WATERMARK
COAL PROJECT
ENVIRONMENTAL IMPACT STATEMENT

February 2013

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Acoustics Impact Assessment

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SHENHUA WATERMARK COAL PTY LIMITED

ACOUSTICS IMPACT ASSESSMENT

WATERMARK COAL PROJECT
ENVIRONMENTAL IMPACT STATEMENT

REPORT J0130-28-R2
14 JANUARY 2013

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TABLE OF CONTENTS

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 Shenhua Watermark Coal Pty Limited (Shenhua Watermark) to complete an Acoustics Impact Assessment for the Watermark Coal 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 Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the construction and operation of the Project.

The assessment includes the following components:

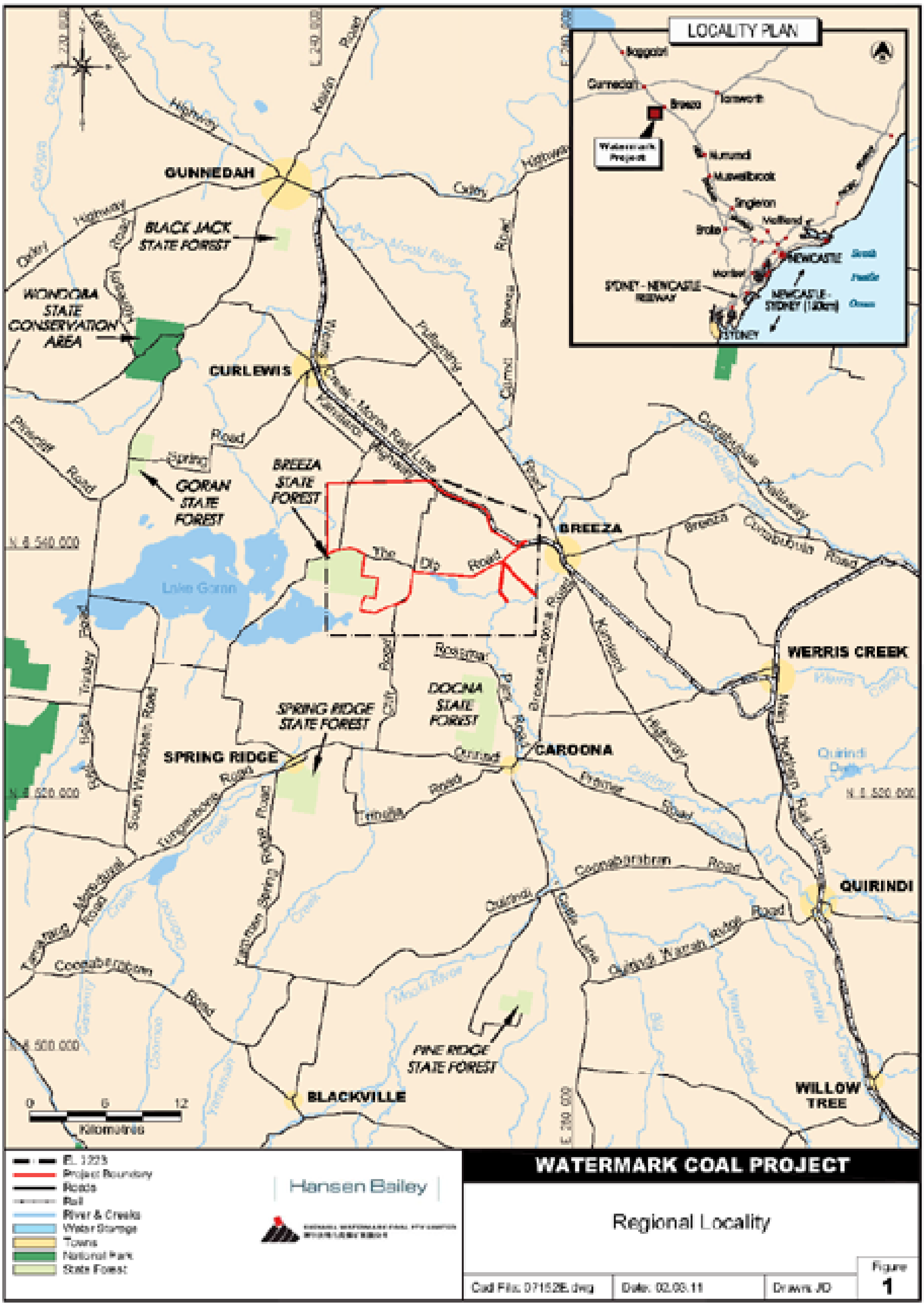
- A desktop review of background noise monitoring data collected at representative receiver locations;
- Assessment of prevailing weather conditions that may affect noise propagation to receivers in the vicinity of the Project, based on data from Shenhua Watermark's two weather stations;
- Development 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;
- 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 any remaining impacts.

1.1 Background

Shenhua Watermark, a subsidiary of the Shenhua Corporation, was granted Exploration Licence (EL) 7223 in October 2008. The Project is located within EL 7223, approximately 25 km south south-east of the township of Gunnedah and to the immediate west of the village of Breeza, within the Gunnedah Local Government Area (LGA). The Project is approximately 282 km by rail from the export Port of Newcastle.

Figure 1 illustrates the regional locality of the Project in relation to the nearest town centres of Breeza and Gunnedah.

Figure 1: Regional Locality.



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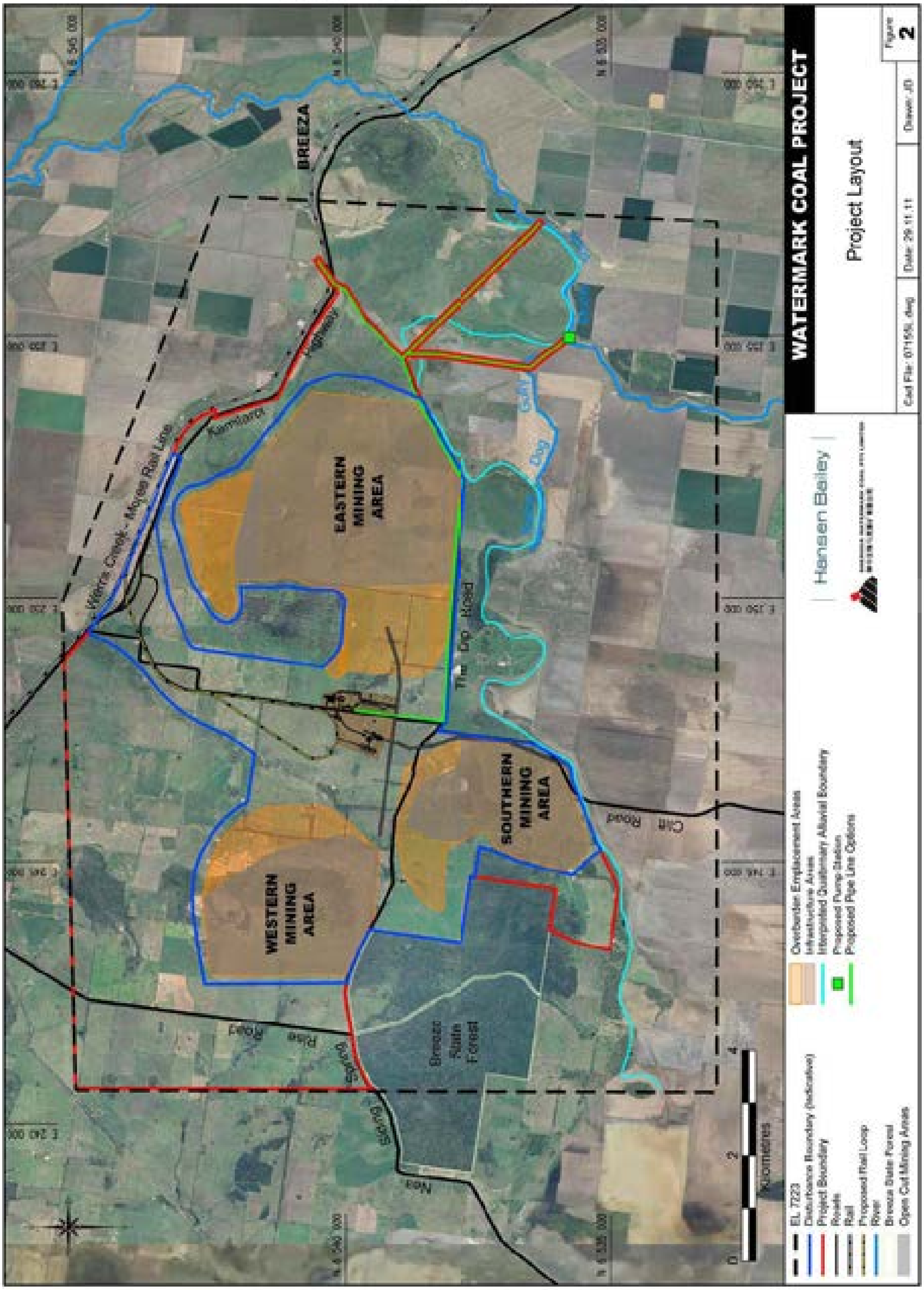
The Project Application Boundary (Project Boundary) is shown in Figure 2.

Figure 2: Conceptual Project Layout.



1.2 Project Description

Shenhua Watermark is seeking State Significant Development Consent under Division 4.1 of Part 4 of the EP&A Act for the Project. The Project generally comprises:

- Construction and operation of an open cut mining operation extracting up to 10 Million tonnes per annum (Mtpa) of Run Of Mine (ROM) coal for a 30 year period;
- An open cut mining fleet of excavators and shovels supported by haul trucks, dozers, graders, drill rigs and water carts;
- Progressive rehabilitation of all disturbed areas;
- Construction and operation of a Coal Handling and Preparation Plant (CHPP) with a throughput of 10 Mtpa ROM coal;
- Co-disposal of tailings and coarse reject within Overburden Emplacement Areas (OEAs);
- Construction and operation of a rail spur, rail loop, Kamilaroi Highway rail overpass, associated load out facility and connection to the Werris Creek – Moree Railway Line;
- Construction and operation of a Mine Access Road;
- Construction and operation of administration, workshop and related facilities;
- Construction and operation of surface and groundwater management and reticulation infrastructure including pipelines, pumping stations and associated infrastructure for access to water from the groundwater aquifers, the Mooki River and private dams to the north-east of the Project Boundary;
- Installation of communications and electricity infrastructure; and
- A workforce of up to approximately 600 full-time equivalent employees during construction and up to 600 full-time equivalent employees during operation of the Project.

The Project would include a number of geographically distinct areas:

- The Eastern Mining Area located generally within the area bounded by the Kamilaroi Highway, The Dip Road and Court Lane. The Eastern Mining Area would be mined from Year 1 to approximately Year 18;
- The Southern Mining Area located south of The Dip Road, west of Clift Road and generally east of the Breeza State Forest. The Southern Mining Area would be mined from approximately Year 18 to approximately Year 22;
- The Western Mining Area located north of The Dip Road and east of Nea Siding Road. The Western Mining Area would be mined from approximately Year 22 to the end of mine life in Year 30; and
- The Mine Infrastructure Area located around the southern end of Court Lane and north of The Dip Road would include the Coal Handling and Preparation Plant (CHPP), workshop, bathhouse and office facilities.

1.3 Receivers

With the exception of the Breeza State Forest, the Project is surrounded on all sides by privately owned or Shenhua Watermark owned properties. The Dip Road runs through the southern portion of the Project while Court Lane runs south from the Kamilaroi Highway through the approximate centre of the Project. Nea Siding Road adjoins the western Project boundary while Clift Road adjoins the eastern boundary of the Southern Mining Area.

A land ownership plan for the area around the Project showing land owned by Shenhua Watermark, land owned by private individuals or companies and the Breeza State Forest, is included in the noise contour figures in Appendix A. Identification numbers have been assigned to contiguous properties rather than to individual lots, as shown in the figures.

2 REGULATORY FRAMEWORK

This assessment investigates the 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) (EPA, 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.

Table 1: Director-General's Requirements

Requirement	Relevant Report Section
Noise, Vibration and Blasting – including a quantitative assessment of the potential: Construction, operational and off-site transport noise impacts;	Construction – Section 6 Operations – Section 5 Transport – Sections 7 and 8
Blasting impacts on people, livestock and property;	Section 10
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 5.2, 5.3, 5.8
Monitoring and management measures, in particular real time, attended noise monitoring and predictive meteorological forecasting.	Section 5.10

The assessment also considers input from the Office of Environment & Heritage (OEH), Namoi Catchment Management Authority (Namoi CMA), Gunnedah Shire Council (GSC) and the NSW Farmers Association (NFA), as shown in Table 2.

