emulate agricultural landscapes as defined above;
- Consistent with maintaining tree planting areas, prepare landscape design for planting areas to achieve the best visual outcome to critical eastern and southern views. This means planting patterns consistent with the existing adjacent woodland and grassland of the existing landscape;
- Ensure the Western OEA is seeded with grass cover as soon as practical, commencing from the western and northern sides to reduce visibility;

- Re-establish agricultural use of rehabilitated areas consistent with successful tree establishment upon completion of mining;
- Design drop down drainage structure alignments to vary with the topographic form of the OEAs and avoid extensive straight line drop downs;
- Utilise tree areas to assist in breaking up views to drainage structures;
- Utilise dark rock where possible in such structures to minimise colour contrast with surrounding landscape;
- New infrastructure developments, including explosive storage and recharge facilities to be finished in forest tones such as olive green or grey as far as practical to reduce visual contrast with the surrounding landscape, consistent with regulatory and safety requirements;
- Complete topographic and tree planting design around explosive magazines and reload facilities to ensure that it is not the dominant elevated element in the landscape; and
- Where consistent with health and safety requirements, ensure lights are hooded or directed away from sensitive receivers to avoid direct light spillage from the site.

8.1.2 Off-site Treatments

The following off-site treatments will be implemented for the Project:

- Prepare and implement a consolidated Rehabilitation and Landscape Management Plan for the Project. This plan should be prepared to consider specific impact mitigation strategies for sensitive viewing locations;
- Extend tree screen planting along Wybong Road to the western extent of the Project Boundary;
- Prepare and implement landscape plans for screening the eastern side of Bengalla Link Road. Extend clump planting already established on Bengalla Link Road along the deviation and Roxburgh Road (where private residences exist);
- Where appropriate, carry out tree screen planting along Denman Road in the vicinity of privately owned receivers including Receiver 93 and Pukara, Receivers 102, 103 & 107 (in consultation with landowners and the RTA) as shown on Figure 3.2;
- Complete a site inspection and where required, prepare landscape strategies for receivers that will experience prolonged high levels of visual impact, where requested;
- Implement landscape strategies according to plans as agreed with the landholder and land management agencies to achieve visual screening at sensitive viewing locations along Roxburgh Road, Wybong Road and Denman Road; and
- Ensure off site landscape treatments at Edinglassie and Rous Lench create visual separation between these elements and active faces of the OEA.

8.1.3 Lighting

- Design of fixed night lighting to the minimum level necessary for operations and safety;
- Use of low flux lamps and direction of fixed lights toward the ground, where practical;
- Implementation of work procedures related to the use of mobile lighting plants to avoid adverse off-site lighting impacts;
- Where possible, conduct operations behind noise/light barriers, especially at night, particularly on the OEA, to avoid adverse off-site lighting impacts; and
- Off-site treatments may include the reinforcement of plantings close to viewing locations.

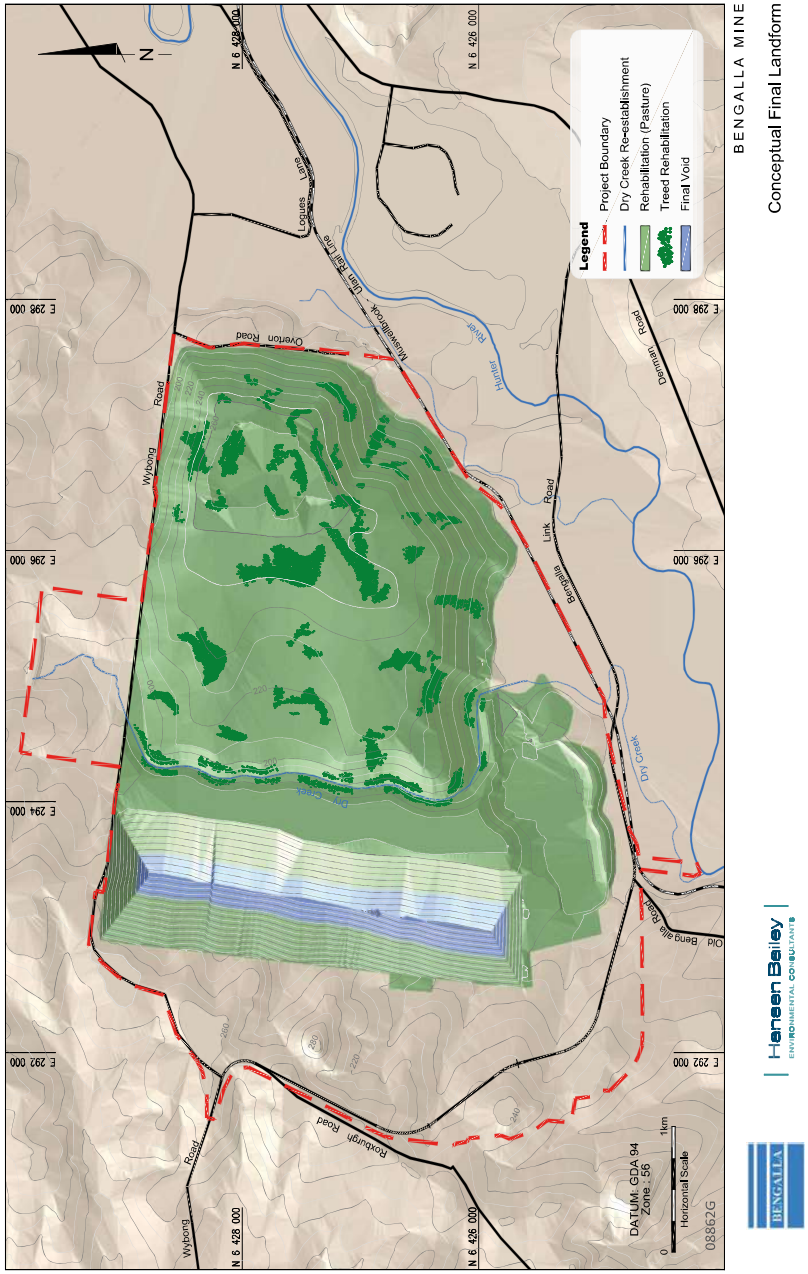


Figure 8.1 | *Rehabilitation Plan*

9. CONCLUSION

The continuation of mining at Bengalla by extending mining to the west will increase screening from sensitive locations to the north, east (particularly Muswellbrook township and Racecourse Road) and to the south. The Main OEA will continue to be rehabilitated. This element is of a much larger scale with elevations up to 270 m than the Project with an OEA elevation of 180 m. The Main OEA will further reduce views of the mine extraction area from most sensitive receivers to the north east, east and south east.

The sector that will continue to be impacted is to the west. However, the number of sensitive visual receivers are limited to a small number of residences on Roxburgh and to the south west on Denman Road (including parts of Pukara as well as Denman Road itself).

The visual effect of the western side of the OEA will decrease over time as the overall scale of the active face of the OEA is reduced from 270 m to 180 m. In addition, the creation of a backgrounding and dominant rehabilitated OEA will also reduce the visual effect of the active face of the OEA to the east. Eventually (after 15 years) the active face will not be visible to sensitive view locations in the western and south western areas with the exception of the upper section of Roxburgh Road.

The visual impact of the Project will decrease impact levels as the Project progresses with the rehabilitated Main OEA areas dominating and screening the Project from sensitive receivers in the east and increasing dominating views from the west.

The implementation of suggested mitigation strategies will further ameliorate visual impacts.