Table 2: Agency Comments to DGRs

Agency	Requirement	Relevant Report Section
OEH	The development should be designed so that the mine premises and associated activities comply with the NSW Government's Industrial Noise Policy (INP) and the Australia and New Zealand Environmental Council's *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*. Please note that the recently released publication "Interim Construction Noise Guideline, DECC 2009" has advised that construction noise from mining and quarrying needs to be assessed and considered as operational noise under the INP.	INP – Sections 5 and 6 ANZEC – Section 10 Construction – Section 6
OEH	Noise impacts associated with road haulage off the defined premises will need to be assessed against the DEC's guidance document 'NSW Environmental Criteria for Road Traffic Noise (EPA, 1999).	No road haulage of coal is proposed. Other road traffic issues are assessed in Section 7
OEH	Sleep disturbance as a result of mine activities, including road/rail movements on the private premises needs to be fully assessed.	Section 5.9
OEH	Modifying factor adjustments as outlined in section 4 of the INP need to be fully considered, particularly low frequency noise from locomotive operation and coal handling and preparation plant, impulsive and tonal noise sources.	Section 5.5
OEH	Impacts of increased rail movements along the rail network to Newcastle needs to be evaluated against the noise objectives set in the ARTC rail network licence (EPL 3142) and the guideline "Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, 2007"	Section 8

Agency	Requirement	Relevant Report Section
OEH	A key issue in the Gunnedah Basin area is that an adequate assessment of impact of inversions be undertaken, using if available, real temperature lapse rate data as outlined in section E of the INP. Anecdotal evidence from existing mining operations near Boggabri suggests that inversions greater than the default of 3°C/100m are a feature of the area exacerbating noise impacts. This issue needs to be fully evaluated in the EA.	Section 5.4
OEH	The cumulative effects of operational noise and blasting (including increase in blast frequency) from adjoining mining operations needs to be fully evaluated.	Noise - Section 9 Blasting – Section 10
Namoi CMA	Noise and Blasting - The EIS should address and consider the potential impacts, mitigation measures and safeguards on all of the above issues especially with regard to impacts on both the local and broader catchment community.	Noise - Section 5 Blasting – Section 10
Namoi CMA	Consider the impacts, safeguards and contributions especially in consideration of the Catchment Targets within the Namoi CAP (2010-2020): People 1: Natural resource management decisions contribute to social wellbeing. People 2: There is an increase in the adaptive capacity of the Catchment Community	Noise - Section 5 Blasting – Section 10
Namoi CMA	The EIS needs to undertake a thorough and rigorous pre and post mining risk assessment with respect to long term site specific and cumulative impacts of the above issues on local and catchment communities.	Noise - Section 5 Blasting – Section 10
GSC	The proposed development will significantly change the tone and amenity of the rural environment north of the village of Breeza. The noise analysis associated with the project must consider the rural dwellings within proximity of the development site as well as the village of Breeza.	Noise - Section 5 Blasting – Section 10
GSC	In particular the increased rail movements through the village of Breeza will be major concern for the village community with consequential environmental impacts particularly in terms of noise and vibration.	Section 8
NFA	What the projected air quality, noise, vibration and subsidence impacts will be, and their systems monitoring, mitigating and compensating for those effects.	Noise - Section 5 Blasting – Section 10

3 EXISTING ENVIRONMENT

The Project Boundary covers a large area which can result in different acoustic environments in different receiver areas. In particular, traffic noise from the Kamilaroi Highway can influence the existing acoustic environment at receivers located generally north and east of the Project, while receivers in other directions can receive very little traffic noise. To account for existing differences in noise level at receivers, Shenhua Watermark commissioned background noise surveys at five representative locations at various times from July to December 2010. Noise monitoring locations are shown in the noise contour figures in Appendix A.

3.1 Long Term Background Noise Surveys

Background noise surveys were completed at five representative receiver locations from July to December 2010 by GHD Pty Ltd (GHD) and were described in monthly environmental monitoring reports. According to the GHD reports, background noise levels were measured using unattended noise monitors to quantify the long term background noise level at each monitoring location.

Background noise surveys were completed in winter, autumn and summer, with spring noise surveys omitted as sufficient data had already been collected to determine representative background noise levels at each location. Monitors used for the initial August 2010 noise surveys were Acoustic Research Laboratories EL-215 noise loggers which comply with the requirements for Class 2 accuracy according to *AS IEC 61672.1-2004 Electroacoustics - Sound level meters* (Standards Australia International, 2004). These loggers were fitted with a 12 mm polarised condenser microphone mounted approximately 1.2 m above the ground and fitted with a windshield. The loggers were programmed to measure and store 15 minute A-weighted percentile statistics over the initial noise survey period of approximately one week. Instrument calibration was checked at the beginning and end of each noise survey using a Bruel & Kjaer 4231 calibrator producing 114 dB at 1 kHz.

Due to the low background noise levels measured in the initial survey, instruments used for all subsequent noise surveys from August to December 2010 were Rion NL-22 or NL-21 Type 2 sound level meters which are capable of measuring noise levels down to or below 20 dBA. These instruments were otherwise similar to the initial noise loggers, except that only two instruments were used and these two were rotated around the five monitoring locations in approximately weekly intervals. According to the GHD monitoring reports, background noise levels were determined via the following procedure which satisfies the recommendations in the INP:

- For each 15 minute period, the noise level that occurred for the quietest 10% of the time in that 15 minute period (known as the LA90,15min) is reported by the noise monitor;
- For each day, evening or night, the lowest 10% of the measured LA90,15min values is calculated and is known as the Assessment Background Level (ABL), after excluding data affected by winds over 5 m/s or rain; and
- For the day, evening or night time periods, the median value of the individual ABLs is taken as the background noise level in that time period. For this assessment, data collected in each season have been considered separately.

For noise assessment purposes:

- Day is defined as the period 7am to 6pm, or from 8am on Sundays or public holidays;
- Evening is defined at the period 6pm to 10pm; and
- Night is defined as the period 10pm to 7am, or to 8am on Sundays and public holidays.

Summary results are presented in Table 3 while daily background noise levels are presented for each location in table form in Appendix E.

Results in Table 3 indicate background noise levels are generally lower than 30 LA90,15min at all locations and in all time periods. As required by the INP, a background noise level of 30 LA90,15min has therefore been adopted at all locations. Daytime background noise levels at NM3 Rowarth are at least 31 LA90,15min in all seasons, however the additional 1 dBA has been conservatively ignored for this assessment.

Table 3 also shows background noise levels in summer are generally higher than in the other seasons primarily due to the influence of insects, however the higher summer levels have also been conservatively ignored when determining noise criteria for this assessment.

Table 3: Measured Background Noise Levels, LA90,15min.

Location	Season	Rating Background Level LA90,15min			Number of valid daily ABLs provided by noise surveys		
		Day	Evening	Night	Day	Evening	Night
NM1 Clift	Winter	32.0	26.5	26.7	17	21	21
	Spring	30.4	30.1	26.3	29	29	30
	Summer	39.9	40.6	40.6	8	7	7
NM2 Kirby	Winter	30.5	29.2	29.5	16	18	19
	Spring	28.9	29.2	26.3	22	24	24
	Summer	36.5	44.6	43.3	15	13	13
NM3 Rowarth	Winter	31.0	29.0	28.5	12	12	13
	Spring	31.6	33.5	27.6	28	29	30
	Summer	35.9	43.5	43.0	7	6	6
NM4 Breeza Station	Winter	29.0	27.0	26.5	17	19	19
	Spring	30.1	30.6	25.5	26	27	27
	Summer	37.9	41.0	43.0	8	7	7
NM5 Smythe	Winter	24.7	30.4	27.5	13	16	16
	Spring	29.1	30.2	28.2	28	26	29
	Summer	34.0	36.4	39.6	8	7	7

3.2 Short Term Noise Surveys

Short term operator attended noise surveys were also completed by GHD at all monitoring locations and in all time periods, with data from the surveys showing background noise levels were generally influenced by the noise sources shown in Table 4.

Table 4: Existing Dominant Background Noise Sources

Location	Time Period	Dominant Background Noise Sources
NM1 Clift	Day	Birds, breeze, farming activity and occasional windmill and aircraft noise
	Evening	Birds and insects, farming and domestic activity, occasional windmill
	Night	Frogs, insects, a light breeze or very still
NM2 Kirby	Day	Birds, cattle, aircraft and a light breeze
	Evening	Distant highway traffic, occasional local traffic, birds frogs and insects
	Night	Frogs and insects, cattle or very still
NM3 Rowarth	Day	Highway traffic, cattle birds and insects
	Evening	Highway traffic, frogs and insects
	Night	Highway traffic, cattle or very quiet
NM4 Breeza Station	Day	Highway traffic, occasional crop dusting aircraft and local vehicles
	Evening	Highway traffic, occasional local vehicles, birds frogs and insects
	Night	Highway traffic, frogs and insects
NM5 Smythe	Day	Distant highway traffic, birds and frogs
	Evening	Distant highway traffic, birds frogs and insects
	Night	Frogs and insects, a light breeze or very still

Results from the operator attended noise surveys indicate existing industrial noise levels are insignificant at all monitoring locations. In addition, there are no known sources of industrial noise operating in the area. Agricultural activity, including operation of trucks, tractors and harvesters, is not considered to be industrial activity for the purposes of this noise assessment.

4 CRITERIA

4.1 Mining Noise

The INP contains two sets of noise criteria for residential receivers. Intrusive criteria are set 5 dBA above the adopted RBL in each time period and are designed to limit the relative audibility of mining or industrial operations. 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. Any relevant adjustments have been applied to source noise levels in this assessment.

Amenity limits recommended in the INP depend on existing industrial noise levels and the nature of the receiver area and are designed to control the total or cumulative level of industrial noise at a sensitive receiver such as a residence. 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.

All assessed receivers have conservatively been assigned the ‘rural’ amenity category for the purposes of determining appropriate noise amenity criteria. Table 5 shows the intrusive and amenity criteria adopted for this assessment and the method used to determine these criteria.

Table 5: Adopted Operational Noise Criteria.

Steps to Determine Noise Criteria	Noise Criteria by Time Period		
	Day[1] 7 am to 6 pm	Evening 6 pm to 10 pm	Night[1] 10 pm to 7 am
Background level LA90,15min (Section 3)	30	30	30
Intrusive criteria LAeq,15min (LA90 + 5)	35	35	35
Amenity limit LAeq,period (INP, rural)	50	45	40
Existing industrial level	-	-	-
Amenity criteria LAeq,period (INP Table 2.2)	50	45	40

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

4.2 Where Criteria May be Exceeded

Noise criteria listed in Table 5 should be considered the levels above which some acoustic impact may be noticed by receivers. Higher noise levels at a receiver do not necessarily imply the noise is unacceptable at that receiver. The INP describes strategies to deal with potential exceedances of the criteria such as:

- best practice noise mitigation measures applied to individual plant items and mine operating procedures designed to mitigate remaining noise impacts;
- adoption of alternative noise criteria based on achievable noise levels in conjunction with noise mitigation measures and considering other factors such as social worth attached to the development and historical noise levels from existing related developments;
- negotiation of offset arrangements with regulators and/or the affected community; and

- acquisition of properties where the predicted or measured noise impacts are unacceptable and other options cannot reasonably be negotiated.

4.3 Cumulative Noise Levels

The INP recommends two sets of criteria, including the intrusive criteria which would apply to the Project operating alone and the amenity criteria which are intended to control the total noise level at a receiver location from all industrial or mining developments. Cumulative noise levels are therefore assessed to the amenity limits shown in Table 2:

- 50 LAeq,11hr during the day;
- 45 LAeq,4hr during the evening; and
- 40 LAeq,9hr during the night.

4.4 Construction Noise

Construction noise levels from most developments are normally assessed to the ICNG. Section 1.2 of the ICNG states it does not apply to industrial sources, including 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 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.

4.5 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 *Environmental Criteria for Road Traffic Noise* (EPA, 1999) (now superseded by 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 6 shows relevant sleep disturbance criteria, including the historical criteria and more recent guidance in the RNP. Sleep disturbance criteria apply during the night period 10pm to 7am, at a point 1 m outside a potentially affected bedroom window.

Table 6: Sleep Disturbance Criteria, Night, LA1,1min.

Steps to Determine Noise Criteria	Noise Criteria LA1,1min, 10pm to 7am
Background level LA90,15min (Section 3)	30
Historical Criteria LA1,1min (LA90 + 15)	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.

4.6 Road Traffic Noise

The Project would generate traffic on the Kamilaroi Highway during the construction and operational phases of the Project. 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. Noise criteria for Situation 3 *"Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments"* applies to road traffic on the Kamilaroi Highway and are 60 LAeq,15hr during the day (7 am to 10 pm) and 55 LAeq,9hr during the night (10 pm to 7 am) for residential receivers. The LAeq,15hr and LAeq,9hr parameters refers to the average traffic noise level over an entire 15 hour day or 9 hour night.

Some construction related traffic would occur on local roads in the vicinity of the Project. Noise criteria for Situation 6 *"Existing residences affected by additional traffic on existing local roads generated by land use developments"* applies to road traffic on local roads such as The Dip Road and are 55 LAeq,1hr during the day (7 am to 10 pm) and 50 LAeq,1hr during the night (10 pm to 7 am) for residential receivers. The LAeq,1hr parameter 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.

4.7 Rail Traffic Noise

Rail noise criteria in this section apply to train movements on publicly owned rail lines such as the Werris Creek – Moree 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.

4.8 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.

4.9 Blast Overpressure and Vibration

Noise and vibration criteria for occupied buildings are recommended in the Blasting Guideline. Recommended noise and vibration limits at non-mine owned and occupied buildings such as residences, schools and hotels are:

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

The Blasting Guideline 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 on a site in a 12 month period. Recommended blasting criteria apply during the hours 9am to 5pm Monday to Saturday, excluding public holidays, and are designed to minimise disturbance to occupants.

The majority of occupied buildings can withstand much greater vibration levels, typically well over 20 mm/s, before the onset of superficial or cosmetic damage. Vibration levels well over 25 mm/s would typically be required to cause structural damage to these buildings. Appendix J4 of *Australian Standard 2187.2-2006 Explosives – Storage and use, Part 2: Use of explosives* (AS 2187.2:2006) suggests a vibration criterion of 15 mm/s at 4 Hz, rising to 50 mm/s at 40 Hz and above, would protect occupied buildings constructed of lightweight materials such as timber frames and plasterboard lining. AS 2187.2:2006 also recommends a vibration criterion of 50 mm/s for industrial and heavy commercial buildings. The recommended vibration criterion of 5 mm/s and upper limit of 10 mm/s for occupied buildings is therefore adequate to protect all buildings from even superficial or cosmetic damage.

Similarly, occupied buildings routinely withstand wind pressures, including strong wind gusts, so are not particularly sensitive to overpressure. Appendix J5 of AS 2187.2:2006 states *"From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133 dBL. Windows are the building element currently regarded as most sensitive to airblast, and damage to windows is considered improbable below 140 dBL"*. The recommended criterion of 115 dBL, and upper limit of 120 dBL, is therefore adequate to protect occupied buildings from damage due to overpressure.

4.9.1 Heritage Items

Aboriginal, Non-Aboriginal and other cultural items which are potentially sensitive to blasting impacts exist within and surrounding the Project Boundary. These items are documented in the following EIS reports:

- Watermark Coal Project – Historical Heritage Assessment (AECOM, 2012);
- Watermark Coal Project – Aboriginal Archaeological Report (AECOM, 2012)

- Watermark Coal Project – Aboriginal Cultural Heritage Values Assessment Report (Connect for Effect, 2012); and
- Watermark Coal Project – Desktop Review of Impacts of Blasting on Landforms and Slopes (SCT, 2012).

Table 7 indicates criteria applied to heritage buildings owned by Shenhua Watermark that are not proposed to be directly impacted by proposed mining activities. The locations of heritage buildings are shown in Figures L3 and L4 in Appendix A. The recommended blasting criteria are considered adequate to protect Shenhua Watermark owned heritage buildings from structural, superficial and cosmetic damage. The criteria should be confirmed by a suitably qualified structural engineer and blast monitoring is recommended to ensure blasting does not adversely impact the heritage buildings.

SCT (2012) confirmed bedrock features such as grinding grooves are less sensitive to ground vibration than surface infrastructure as they have the ability to move with the surrounding ground movement. SCT recommended a 100 m buffer between blast sites and grinding grooves to reduce the potential for adverse impact due to blasting. The risk of flyrock damage to the grinding grooves can be controlled by covering the grooves with flexible mats, sand or other suitable materials during blast events within 500 m of the grooves.

Table 7: Vibration Sensitive Items and Recommended Vibration Criteria.

Heritage or Other Item	Comments	Suggested Criteria
Farm Complex 3 The Wilgas, house and sheds	European Heritage structure to the north east of the proposed Disturbance Boundary. Proposed mining is approximately 800 m from this structure. Owned by Shenhua Watermark.	15 mm/s 133 dB
Farm Complex 7 Inverness	European Heritage structure to the north west of the proposed Disturbance Boundary. Proposed mining is approximately 1.3 km from this structure. Owned by Shenhua Watermark.	15 mm/s 133 dB
Farm Complex 12 Tilbrook	European Heritage structure to the north west of the proposed Disturbance Boundary. Proposed mining is approximately 1.8 km from this structure. Owned by Shenhua Watermark.	15 mm/s 133 dB
Farm Complex 13 Wattle Vale	European Heritage structure to the west of the proposed Disturbance Boundary. Proposed mining is approximately 1.3 km from this structure. Owned by Shenhua Watermark.	15 mm/s 133 dB
Breeza Cemetery	Located approximately 4 km east of the proposed Disturbance Boundary.	2 mm/s N/A dB

4.9.2 Infrastructure Items

Other structures such as buried pipelines, storage silos and water tanks are expected to withstand ground vibration levels of at least 50 mm/s with an insignificant chance of suffering permanent damage. A lower and more conservative ground vibration criterion of 25 mm/s is considered appropriate for the Central Ranges Gas Pipeline, subject to consultation with the owner of the pipeline.

5 OPERATIONAL NOISE

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 Noise Control Strategies

Initial noise modelling was completed to identify potentially affected receivers in the absence of noise mitigation and to identify appropriate noise control strategies. Noise contour figures showing predicted noise levels under the original no-mitigation case are attached as Appendix C. Additional modelling of alternative mine plans and equipment noise reduction strategies allowed the optimum strategies to be adopted, as presented in this EIS. The noise control strategy adopted in this assessment is the result of seven major iterations and approximately five minor iterations involving combinations of the following strategies:

- Selection of the quietest available equipment;
- Equipment noise control, particularly for mobile mining machines;
- Noise barriers such as walls and bunds, particularly to shield noise from mining areas;
- No mining in exposed areas or areas too close to receiver properties, particularly at night; and
- Restrictions on operating hours, such as daytime-only operation.

Apart from a reduction in mining areas, which would have the undesired effect of sterilising coal resources, the proposed mine plan has adopted all feasible and reasonable noise mitigation measures that are available with current technology. Further information regarding this issue is presented in Sections 5.3 and 5.7.

5.3 Proposed Noise Control Measures

Initial noise modelling with no mitigation measures in place indicated the need for a comprehensive set of noise control measures to minimise noise levels at closest privately owned receiver properties. The following noise control and mitigation measures have been incorporated into the Project to reduce noise impacts on private receivers.

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 reasonably be achieved, are proposed as part of the Project. The modelled sound power level represents normal operation of each machine which is generally known as the 'dynamic' sound power level.

- Shovels and excavators have been modelled with a sound power level of 116 dBA for large machines and 115 dBA for smaller machines (compared to 120 to 122 dBA for a standard machine) with the following best practice modifications, or equivalent:
  - best available exhaust silencers;
  - quieter 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.
- Loaders and wheel dozers have been modelled with a sound power level of 114 dBA (compared to 121 dBA standard) with the following best practice modifications, or equivalent:
  - best available exhaust silencers;
  - quieter 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.
- Overburden trucks have been modelled with a sound power level of 114 dBA, smaller coal trucks with a sound power level of 113 dBA and water carts with a sound power level of 112 dBA (compared to 120 to 122 dBA standard) with the following best practice modifications, or equivalent:
  - best available exhaust silencers;
  - quieter 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
  - quiet helical gears in gearboxes and hubs rather than noisy straight-cut gears.
- Drills have been modelled with a sound power level of 114 dBA (compared to approximately 119 dBA standard) with the following best practice modifications, or equivalent:
  - best available exhaust silencers;
  - quieter aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres; and
  - acoustically lined engine and compressor covers including belly plates.
- Dozers have been modelled with a sound power level of 115 dBA (compared to 118 dBA from the engine and approximately 132 dBA from the tracks during high speed reverse operation for a standard machine) based on the following best practice modifications and management measures, or equivalent:
  - best available exhaust silencers;
  - quieter aerodynamic radiator fan blades and temperature-based fan speed control;
  - radiator acoustic louvres;
  - engine bay side covers;
  - track modifications to reduce impact noise, if possible;

  - 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 have been modelled with a sound power level of 111 dBA (compared to 113 to 115 dBA for a standard machine) based on the following best practice modifications, or equivalent:
  - best available exhaust silencers.

5.3.2 Engineering Controls for CHPP Equipment

Feasible and reasonable noise mitigation measures have been proposed for CHPP equipment, with a particular focus on the main coal preparation plant building and the rail spur, have been proposed as part of the Project. The proposed noise control measures would result in the CHPP producing insignificant noise, and noise levels from the rail spur within relevant criteria, at all privately owned receiver properties.

- Coal Preparation Plant (CPP) building has been modelled with a sound power level of 113 dBA (compared to approximately 117 dBA for a standard CPP) based on the following best practice modifications, or equivalent:
  - the coal washing process would be designed with the minimum number of noisy machines such as vibrating screens and centrifuges;
  - process items would be selected to minimise noise where this selection is consistent with the required process outcomes;
  - the building's structure would be designed to minimise floor, wall and roof vibration to minimise noise generated by these surfaces;
  - the building would be clad with steel sheeting on all sides from approximately 4 m above the ground to the roof, with less than 15% of translucent sheeting on each wall to minimise noise transmission;
  - the roof would be clad with steel sheeting with no more than 20% translucent sheeting and the minimum of roof vents required to provide adequate ventilation; and
  - elevated conveyors entering the building would be fully enclosed where practical.
- Conveyors have been modelled with a sound power level of 87 dBA per metre for sections of conveyor that cannot be enclosed. This sound power level has been conservatively modelled for all conveyors except those located in reclaim tunnels, however the following noise control measures are proposed:
  - Enclose sections of elevated conveyor where practical; and
  - Regularly monitor the condition of the idler bearings and repair or replace noisy bearings to maintain the adopted conveyor sound power level.
- Rail loop and rail spur would be constructed with current best practice noise control measures, or equivalent:
  - rails would be continuously welded rather than jointed;
  - points and crossovers would be constructed to minimise wheel impact noise;
  - large radius bends would be used to minimise wheel and flange noise; and
  - a rail over road bridge, which has the potential to generate additional noise from train pass-by vibration in elevated steel bridge sections, has not been proposed.

5.3.3 Acoustic Shielding

A range of acoustic shielding options including earth bunds up to 6 m high adjacent to mining areas and along major haul roads have been investigated for their effectiveness at reducing received noise levels under noise enhancing weather conditions. The investigation showed a minor noise reduction of up to 1 dBA at privately owned receivers could be achieved with all noise bunds in place, with a significant increase in construction noise and material rehandling in exposed areas to regularly advance the noise bunds ahead of mining areas. Given the minor operational noise level decrease provided by the bunds is partly offset by the additional noise and air quality impacts to construct and regularly relocate the bunds, provision of earth bunds is not considered feasible or reasonable.

In contrast, active management of equipment operating locations during periods of strong noise enhancing weather conditions offered a similar noise reduction of up to 1 dBA without the additional construction and material rehandling noise associated with earth bunds. The proposed active management strategy includes the following proposed measures which were reflected in the noise model:

- Mobile machines including trucks, dozers, graders and water carts would 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;
- In-pit haul roads would be located in acoustically shielded areas where possible;
- Out of pit haul roads would be located as far from sensitive receivers and through low elevation and shielded areas where possible;
- Mining machines (shovels, excavators and loaders) would work below the surface during the sensitive night period. Surface work including clearing, topsoil stripping, stockpiling and rehabilitation would be completed during the day; and
- Drilling and drill pad preparation would occur at least 6 m below the natural surface during the evening and night.

5.4 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. The INP recommends noise enhancing winds or temperature inversions that occur for at least 30% of the time in any season or time period should be considered when predicting noise levels.

5.4.1 Gradient Winds

Weather data in 10 minute intervals were supplied for the 12 month period August 2010 to July 2011 from Weather Station 1 (WS1) and Weather Station 2 (WS2), as described in Appendix F – Air Quality and Greenhouse Gas Impact Assessment Report. Data were processed according to INP guidelines to determine prevailing weather conditions for this assessment. Data analysis was completed using an equivalent to the OEH's Noise Enhancement Wind Analysis (NEWA) program in each of 16 compass directions, with results shown in Table 8 for WS1 data and in Table 9 for WS2 data. Tabulated values in bold font highlight potentially noise enhancing winds that occur for 30% of the time or more in any season or time period.

Table 8: Noise Enhancing Winds, WS1 2010-2011 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	12.2	14.1	11.5	4.6	5.3	8.3	7.4	8.6	9.2	12.3	15.8	12.7
NNE	11.0	16.3	12.5	6.1	5.8	6.9	6.3	4.9	4.9	11.9	14.5	13.0
NE	15.2	24.0	25.7	12.7	12.4	12.4	9.4	7.7	5.6	16.5	18.7	19.1
ENE	24.7	**46.3**	**51.1**	26.7	**37.7**	**34.5**	17.0	18.3	15.2	27.8	**36.9**	**41.2**
E	29.9	**45.0**	**54.6**	**33.7**	**43.6**	**42.5**	21.6	26.6	24.0	**31.6**	**39.4**	**42.4**
ESE	26.6	**39.7**	**51.5**	**32.7**	**38.0**	**38.7**	19.3	24.3	24.3	28.1	**31.7**	**38.7**
SE	26.6	**38.8**	**50.0**	**33.7**	**38.5**	**38.6**	18.0	23.2	24.3	27.1	**32.1**	**38.3**
SSE	28.1	**34.5**	**43.3**	**37.1**	**39.6**	**38.3**	19.4	24.5	24.3	29.0	**33.3**	**36.5**
S	29.8	24.2	25.5	**35.7**	**32.3**	25.9	28.0	27.7	23.8	**30.6**	27.1	22.5
SSW	25.8	9.4	11.3	29.0	15.2	12.0	**30.0**	25.1	19.3	27.3	17.4	13.5
SW	28.3	6.9	8.2	26.6	15.9	12.0	28.8	27.5	21.8	28.0	18.1	13.2
WSW	**30.4**	7.8	9.3	24.2	16.8	14.0	29.8	**31.8**	24.9	**30.6**	20.6	14.1
W	27.1	11.2	11.6	22.1	16.8	15.2	29.8	**30.8**	28.3	**30.4**	22.6	15.9
WNW	18.5	10.2	9.5	18.0	15.2	13.9	26.9	27.8	27.3	25.1	20.6	15.6
NW	14.8	9.1	7.5	12.7	9.5	11.1	16.8	20.5	22.0	15.9	14.1	12.9
NNW	13.3	10.7	8.0	7.2	6.3	9.5	11.5	15.9	16.8	12.6	15.0	13.9

Table 9: Noise Enhancing Winds, WS2 2010-2011 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	11.2	7.8	7.0	8.4	4.3	5.1	15.1	11.1	9.9	14.9	10.9	13.9
NNE	13.1	10.0	8.7	8.3	3.8	6.6	14.4	8.1	9.6	14.2	13.7	15.5
NE	18.4	14.3	15.0	12.0	6.7	9.4	15.3	7.9	9.5	17.1	21.0	19.7
ENE	25.3	25.6	23.4	16.7	10.3	12.5	16.5	9.1	9.8	23.2	29.7	26.3
E	27.1	29.1	23.6	19.9	11.8	13.4	17.7	10.0	10.9	26.0	**31.4**	29.1
ESE	**30.7**	**44.0**	**32.5**	**30.7**	**34.8**	23.1	21.3	20.7	16.6	**30.7**	**36.2**	**30.4**
SE	**38.0**	**56.4**	**57.7**	**43.2**	**56.1**	**56.1**	28.3	**34.9**	**33.4**	**31.7**	**46.6**	**44.8**
SSE	**33.5**	**52.7**	**49.7**	**40.5**	**52.3**	**57.2**	24.2	**38.5**	**36.5**	28.4	**41.5**	**43.2**
S	**31.2**	**47.0**	**41.9**	**39.4**	**52.2**	**55.5**	24.0	**41.3**	**36.8**	26.1	**34.5**	**39.3**
SSW	**32.1**	**42.9**	**41.8**	**43.3**	**57.5**	**59.4**	28.3	**45.4**	**39.7**	28.5	**34.1**	**37.1**
SW	**34.4**	**32.1**	**44.0**	**44.9**	**57.3**	**61.7**	**35.7**	**48.6**	**43.8**	29.8	**32.3**	**36.3**
WSW	25.4	12.6	17.0	29.4	23.9	25.4	28.8	**36.2**	27.9	24.8	21.9	18.9
W	18.8	9.2	8.0	18.4	16.8	10.8	22.4	29.4	18.8	24.8	16.5	12.2
WNW	13.2	5.3	4.2	12.5	11.1	4.7	20.8	22.4	14.5	19.0	11.0	7.7
NW	10.1	3.1	2.6	9.6	7.4	2.5	20.8	19.2	12.9	16.3	8.0	5.7
NNW	10.7	5.4	5.2	9.1	5.6	4.1	17.5	15.2	10.4	14.6	7.7	9.8

Table 8 shows potentially noise enhancing winds can occur a significant proportion of the time from the east to south, with less common yet still significant winds occurring from the south to west. The evening and night periods in Table 8 show similar results in most seasons.

Table 9 shows significant winds can occur from the south east to the south west quadrant, with evening and night periods also showing similar results in all seasons.

Differences between the two sets of data indicate some influence from local topography at the two weather station sites. In the absence of high quality data from another nearby weather station that may allow the influence of local topography on Shenhua Watermark's weather stations to be quantified, this assessment has considered the noise enhancing effect of all potentially noise enhancing wind directions shown in Tables 8 and 9.

5.4.2 Temperature Inversions

Supplied weather data from WS1 included the standard deviation of wind speed in each 10 minute period. Analysis of the data to determine the percentage occurrence of mild and strong temperature inversions was based on the sigma-theta method described in Section E4 of Appendix E of the INP which recommends the following steps:

- Sort the data by month and discard all except the winter data;
- Sort the data by time and discard the day period (7 am to 6 pm);
- For remaining data representing winter evenings and nights, determine the initial stability category (A to G class) based on the standard deviation of wind direction (wind sigma theta) reported by the weather station in each 10 minute period and on the sigma-theta ranges shown in Table E5 of the INP;
- Determine the final stability category based on the initial stability category and the wind speed ranges described in Table E6 of the INP. The initial stability categories E, F and G were combined then reclassified by wind speed as described in Note 2 to Table E6 in the INP;
- Finally, count the percentage occurrence of each stability category for winter evenings and nights.

Results from this analysis indicated the D stability category, representing an approximately zero vertical temperature gradient, occurs 31 % of the time while the E stability category, representing a very mild temperature inversion, occurs for approximately 14 % of the time. Moderate F class temperature inversions occur 45 % of the time while strong G class inversions occur 9 % of the time. This result indicates G class inversions occur significantly less than 30 % of the time and do not require further consideration, while F class inversions occur more than 30 % of the time and should be considered in this assessment. According to Table E8 in the INP, an F class inversion is represented by a 3 °/100m vertical temperature gradient combined with a 2 m/s wind where the noise source is on elevated ground compared to the receiver.

5.4.3 Drainage Flows

Cold air drainage flows associated with a temperature inversion during the night tend to run downhill and would therefore flow in different directions over various areas with and surrounding the Project Boundary depending on local terrain.

A detailed inspection of regional topography shows the Project is located adjacent to the Mooki River valley which runs generally south to north. Drainage flows would therefore generally run south to north to follow the valley, although significant variation in drainage flow rate and direction could be expected within and around the Project Boundary due to the hilly terrain. As data from the two weather stations indicate dominant winds generally flow from the south during the night, these winds are assumed to be drainage flows caused by the regional Project setting. To ensure the assessment remained conservative, assessed night weather conditions include the noise enhancing effect of drainage flows from all directions indicated by the weather stations.

5.4.4 Adopted Weather Conditions

Table 10 shows adopted atmospheric parameters used in this assessment which represent prevailing conditions for receivers in all directions from the Project. The last row of each table shows the effective inversion strength for downwind receivers based on the calculation methods included in the noise model software and presented as Equation 1 in the following section.

Table 10: Modelled Weather Conditions.

Atmospheric Parameter	Day Neutral	Day Prevailing			Evening/Night Prevailing			
Temperature, °C	20				10			
Relative Humidity, %	70				90			
Wind Speed, m/s	0	3			0	2		
Wind Direction	-	East	South	West	-	East	South	SW
Temp Gradient, °C/100m	-2				3			
Equivalent Inversion	-2	5.5	5.5	5.5	3	8	8	8

The evening and night periods have been combined given the similarity between prevailing weather conditions in these two time periods. Noise contour figures for prevailing weather conditions during the day and during the evening and night have been prepared by taking the outer envelope, or maximum noise level, of each set of weather conditions for the relevant time period. For example, the evening/night noise contours shown in Appendix A represent the maximum of the four sets of evening and night weather conditions (inversion no wind, inversion and east wind, inversion and south wind, inversion and south west wind) listed in Table 10. Similarly the day prevailing noise contours represent the maximum noise level from the four sets of day weather conditions.

5.4.5 Strong Temperature Inversions

Section 5.4.2 indicates stronger G class inversions can occur for approximately 9 % of the time during winter evenings and nights. Temperature inversions tend to increase received noise levels because they refract sound 'rays' down towards the ground. Winds also cause increased noise levels for receivers down wind, for the same reason. Research indicates the effects of inversions and winds are approximately cumulative and the noise model software adopts this approach by combining inversions and winds into an equivalent inversion strength or an equivalent radius of curvature for sound rays. For the 'rural' terrain category in ENM software as used for this assessment, the equivalent inversion strength used for determining received noise levels is calculated by:

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

According to Equation 1, a 2 m/s wind is equivalent to a 5 °/100 m inversion for receivers downwind of the source. Based on Equation 1, a night scenario with a 3 °/100 m inversion combined with a 2 m/s breeze is equivalent to an 8 °/100 m inversion, which is equivalent to or stronger than a G class inversion of typically 4 to 5 °/100 m. The weather conditions considered in this assessment therefore satisfy the recommendations in the INP while simultaneously assessing the effects of strong noise enhancement that may occur in the area.

5.5 Operational Noise Sources

Mining operations would require a number of items of mobile equipment to uncover, extract and transport coal. Modelled sound power levels for mining and on-site transportation equipment are based on current Hunter Valley and Gunnedah Basin best practice equipment noise control measures, as discussed in Section 5.3.1.

Modelled sound power levels for coal handling and processing equipment and idling locomotives are based on measurements taken at other mine sites, while modelled sound power levels for train movements on the rail spur were based on coal train noise measurements taken in the East Maitland area.

Minor items of equipment that are unlikely to be audible at any receiver under any weather conditions, such as light vehicles, can be shown to have no appreciable effect on received noise levels and have been omitted from the assessment.

Figures showing modelled noise source locations are attached as Appendix B. The figures show the modelled location of each source where the actual location is the small cross at the lower left corner of each text entity. Source heights above local ground level have been determined based on the estimated height of the acoustic centre for each source type and the ground level under each source location. Source heights and modelled sound power levels for each source, in octave bands, are shown in Table 11.

Table 11: Modelled Noise Sources and Sound Power Levels.

Code, Source, Height above ground m		Octave Band Centre Frequency, dBL [1]									dBL	dBA
		31.5	63	125	250	500	1k	2k	4k	8k	Total	Total
Mining Sources												
S, Shovel (large)	6	119	117	115	108	111	110	106	100	87	122.9	113.9
s, Shovel (small)	5	118	116	114	107	110	109	105	99	86	121.9	112.9
E, Excavator (large)	5.5	117	118	117	112	111	112	109	106	99	123.4	116.2
e, Excavator (small)	5	119	120	116	111	110	111	108	105	98	124.2	115.2
L, Loader	3	121	117	120	113	107	108	109	103	96	125.0	114.4
T, Truck (overburden)	3	118	118	113	114	113	107	105	101	98	123.0	114.0
t, Truck (coal)	3	117	117	112	113	112	106	104	100	97	122.0	113.0
Z, Dozer	2	117	115	115	112	113	111	106	99	90	122.2	115.0
z, Wheel dozer	3	121	117	120	113	107	108	109	103	96	125.0	114.4
D, Drill (large)	2.5	107	107	110	113	114	105	105	95	91	118.6	113.6
d, Drill (small)	2.5	107	107	110	113	114	105	105	95	91	118.6	113.6
G, Grader	2	111	109	115	111	106	107	103	97	89	118.8	111.1
W, Watercart	2.5	116	116	111	112	111	105	103	99	96	121.0	112.0
F, Fuel truck	2.5	106	108	108	106	105	103	101	93	86	114.4	107.9
Y, Tyre handler	2	106	108	108	106	105	103	101	93	86	114.4	107.9
CHPP Sources												
ROM, ROM bin	6	116	115	116	111	111	107	103	95	88	121.6	112.4
C2, Conveyor 200 m	1	110	105	104	104	107	107	103	93	83	114.8	110.3
PP, Preparation plant [2]	15	133	118	117	113	110	108	104	96	87	133.3	112.9
TB, Train loadout bin	3	109	107	109	103	99	97	94	92	82	113.9	102.8
Lo, Locomotive on loop	3	109	109	102	101	105	104	100	94	88	114.1	107.7
r, train on rail spur [3]	2	92	98	96	91	91	91	94	91	88	103.0	98.8

1. dBL means unweighted, as opposed to A-weighted, sound power levels.
2. Sound power levels for this source include a 5 dB low frequency penalty in the 31.5 Hz band as recommended in the INP.
3 The rail spur noise sources represent LAeq (not LAmax) sound power levels per 200 m length of rail spur for one train travelling at up to 50 km/hr in a 15 minute period. The rail spur sound power levels are significantly lower than the locomotive sound power levels from the loading loop, as a train on the rail spur would not produce noise for a full 15 minute period at each source location.

Many mobile sources have been modelled in multiple locations for a proportion of the time at each location, such as four locations for 25% of the time at each location to represent a haul truck travelling along a road. Such sources are indicated in the source location figures in Appendix B with a '/2' or '/4' after the source code, indicating the source operates at that location for 50 % or 25 % of the time respectively.

5.6 Predicted Mining Noise Levels

Noise levels from the Project have been modelled for representative operating scenarios, time periods and weather conditions. Noise contour figures showing predicted noise levels from the Project have been produced for years 1, 2, 5, 10, 15, 21, 25 and 30 under neutral and prevailing weather conditions.

Noise contour figures A1 to A24 show contours for day neutral, day prevailing and evening/night prevailing weather conditions in each assessed year including the following noise sources:

- Mining equipment proposed for each operating year;
- Normal operation of the CHPP;
- Train loading and four locomotives idling on the loading loop; and
- For Figure A28 to A30, noise from a train travelling along the rail spur from the loading loop to the Werris Creek to Moree Railway Line.

Noise contour Figures A25 to A27 show the outer envelope, or maximum noise level, for all assessed years to show the maximum extent of the noise contours for the life of the Project. Figures A28 to A30 show the outer envelope noise contours for all years including noise from a train on the rail spur.

Table 12 summarises predicted worst case noise levels from the Project based on the detailed noise level tables presented in Appendix D. Shading in Table 12 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 Shenhua Watermark, 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 35 LAeq,15min criterion have generally been excluded from Table 12. 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 more than 35 LAeq,15min, all residences and properties owned by that landowner have been included in Table 12. Noise levels at assessed residences or properties that have been excluded from Table 12 are shown in the more detailed tables in Appendix D.

Table 12: Summary of Predicted Noise Levels, LAeq,15min.

Noise Level at Residence, LAeq,15min				Noise Over 25% of Property Area, LAeq,15min			
Residence Ref	Day Neutral	Day Prevailing	Evening/ Night	Property Ref	Day Neutral	Day Prevailing	Evening/ Night
-	-	-	-	7 east	25.0	35.5	39.9
				7 west	17.6	29.9	32.3
10 north	12.0	33.1	35.7	10	14.7	32.8	35.3
10 south	15.0	31.0	32.2				
12	21.6	31.8	35.4	12	22.2	32.4	36.0
13	23.7	33.8	37.8	13	24.8	34.5	38.1
14	25.5	36.6	40.1	14	25.7	37.1	40.5
-	-	-	-	16 east	11.0	23.0	24.5
16 north	14.4	32.1	35.5	16 west	16.2	33.6	37.0
16 south	15.9	32.9	36.0				
-	-	-	-	20	27.3	38.4	42.2
-	-	-	-	21	13.6	32.3	35.1

Noise Level at Residence, LAeq,15min				Noise Over 25% of Property Area, LAeq,15min			
Residence Ref	Day Neutral	Day Prevailing	Evening/ Night	Property Ref	Day Neutral	Day Prevailing	Evening/ Night
22	18.3	32.0	35.2	22	22.8	34.1	36.9
24 north	19.4	30.7	33.2	24	23.1	34.5	38.3
24 south	20.8	32.1	34.9				
-	-	-	-	25 east	19.5	31.3	35.9
25 south	22.1	32.6	35.0	25 south	21.3	32.0	32.8
25 west	21.8	33.0	38.4	25 west	25.5	36.1	42.5
-	-	-	-	26 east	18.3	31.7	35.2
				26 west	32.8	43.0	46.0
-	-	-	-	27	28.4	41.4	45.7
-	-	-	-	28	25.8	39.6	44.2
-	-	-	-	31	18.6	32.7	35.5
32 east	22.3	36.3	40.0	32	25.4	37.1	41.8
32 north	15.1	27.4	30.5				
32 west	29.7	42.4	40.9				
35	19.8	32.9	35.7	35	19.8	32.8	35.6
39	21.6	35.3	38.6	39	21.6	35.4	38.7
40	20.5	33.3	36.2	40	20.5	33.3	36.1
41	21.2	34.4	37.3	41	23.3	34.6	37.2
-	-	-	-	42	21.3	34.1	36.7
43	20.6	33.2	35.9	43	20.7	33.2	35.9
44	20.3	32.5	35.2	44	20.4	32.5	35.2
60	25.4	37.6	40.3	60	25.5	33.9	38.7
-	-	-	-	61	34.6	36.5	41.8
62 east	31.5	41.6	42.4	62	34.4	39.8	43.9
62 west	29.5	40.1	41.5				
-	-	-	-	65 north	29.5	40.2	43.7
				65 centre	17.3	29.1	29.0
				65 south	12.7	28.6	27.6
99	25.4	33.1	35.4	99	24.7	33.2	34.5
103	25.8	36.4	40.8	103	27.4	38.3	43.1
104	18.9	33.4	36.2	104	18.1	32.1	34.9
105	19.0	33.7	35.6	105	19.4	34.1	36.1
106	17.3	32.6	35.6	106	18.4	34.7	36.4
-	-	-	-	108	16.3	32.8	35.9
-	-	-	-	112	25.8	29.6	35.5
-	-	-	-	114	31.3	32.0	37.5
115	29.4	34.2	35.9	115	36.7	42.3	43.9
-	-	-	-	116	29.8	39.5	40.8
-	-	-	-	118	28.8	35.0	36.8
-	-	-	-	119	29.2	35.6	38.7
125	38.8	45.8	48.2	125	39.2	45.1	49.5
Figure	A25	A26	A27	-	A25	A26	A27
Affected Residences / Properties	0	4	7	Significant	0	5	14
	1	1	5	Moderate	1	7	8
	0	4	14	Mild	1	5	18

Red 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; and
Green shading – a mild noise impact of 2 dBA or less above the 35 LAeq,15min intrusive criteria.

Results in Table 12 show one residence is expected to receive noise levels over the intrusive criterion during day neutral conditions. Prevailing weather conditions during the day would result in 4 significantly affected, 1 moderately affected and 4 mildly affected residences.

Prevailing weather conditions during the most sensitive night period would result in 7 significantly affected residences owned by 6 land owners, one of which also owns a moderately affected residence (Residence 32 east). An additional 4 moderately affected residences are owned by 4 land owners while 14 residences owned by 13 land owners would be mildly affected by the Project during prevailing weather conditions during the most sensitive night period.

5.7 Noise Levels to Livestock

Noise levels from the Project would be audible over areas of grazing land owned by Shenhua Watermark and private land owners. 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 12 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 12, while livestock in more remote areas of a property would experience noise levels lower than the levels shown in Table 12.

Mining operations within the region and elsewhere have for many years used company-owned land in close proximity to open cut mining to raise beef cattle and operate dairy farms. This practise suggests livestock are not sensitive to environmental noise. As such it is unlikely that livestock on privately owned grazing properties within audible range of the Project will be affected by noise. Similarly, livestock quickly become accustomed to vibration and overpressure from blast events which would limit the potential for impacts on livestock health.

5.8 Additional Noise Control Options

A significant focus of this assessment has been to identify noise control options 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;
- Restricting mining activity to the day period only, to avoid mining noise during the more sensitive evening and night periods, has the potential to minimise received noise levels assuming day operations would not change. In practice, additional mining equipment would be required to operate during the day to compensate for the lack of evening and night production. As the day covers 11 hours of a 24 hour period, approximately double the number of mining machines would be required to maintain the proposed annual production rate. In principle, doubling the number of machines would result in an increase of 3 dBA at all receivers, as shown in Figure C4 in Appendix C which has been produced by adding 3 dBA to all proposed daytime mining noise levels. The figure shows predicted noise levels for day-only operation would be similar to, or slightly higher than, the proposed night noise levels shown in Figure A27 in Appendix A. Daytime-only operation would therefore increase the number of residences and properties affected by noise from the Project, as shown in Table 13 below;

- Restricting mining activity to the day and evening period, to avoid mining noise during the most sensitive night period, would also require an increase in the equipment fleet. As the day and evening cover 15 hours of a 24 hour period, a 60% increase in the number of mining machines would be required to maintain the proposed annual production rate. In principle, such an increase in the number of machines would result in an increase of 2 dBA at all receivers during the day and evening. Evening noise contours showing the effect of the additional 2 dBA are shown in Figure C5 in Appendix C which can be directly compared to the proposed evening/night noise contours in Figure A27 in Appendix A. Day and evening operation would therefore cause increased noise levels to receivers during these time periods and would increase the number of residences and properties affected by noise from the Project, as shown in Table 13 below;
- Reduced mining intensity during the most sensitive night period, without a corresponding increase in mining activity during the day, would be technically possible but would have economic consequences for Shenhua Watermark, the community and the government. Estimated economic impacts associated with three night activity levels are shown in Table 14 below;
- Noise bunds around various mining areas would provide some noise reduction during relatively neutral or mild atmospheric conditions. However, noise enhancing conditions involve refraction of noise towards the ground which has the effect of curving the noise over a barrier or hill. This effect is strongest if the barrier or hill is some distance from both the source and receiver. Therefore, noise barriers such as earth mounds or walls constructed around mining areas would be effective at reducing noise during the day under neutral or only mildly noise enhancing weather conditions, when noise reduction is least required, but would be less effective or ineffective during noise enhancing weather conditions when noise control is most needed. In addition, noise and air quality issues associated with barrier construction in exposed locations would outweigh the small operational noise benefits such a barrier would provide, with larger barriers offering minor additional operational noise benefits but more significant construction noise impacts. Figure C6 in Appendix C presents noise contours including the effect of earth bunds an average of 4m high on the natural surface approximately 10 m ahead of each mining area, superimposed on noise contours showing proposed noise levels. The figure indicates the noise bunds would reduce noise levels by less than 0.5 dBA and are therefore not proposed;
- Detailed analysis of noise model results indicates the proposed CHPP would produce insignificant noise at any receiver with currently proposed mitigation measures in place. Additional CHPP noise control measures, such as low noise conveyor idlers, are technically possible to implement but would offer a total noise reduction of less than 0.1 dBA at any receiver so are not considered reasonable and have not been proposed; and
- Further analysis of the noise model results indicates train movements on the rail spur are unlikely to significantly contribute to total Project noise levels at any receiver when assessed on an LAeq,15min basis, due to the relatively short length of rail spur and slow train speeds on the spur. Analysis of maximum noise levels that have the potential to cause sleep disturbance also indicates train movements on the proposed rail spur would not be a significant contributor at any privately owned residence. Noise barriers along all or part of the rail spur, and along the Mine Access Road, are technically possible to construct but are not proposed due to the insignificant benefit such barriers would provide.

This discussion shows a wide range of noise control and management measures have been considered and all reasonable measures have been proposed as part of the Project.

5.8.1 Restricted Operating Hours

Table 13 shows the number of residences and properties predicted to be affected by noise if day-only or day and evening-only operation is considered, compared to the number of affected properties considering the proposed 24 hour operation, assuming no change to the proposed annual production rate.

Table 13: Number of Noise Affected Properties for Restricted Operating Hours Options

	Significance	Affected Residences by Option			Affected Property Areas by Option		
		Day Only	Day and Evening Only	Proposed 24 Hour	Day Only	Day and Evening Only	Proposed 24 Hour
Number of Affected Residences/ Properties	Significant	6	10	7	12	20	14
	Moderate	5	16	5	13	20	8
	Mild	16	10	14	15	14	18
	Total	27	36	26	40	54	40
Noise Contour Figures		C4 [1]	C5 [1]	A25-A27	C4 [1]	C5 [1]	A25-A27

Red 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; and
Green shading – a mild noise impact of 2 dBA or less above the 35 LAeq,15min intrusive criteria.

1 Day Only and Day/Evening Only options are presented for comparison only. These strategies are not proposed as part of the Project.

Results in Table 13 indicate the day-only option would result in one additional affected residence and the same number of affected properties, while the day and evening-only case would result in a significant increase in the number of affected residences and properties. These results clearly indicate restricted working hours without a corresponding reduction in annual production would not provide an acoustic benefit to receivers.

5.8.2 Reduced Night Operation

A reduction in the intensity of mining during the night, with a corresponding reduction in annual production to avoid an increase in day and evening noise levels, has also been considered. Shenhua Watermark has provided advice regarding the economic effects of restricted night operations based on three levels of night mining intensity, as shown in Table 14.

Table 14: Economic Effect of Restricted Night Operation

Night Operation	Mining Fleets Operating at Night	Receiver Acoustic Benefit [1]	Shenhua Watermark Revenue Reduction [2]	Community Employment Reduction [3]	Product Coal Reduction (Mtpa) [4]
Proposed 100%	4	Base Case as Proposed			
25% Reduction	3	1 dBA	$62-79M	20 FTE	0.63
50% Reduction	2	3 dBA	$144-184M	50 FTE	1.47
75% Reduction	1	6 dBA	$233-297M	75 FTE	2.38

1 The approximate acoustic benefit, compared to the proposed night operation using all mining equipment, assumes similar equipment operating locations and exposure to or shielding from receivers.

2 Per annum, based on revenue of AUD$98 - AUD$125 per product tonne.

3 Full Time Equivalent (FTE) staff reduction estimated by Shenhua Watermark based on the number of idle mining fleets during the night in each case.

4 Estimated by Shenhua Watermark based on the lost production capacity of the idle mining fleets at night.

A moderate 3 dBA reduction in night noise levels would result from two out of four mining fleets remaining idle during the night, with a resulting reduction of approximately 50 full time equivalent staff, a loss of AUD $144M to AUD $184M revenue and a loss of government royalties from an estimated reduction of 1.47 Mtpa of product coal per year.

A significant noise reduction of 6 dBA in night noise levels would result from three out of four mining fleets remaining idle during the night, with a resulting reduction of approximately 75 full time equivalent staff, a loss of AUD $233M to AUD $297M revenue and a loss of government royalties from an estimated reduction of 2.38 Mtpa of product coal per year.

Further analysis of the economic consequences of a reduction in night mining intensity, and the trade-off between community benefits and receiver benefits, is beyond the scope of this technical report.

5.9 Sleep Disturbance

5.9.1 Mining

Coal mining primarily involves 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, shovels and dozers can produce intermittent louder noise depending on working conditions, machine condition and operator actions.

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 tracks tends to cause them to droop between the drive sprocket and the rear idler and this lack of tension can cause a regular impact noise. The level of noise a dozer can produce in reverse depends on a number of factors including machine type, condition, speed and ground conditions, with a sound power level in the range 125 to 132 dBA representing a typical maximum for this source.

Shovels can produce a significant impact noise as the bucket gate is closed, primarily depending on the speed of the gate as it closes and latches. Shovel gate impacts can produce a sound power level in the range 125 to 130 dBA, although impact noise from this source is often below 120 dBA.

Other sources of potential sleep disturbance include raw coal being dumped from a shovel or excavator bucket into a truck or from a truck or loader into a steel ROM hopper, vehicle horns and equipment start alarms.

Truck bodies can typically produce a sound power level of up to 120 dBA. A ROM hopper can typically produce up to 120 dBA, or a higher noise level up to approximately 126 dBA if the hopper is empty. Quieter vehicle horns and alarms can produce a sound power level in the range 110 to 115 dBA, although mobile machine reverse alarms would be non-tonal smart alarms and would not contribute significant environmental noise.

Locomotive horns can produce a sound power level in the range 125 to 130 dBA, although horns would not normally be required while a train is operating on the rail loop or rail spur. Train wagon bunching, however, can occur on the rail loop or on the rail spur if a train is required to stop or start, and a typical sound power level of 127 dBA has been adopted for train wagon bunching and train locomotive horns.

This discussion indicates a number of noise sources can potentially produce noise levels in the 125 to 130 dBA range, although such sources should not normally occur with the proposed noise management measures in place. A theoretical worst case sleep disturbance assessment has been completed based on the following strategy:

- Model a number of 132 dBA dozer track sources, at the same dozer locations as shown in Figures B1 to B8 in Appendix B, for each year. The maximum noise level produced by any source, rather than the sum of all sources, is adopted at all receiver locations assuming only one significant source of dozer track noise occurs at any time. This assumption is considered reasonable given dozers would be managed to avoid this source of noise;

- Model a number of 127 dBA shovel gate sources, at the same shovel and excavator locations as shown in Figures B1 to B8 in Appendix B, for each year. The maximum noise level produced by any source, rather than the sum of all sources, is adopted at all receiver locations assuming only one shovel gate impact occurs at any time. This assumption is considered reasonable given the shovels would be managed to minimise this source of noise;
- Distribute a number of 127 dBA sources around the rail loop and along the rail spur to represent train wagon bunching, with the sources placed at the same locations as the rail loop and rail spur sources in Figure B9 in Appendix B. The maximum noise level produced by any source, rather than the sum of all sources, is adopted at all receiver locations as wagon bunching noise tends to 'travel' along a train rather than be generated at all wagon couplings simultaneously;
- Calculate the maximum noise level, not the sum, from dozer track and train sources; and
- Sum the maximum noise level with the 'normal operation' LAeq,15min noise level from Figure A27 in Appendix A, as received noise levels during maximum noise events would occur in conjunction with normal operational noise.

5.9.2 Maximum Noise Levels – No Mitigation

Sleep disturbance noise contours produced by the adopted assessment strategy are shown in Figure A34 in Appendix A, with separate noise contours shown with and without wagon bunching on the rail spur. A maximum noise level of 45 LA1,1min or more is predicted at residences 14, 32 east, 32 west, 103 and 125, with predicted noise levels below the sleep disturbance criterion at all other residences. It is noted that all residences that would be potentially affected by sleep disturbance noise impacts are also predicted to be significantly affected by operational noise as shown in Table 12.

Noise management plans for mining operations and operation of the rail loop and rail spur would include best practise management measures to avoid or minimise potential sources of sleep disturbance impacts. The predicted maximum noise levels in Figure A34 should therefore occur rarely.

5.10 Recommended Noise Management and Monitoring

Project noise levels should be monitored to confirm the predicted noise levels. The noise monitoring strategy would vary from year to year as the mine progresses and as such, development of a detailed monitoring strategy for the entire life of the Project is not appropriate at this stage. However, the following recommendations would be considered by Shenhua Watermark when developing a detailed Noise Management Plan unless otherwise agreed with the EPA and DP&I:

- A Noise Management Plan including an active noise management strategy is recommended, including the following components (or equivalent):
  - A weather prediction system to identify potentially noise enhancing weather conditions up to 12 hours or ideally 24 hours in advance;
  - A noise prediction system, linked with the weather prediction system, to provide advance warning of potential exceedances of relevant noise criteria and advice to operations staff regarding available equipment relocation options;
  - Real time noise monitors deployed in representative receiver areas or at reference locations closer to the Project to enable ongoing noise management. The noise monitor locations should be reviewed at least every three years. Data from the real time noise monitors should be transmitted to an on-site office or control room for monitoring and action; and
  - A Trigger Action Response Plan (TARP) should be developed and implemented, including actions required upon detection of noise levels over the intrusive criteria taking into account relevant factors such as time of day, equipment operating locations and weather conditions.

- Quarterly operator attended noise monitoring should occur at a minimum of four locations during normal mining operations to confirm Project noise levels. The monitoring locations should vary from time to time as the mine progresses and should be reviewed every three years. Noise surveys should include two non-consecutive 15 minute noise measurements, and associated observations to identify and quantify dominant sources of noise, during the day, evening and night at each location. Long term quarterly noise monitoring, using unattended monitors for a period of a few days to a week, does not allow Project related noise to be reliably distinguished from other sources such as traffic or agricultural activity and is therefore not recommended; and
- Summary results from the real time noise monitors, and detailed results from the quarterly noise surveys, should be reported in each Annual Environmental Monitoring Report.

6 CONSTRUCTION NOISE

6.1 Construction Activities

The following major construction works would be required as part of the Project:

- Construction of the Mine Access Road from the Kamilaroi Highway to the MIA and CHPP, including realignment of a short section of the Kamilaroi Highway and a highway bridge over the proposed rail spur;
- Construction of the rail spur and rail loop from the Werris Creek – Moree Railway Line to the Project;
- Construction of the CHPP and MIA; and
- Construction of haul roads leading to the initial mining area, various water management structures and other services.

The earthmoving phase for each construction activity typically produces the highest sound power level and is therefore considered in this assessment.

6.2 Construction Noise Sources

The bulk earthworks phase of the construction program is expected to utilize the same fleet of earthmoving machines being moved from one component of the works to the next component as required. Bulk earthworks would be completed according to the following indicative program:

- Mine Access Road — 3 months, day only;
- Kamilaroi Highway overpass, rail spur and loop — 4 months, day only;
- CHPP — 4 months, 24 hours per day;
- Coal stockpiles — 3 months, 24 hours per day; and
- MIA and initial mine haul roads — 4 months, 24 hours per day.

Some overlap between consecutive works would occur and would result in a total bulk earthworks program of approximately 13 months. Table 15 shows proposed construction noise sources required to complete the bulk earthworks, assuming all machines operate continuously at full power to present a worst case assessment.

Table 15: Proposed Bulk Earthworks Construction Fleet and Sound Power Levels.

Indicative Construction Fleet		Sound Power Level, LAeq	
Machine	Number in Fleet	Per Machine Type	Total
Articulated truck	6	116	130
Scraper	6	119	
Grader	2	112	
Excavator	2	117	
Backhoe	2	106	
Mobile crane	2	108	
Roller	3	110	
Flat bed truck	1	106	
Fuel truck	1	106	
Water cart	3	106	
Wheel dozer	3	116	

General construction work would occur 24 hours per day although bulk earthworks near the Project Boundary would only occur during the day. Minor earthworks may occur 24 hours per day for all construction components.

6.3 Construction Noise Assessment

Noise levels for this worst case construction scenario have been calculated using the Project noise model, based on Year 1 terrain and a total sound power level of 130 dBA as shown in Table 14. Noise contours were calculated using the following procedure, with all sources located a nominal 2m above the ground:

- Distribute Mine Access Road, rail spur and rail loop construction sources along the length of each road or railway, at intervals of no more than 200m. Assign the maximum construction sound power level to each source, assuming construction activity is concentrated within a 200 m section or road or railway, and calculate the maximum rather than the sum of all sources;
- Distribute construction noise sources within the MIA and the CHPP footprint. Assign the maximum construction sound power level to each source, assuming construction activity is concentrated within a part of the area at any time, and calculate the maximum rather than the sum of all sources;
- Distribute construction noise sources along the eastern mine haul road from the CHPP to the initial mining area. Assign the maximum construction sound power level to each source, assuming construction activity is concentrated within a part of the haul road at any time, and calculate the maximum rather than the sum of all sources;
- Calculate the maximum noise level from the Mine Access Road, highway bridge, rail spur and loop, MIA, CHPP and mine haul road construction noise levels to determine construction noise levels during the day; and
- Calculate the maximum noise level from the MIA, CHPP and mine haul road construction noise levels to determine construction noise levels during the evening and night.

Noise contours resulting from this assessment procedure are shown in Figures A31 to A33 in Appendix A for day neutral, day prevailing and evening/night prevailing conditions, respectively. The noise contour figures indicate predicted construction noise levels would be acceptable at all residences except Residence 125 under day neutral, day prevailing and night prevailing conditions. Residence 125 is expected to receive construction noise levels up to:

- 39 LAeq,15min under day neutral conditions;

- 42 LAeq,15min under day prevailing conditions; and
- 47 LAeq,15min under evening/night prevailing conditions.

Noise levels over the conservative operational noise criterion at Residence 125 are primarily due to construction work associated with the mine haul roads. It is noted that this residence is also identified in Table 12 as being significantly affected by proposed operational noise.

6.4 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 proposed construction activities would be acceptable at all privately owned receivers except Receiver 125 which is also predicted to be significantly affected by operational noise.

The following noise management measures are recommended to minimise noise levels at Residence 125 and to ensure acceptable construction noise levels at other receivers, particularly during the night:

- A construction noise management plan is recommended for the Mine Access Road, Kamilaroi Highway realignment and rail spur works to ensure all feasible and reasonable noise control measures are identified and implemented for these works, particularly in relation to any night work that may be required to meet the construction program;
- A construction noise management plan is recommended for night construction work. The plan should outline procedures to identify machines and activities that would produce dominant noise levels at Receiver 125 and, where possible, to avoid or reduce noise levels from those machines or processes to result in the lowest practical noise levels at the receiver;
- 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 be required; and
- Communication protocols and response protocols should be developed to minimise the potential for ongoing exceedances of the noise criterion.

7 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 the Kamilaroi Highway is assessed in this section.

7.1 Existing Traffic Flows

According to Figure 9 in the *Traffic and Transport Impact Assessment* (TTIA) prepared as part of the EIS for the Project (DC Traffic Engineering Pty Ltd, 2012), the Kamilaroi Highway in the vicinity of the Project currently carries an average of approximately 2,200 vehicles per day over a 7 day week and an average of approximately 2730 vehicles per weekday. A projected annual increase, in the absence of the Project, is estimated at approximately 1.9% per year. Table 2 in the TTIA indicates approximately 11 % of existing vehicle movements occur during the night period from 10 pm to 7 am, with approximately 89 % of traffic occurring during the day from 7 am to 10 pm. A daily average of 2430 vehicles, representing 89 % of 2730 vehicles per day, has therefore been adopted for existing Kamilaroi Highway traffic flows. The adopted traffic flows are conservative compared to an average of approximately 1500 vehicles per day measured by Shenhua Watermark in July 2012.

Local roads in the vicinity of the Project, such as The Dip Road and Nea Siding Road, carry significantly less than 100 vehicles per day according to traffic counts completed in July 2012.

Existing traffic flows of up to 50 vehicles per day have been adopted for local roads in the vicinity of the Project.

7.2 Construction Traffic Flows

7.2.1 Local Roads

The Project would include closure of a number of local roads, including a section of The Dip Road, which in turn would require upgrade and extension work on a section of Cull Road to the south west of the Project boundary by Year 10. Construction work associated with the Cull Road upgrade would result in some traffic flows on The Dip Road and the northern section of Clift Road, however no significant operational traffic flows are expected to occur on these roads upon completion of the upgrade work.

Construction related traffic flows on The Dip Road and nearby local roads have not been estimated in the TTIA. Up to 40 car movements and 10 truck movements per hour on The Dip Road, Clift Road and Cull Road have therefore been assumed during construction work to extend and upgrade Cull Road.

7.2.2 Access to the Project

The Project would initially be accessed from the Kamilaroi Highway via Court Lane until construction of the Mine Access Road is completed. Court Lane would then be closed to all traffic.

According to the TTIA, a peak of approximately 600 construction staff would be required. The TTIA assumes approximately 30 % of construction staff would travel via shuttle bus, with up to 8 bus movements per hour. Remaining construction staff are assumed to travel via private car, resulting in approximately 100 car movements to or from the Project per hour and a total of 200 vehicle movements per hour at shift change. A worst case situation, assuming the maximum construction staffing level is reached before the permanent Mine Access Road is completed, would include up to 200 car movements, 8 bus movements and 10 truck movements per hour accessing the Project via Court Lane. A similar number of vehicles would continue to access the Project via the completed Mine Access Road during the remaining construction period.

Approximately 400 car movements, 16 bus movements and 70 truck movements per 15 hour day have been assumed for the Kamilaroi Highway with 2 shift change periods per day. Approximately 60 % of these movements are assumed to approach the Mine Access Road from the north and the remaining 40 % would approach the Mine Access Road from the south. Traffic noise calculations include 60 % of the anticipated traffic flows in both directions to present a worst case assessment.

7.3 Operational Traffic Flows

According to the TTIA, approximately 300 car movements and 8 truck movements would occur along the Mine Access Road to and from the Kamilaroi Highway during peak traffic hours. Vehicle movements would primarily be due to staff arriving or departing, service vehicles, delivery vehicles and visitors. All traffic on the Mine Access Road must necessarily travel on the Kamilaroi Highway, although the proportion of vehicles approaching the Mine Access Road from the north or south would affect calculated traffic noise levels at any receiver. The TTIA assumes approximately 60 % of cars would approach the Mine Access Road from the north, with the remaining 40 % approaching the Mine Access Road from the south.

Approximately 600 car movements and up to 40 truck movements per day have been assumed on the Kamilaroi Highway due to operation of the Project, with the same 60 % north and 40 % south proportions as reported in the TTIA.

7.4 Calculated Traffic Noise Levels

Calculated traffic flows and noise levels for the existing situation and during the proposed construction and operational phases of the Project are shown in Table 16. Traffic noise calculations are based on the Calculation of Road Traffic Noise (CoRTN) method developed by the United Kingdom Department of Transport (UKDoT), with adjustments to the base method to determine an average (LAeq) noise level.

Table 16: Calculated Traffic Noise Levels, Existing and Project Traffic, Day.

Scenario	Vehicle Type, Noise Level	Traffic Flows And Traffic Noise Levels From Assessed Roads		
		Kamilaroi Highway LAeq,15hr	Court Lane, Mine Access Road LAeq,1hr	The Dip Road, Clift Road, Cull Road LAeq,1hr
Closest Receiver	-	Receiver 40 Breeza, 20m	Receiver 22 2.9 km north	Receiver 62 west 150 m south
Existing Traffic	Cars Trucks Cars+Trucks Noise Level	2126 304 2430 56.7	0 0 0 -	50 0 50 40.1
Existing +Project Construction	Cars Buses, Trucks Cars+Trucks Noise Level	2126 + 240 = 2366 304 + 52 = 356 2430 + 292 = 2722 57.3	200 18 218 32.5	50 + 40 = 90 0 + 10 = 10 50 + 50 = 100 45.7
Existing +Project Operation	Cars Trucks Cars+Trucks Noise Level	2126 + 360 = 2486 304 + 24 = 328 2430 + 384 = 2814 57.2	300 8 331 32.8	50 + 0 = 50 0 + 0 = 0 50 + 0 = 50 40.1
Noise Criteria		60 LAeq,15hr day	55 LAeq,1hr day	55 LAeq,1hr day

Traffic noise levels calculated in Table 16 are in all cases below relevant traffic noise criteria. Traffic noise control or management measures are therefore not required and have not been recommended.

Court Lane is currently a public road and would remain a public road while being temporarily used to access the Project during construction of the Mine Access Road. It is noted that the nearest privately owned receiver is approximately 2.8 km north west of the Kamilaroi Highway intersection with Court Lane. All noise sensitive receivers would therefore receive noise levels within INP noise criteria if the INP noise criteria were applied to Court Lane traffic noise.

8 RAIL TRAFFIC NOISE ASSESSMENT

Noise levels from train movements on the Werris Creek - Moree Railway Line are subject to the criteria described in Section 4.7 and are assessed separate to noise from train movements on the private rail spur.

A detailed assessment of noise from train movements on the Werris Creek - Moree Railway 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 *2009-2018 Hunter Valley Corridor Capacity Strategy – Consultation Document* (ARTC, 2009) includes the following data regarding train movements on the Werris Creek - Moree Railway Line:

- 12 train movements per day from Narrabri to Boggabri;

- 14 train movements per day from Boggabri to Gunnedah; and
- 20 train movements per day from Gunnedah to Curlewis;

The more recent publication *2011-2020 Hunter Valley Corridor Capacity Strategy – Consultation Document* (ARTC, 2011) contains information that is consistent with the above data.

Approved or recently proposed coal mine developments that are likely to generate additional train movements are:

- Continuation of Boggabri Coal Project – 1 to 2 additional train trips, or an average of 3 additional train movements, would be required per day. Existing train movements associated with Boggabri Coal Mine are included in the ARTC data above;
- Maules Creek Project - 7 additional train trips or 14 additional train movements would be required per day;
- Narrabri Coal Mine Stage 2 Project – 3 additional train trips or 6 additional train movements would be required per day. Existing train movements associated with Narrabri Coal Mine Stage 1 would be included in the ARTC data above;
- Tarrawonga Mine Modification – 1 additional train trip or 2 additional train movements would be required per day;
- Vickery Coal Project – 2 additional train trips or 4 additional train movements would be required per day;
- Caroona Coal Project – no details are available regarding forecast train movements associated with this project. Any future train movements associated with the Caroona Coal Project have not been considered in this cumulative impact assessment; and
- Werris Creek Mine – 1 or 2 train trips or an average of 3 train movements would be required per day.

The Project would require approximately 4 trains per day, or an average of 8 train movements per day, to transport up to approximately 6 Mtpa of product coal assuming a limit of 72 wagons per train and the current axle load limit of 25 tonnes. A possible increase to 96 wagons per train, which is expected to be achieved after completion of ARTC's proposed rail realignment and duplication at Ardglen, would result in an average of 3 trains (6 movements) per day. A conservative average of 8 train movements per day and a reasonable maximum of 16 movements per day has been adopted in this assessment.

There are a number of residences between the Project and Werris Creek located at various distances from the Werris Creek - Moree Railway Line and the Main Northern Railway. Closest residences to the railway include:

Project to Breeza

- Receiver 32 west approximately 110 m east of the railway;

In Breeza

- Receiver 39, 5454 Kamilaroi Highway, approximately 15 m south of the railway;
- Receiver 38, 48 Edward Street, approximately 25 m east of the railway;

Breeza to Werris Creek

- 8 Fishers Lane, approximately 160 m west of the railway;
- 457 Gap Road, approximately 45 m north of the railway;

In Werris Creek

- Closest Single Street residences are approximately 50 m from the railway;

Werris Creek to Quirindi

- 1715 and 1711 Werris Creek Road, approximately 50 m west of the railway;
- 33 Lowes Creek Road Quipolly, approximately 20 m west of the railway;
- Lot 3152 Bells Gate Road Quipolly, approximately 45 m east of the railway;

In Quirindi

- Closest residences on Centre Street, Fern Street, Nowland Street and Pryor Street, 6 residences all approximately 15 m from the railway;

Quirindi to Willow Tree

- 1178 Kamilaroi Highway, approximately 50 m west of the railway;
- 906 and 908 Kamilaroi Highway, approximately 30 m west of the railway;
- 'Collangi', 538 Kamilaroi Highway, approximately 35 m east of the railway;
- 'Colly Creek', Cattle Lane, approximately 40 m west of the railway;

In Willow Tree

- 1 Cadell Street, 7 Henry Street and 23 New England Highway, approximately 35 m east of the railway;
- 4 Recreation Road, approximately 20 m west of the railway;
- 5 residences on Humble Street, approximately 35 m east of the railway;

Willow Tree to Murrurrundi

- 453 Kankool Access Road, approximately 15 m west of the railway;
- 'Oakvale', Bounty Street Ardglen, approximately 30 m north of the railway;

In Murrurrundi

- 121 and 125 Haydon Street, approximately 20 m north of the railway;
- 3 Pages River Road, approximately 25 m south of the railway;
- 8 Polding Street, approximately 30 m south of the railway;
- 30 Polding Street, approximately 20 m south of the railway;

Murrurrundi to Scone

- 2 White Street Blandford, approximately 20 m south of the railway;
- Lot 1 New England Highway Parkville, approximately 40 m west of the railway;
- Lot 12 Mareeba Road Parkville, approximately 25 m east of the railway;
- 41 Mareeba Road Parkville, approximately 30 m east of the railway;

In Scone

- Ten Eveleigh Court residences, approximately 15 m west of the railway;
- 2 Belmore Street and 72 Kelly Street, approximately 20 m west of the railway;
- 104 St Aubins Street, approximately 10 m west of the railway;

- 80 Kingdon Street, approximately 10 m west of the railway;
- 'Willowgate Hall', 91 Kingdon Street, approximately 15 m east of the railway;
- 2 and 5 Smith Street, approximately 15 m east of the railway;

Scone to Muswellbrook

- Lot 11 New England Highway Aberdeen, approximately 30 m west of the railway;
- 67 McAdam Street Aberdeen, approximately 15 m west of the railway;
- 78 New England Highway Aberdeen, approximately 15 m west of the railway;
- 47 Bedford Street Aberdeen, approximately 15 m west of the railway;
- 11 Alexander Circuit Aberdeen, approximately 15 m west of the railway;
- 622 New England Highway Muswellbrook, approximately 30 m west of the railway;

In Muswellbrook

- 1 to 3 Aberdeen Street, approximately 25 m west of the railway;
- 220 to 224 Bridge Street, approximately 15 m east of the railway;
- 9 Wilkins Street, approximately 15 m west of the railway;
- 63 Ford Street, approximately 20 m west of the railway;
- 81 and 82 Lower Hill Street, approximately 20 m west of the railway;
- 'Weidmann Village' Brook Street, approximately 15 m west of the railway; and
- 2 William Lane, approximately 15 m west of the railway.

Calculated noise levels produced by existing rail traffic flows, future background rail traffic including other known coal mining projects, and proposed train movements including background movements and the Project, are shown in Table 17 with bold font highlighting noise levels over the 60 LAeq,9hr night and 85 LAmax noise criteria.

Table 17: Calculated Rail Traffic Noise Levels to Closest Receivers.

Receiver Area	Receiver, Distance	Predicted Noise Level					
		Existing 20 trains/day		Background 49/52 trains/day[1]		Proposed 57 trains/day	
		LAeq	LAmax	LAeq	LAmax	LAeq	LAmax
Project to Breeza	Receiver 32 west, 110 m	51.9	71.2	55.8	71.2	56.5	71.2
Breeza	Receiver 39, 15 m	**60.6**	**88.5**	**64.5**	**88.5**	**65.1**	**88.5**
	Receiver 38, 25 m	58.4	84.0	**62.3**	84.0	**62.9**	84.0
Breeza to Werris Creek	8 Fishers Lane, 160 m	50.3	67.9	54.2	67.9	54.8	67.9
	457 Gap Road, 45 m	55.8	78.9	59.7	78.9	**60.4**	78.9
Werris Creek	Various, approx. 50 m	55.4	78.0	59.2	78.0	59.9	78.0
Werris Creek to Quirindi	1711,1715 Werris Creek Rd, 50 m	55.4	78.0	59.2	78.0	59.9	78.0
	33 Lowes Creek Rd, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	Lot 3152 Bells Gate Rd, 45 m	55.8	78.9	60.0	78.9	**60.6**	78.9
Quirindi	Closest residences, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**

Receiver Area	Receiver, Distance	Predicted Noise Level					
		Existing 20 trains/day		Background 49/52 trains/day[1]		Proposed 57 trains/day	
		LAeq	LAmax	LAeq	LAmax	LAeq	LAmax
Quirindi to Willow Tree	1178 Kamilaroi Highway, 50 m	55.4	78.0	59.5	78.0	**60.1**	78.0
	906, 908 Kamilaroi Hwy, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
	538 Kamilaroi Highway, 35 m	56.9	81.1	**61.1**	81.1	**61.7**	81.1
	'Colly Creek', 40 m	56.3	80.0	**60.5**	80.0	**61.1**	80.0
Willow Tree	Cadell St, Henry St, NEH, 35 m	56.9	81.1	**61.1**	81.1	**61.7**	81.1
	4 Recreation Road, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	Humble Street, 35 m	56.9	81.1	**61.1**	81.1	**61.7**	81.1
Willow Tree to Murrurrundi	453 Kankool Access Road, 15m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	'Oakvale' Bounty Street, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
Murrurrundi	121, 125 Haydon Street, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	3 Pages River Road, 25 m	58.4	84.0	**62.5**	84.0	**63.1**	84.0
	8 Polding Street, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
	30 Polding Street, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
Murrurrundi to Scone	2 White Street Blandford, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	Lot 1 NEH Parkville, 40 m	56.3	80.0	**60.5**	80.0	**61.1**	80.0
	Lot 12 Mareeba Road, 25 m	58.4	84.0	**62.5**	84.0	**63.1**	84.0
	41 Mareeba Road, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
Scone	Eveleigh Court, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	2 Belmore St, 72 Kelly St, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	104 St Aubins Street, 10 m	**62.3**	**92.0**	**66.5**	**92.0**	**67.1**	**92.0**
	80 Kingdon Street, 10 m	**62.3**	**92.0**	**66.5**	**92.0**	**67.1**	**92.0**
	91 Kingdon Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	2, 5 Smith Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
Scone to Muswellbrook	Lot 11 NEH, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
	67 McAdam Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	78 NEH, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	47 Bedford Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	11 Alexander Circuit, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	622 NEH, 30 m	57.6	82.5	**61.7**	82.5	**62.3**	82.5
Muswellbrook	1,2,3 Aberdeen Street, 25 m	58.4	84.0	**62.5**	84.0	**63.1**	84.0
	220,222,224 Bridge Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	9 Wilkins Street, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	63 Ford Street, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	81, 82 Lower Hill Street, 20 m	59.3	**86.0**	**63.5**	**86.0**	**64.1**	**86.0**
	'Weidmann Village', 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
	2 William Lane, 15 m	**60.6**	**88.5**	**64.7**	**88.5**	**65.4**	**88.5**
Noise Criteria		65 LAeq,15hr day, 60 LAeq,9hr night, 85 LAmax					

1 49 background trains per day from the Project to Werris Creek Mine and 52 background trains per day from Werris Creek Mine to Muswellbrook.

Table 17 shows approximately 24 residences would currently receive noise levels over the night noise criterion or the maximum noise level criterion from existing train movements not associated with the Project. Additional background rail traffic, from known coal mining projects in the Gunnedah Basin excluding the Project, would result in average rail noise level exceedances of the night noise criterion at a total of approximately 39 residences. Additional train movements associated with the Project would increase train noise levels by approximately 0.6 to 0.7 dBA compared to noise from background rail traffic and would contribute to an average noise level exceedance of up to 0.6 dBA above the night noise criterion at three receivers located between Breeza and Willow Tree.

As Project-related train noise would represent approximately 14 % of all train movements on the Werris Creek - Moree Railway Line and Main Northern Railway to Muswellbrook, assuming all other projects are approved and begin operating, it is not considered reasonable to require Shenhua Watermark to directly address exceedances of the rail noise criteria at any receiver. Shenhua Watermark would, however, cooperate with any noise control strategies proposed by ARTC or another authority.

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 other coal trains.

Project-related train movements on the Main Northern Railway from Muswellbrook to the Port of Newcastle would represent less than 10% of all train movements, which is considered insignificant and does not require specific assessment according to the Draft Rail Infrastructure Noise Guideline.

9 CUMULATIVE NOISE LEVELS

Cumulative noise levels refer to total noise levels from the Project combined with other industrial or mining developments and are assessed to the amenity criteria shown in Table 2. For the purposes of a noise assessment, agricultural equipment such as tractors or harvesters are not considered to be industrial noise sources.

There are no existing significant sources of industrial noise in the vicinity of the Project that have the potential to contribute to cumulative noise levels at any receiver. Proposed, or possible future, sources of industrial noise would include BHP Billiton's Caroona Coal Project which is expected to include an underground longwall mining operation with associated surface infrastructure such as a CHPP. In the absence of detailed data regarding the Caroona Project, the following parameters have been assumed:

- A CHPP including conveyors, stockpiles, preparation plant and rail loadout facilities would be located north of Coonabarabran Road approximately 12 km south of The Dip Road; and
- The total sound power level of all Caroona Coal Project surface infrastructure would be approximately 125 dBA, which is at least 5 dBA lower than the total effective surface sound power level of the Project.

Noise contour figures in Appendix A indicate the 40 dBA contour generally runs approximately 3 km to 4.5 km from the nearest active mining area for the Project, depending on topography and prevailing wind direction. As the Caroona Coal Project is likely to include an underground mine which would be at least 5 dBA quieter than the Project, the Caroona Coal Project's 35 dBA noise contour would run approximately 3 km to 4.5 km from the Caroona CHPP depending on topography and weather conditions. At the expected maximum extent of 4.5 km from the Caroona CHPP, the Caroona Coal Project's 35 dBA contour would remain approximately 2 km outside the Project's 35 dBA contour. Based on this comparison, receivers located near or within the Caroona Coal Project's 35 dBA contour would be outside the 30 dBA contour for the Project, and vice versa, which indicates cumulative noise impacts of up to 40 LAeq,night are very unlikely to occur.

10 BLAST OVERPRESSURE AND VIBRATION

Blasting would be required to prepare overburden for removal and may be required for coal extraction. Blast effects including ground vibration and overpressure depend on the following factors:

- Ground conditions including rock types and layers;
- Groundwater conditions including extent and depth;
- Distance from the blast site to a sensitive receiver;
- How well the explosive charges are confined with stemming material;
- Maximum Instantaneous Charge (MIC) for the blast event;
- Topography between the blast site and receivers; and
- Atmospheric conditions including wind speed, wind direction and vertical temperature gradient.

A typical blast includes a number of separate charged holes which are detonated in a specific pattern to maximise the effectiveness of the blast. The MIC is determined by the weight of explosive material per hole multiplied by the maximum number of holes detonated simultaneously within the firing pattern, and is typically in the range 1000 kg to 2000 kg for large open cut coal mines such as the Project.

Blast effects have been calculated using the equations in Appendix J of AS 2187.2:2006. Common values of $K = 1140$ and $B = 1.6$ have been adopted for the ground vibration coefficients, although some site-specific adjustment to these parameters may be appropriate based on initial blast monitoring results.

10.1 Predicted Blast Effects

Table 18 shows calculated ground vibration and overpressure levels for closest blast events to each representative receiver location, taking into account topographical or other shielding between the blast site and the receiver where relevant. Results have been calculated in the absence of mitigation measures and should be compared with the 5 mm/s and 115 dB criteria for occupied residences and the alternative criteria listed in Table 18 for heritage and other sensitive structures. Calculated overpressure levels assume a typical well confined bench blast.

Table 18: Predicted Blast Effects at Residences and Structures, No Mitigation.

MIC, kg	1000	1500	2000	1000	1500	2000	Criteria
Receiver (closest distance)	Ground Vibration, mm/s			Overpressure, dBL			mm/s, dBL
25 west (4900)	0.4	0.5	0.6	98	99	100	5, 115
32 west (1450)	2.5	3.5	4.4	111	112	113	5, 115
32 east (3700)	0.6	0.8	1.0	101	102	103	5, 115
62 east (1850)	1.7	2.4	3.0	108	109	110	5, 115
103 (4250)	0.5	0.6	0.8	100	101	102	5, 115
105 (4450)	0.4	0.6	0.7	99	100	101	5, 115
125 (1650)	2.0	2.8	3.6	109	111	112	5, 115
Farm Complex 3 - The Wilgas (730)	7.5	10.4	13.1	118	119	120	15, 133
Farm Complex 7 - Inverness (2050)	1.4	2.0	2.5	107	108	109	15, 133
Farm Complex 12 - Tilbrook (1730)	1.9	2.6	3.3	109	110	111	15, 133
Farm Complex 13 - Wattle Vale (1350)	2.8	3.9	4.9	112	113	114	15, 133
Breeza Cemetery (4000)	0.5	0.7	0.9				2, -
Central Ranges Gas Pipeline (970)	4.8	6.6	8.3	-	-	-	25, -

Results in Table 18 indicate blasting associated with the Project is expected to produce acceptable ground vibration and overpressure levels at all privately owned receivers and at all identified heritage structures.

Additional calculations have been completed to determine appropriate setback distances from a blast site to a potentially sensitive structure such as a buried irrigation pipeline. Assuming a large blast event with an MIC of 2000 kg, a setback distance of 320 m would be sufficient to meet a criterion of 50 mm/s for buried water pipelines and similar structures.

An average of 20 blast events per month or 5 blasts per week are likely to be required for the proposed production rate.

10.2 Blast Management Measures

Initial calculations described above have indicated exceedances of relevant vibration and overpressure criteria may occur at two of the closest sensitive structures in the absence of mitigation measures. The following mitigation and management measures are recommended to control and minimise blast effects to any sensitive receiver:

- Blasting should not occur closer than 500m to any occupied or sensitive building or structure unless adequate controls are implemented to minimise the risk of fly rock;
- A qualified geotechnical, building or engineering expert should inspect and assess buildings or structures within The Wilgas Farm Complex, to determine appropriate ground vibration and overpressure limits and record the current condition of each building or structure. Recommended vibration and overpressure limits for each building or structure would be included in the Blast Management Plan;
- All blasts should be monitored, at receiver locations or alternative representative locations, to confirm acceptable blast impacts and to assist in predicting future blast effects as the blast sites approach sensitive receivers;
- Electronic detonators should be used where necessary to provide accurate timing and firing patterns to minimise the chance of excessive ground vibration;

- Blasts requiring a reduced MIC to meet vibration criteria could include one or more of the following options:
  - Lower density explosives;
  - Deck loading;
  - Reduced hole diameter;
  - Reduced blast area; or
  - Reduced blast bench height.
- Blasts requiring a reduced overpressure level to meet relevant criteria could include one or more of the following options:
  - Appropriate aggregate of sufficient depth could be used for stemming material to contain the blast energy;
  - Sufficient burden (distance between rows) could be designed to minimise the risk of face blowout;
  - Each blast could be oriented, where possible, to avoid facing towards the most sensitive receiver;
  - The hole pattern could be designed to fire the closest holes first, to minimise the risk of overpressure reinforcement;
  - Weather conditions, specifically wind speed and direction and cloud cover, should be monitored before each blast and any weather related effects should be considered when predicting overpressure levels and designing the blast pattern.
- The Blast Management Plan should include detailed procedures and notification requirements for any temporary road closures that may be required during blast events close to public roads.

Potential blast effects on livestock, including the risk of injury from flyrock, should also be considered in the Blast Management Plan. In general, livestock would quickly become accustomed to noise and vibration from blast events which would limit the potential for any ongoing impact on livestock health.

11 CONCLUSION

This assessment shows a number of privately owned receivers near the Project are expected to receive noise levels above the adopted intrusive noise criterion during the most sensitive night period, after all feasible and reasonable noise mitigation measures have been applied to the Project.

One residence is expected to receive noise levels over the intrusive criterion during day neutral conditions. Prevailing weather conditions during the day would result in 4 significantly affected, 1 moderately affected and 4 mildly affected residences.

Prevailing weather conditions during the most sensitive night period would result in 7 significantly affected residences owned by 6 land owners, one of which also owns a moderately affected residence (Residence 32 east). An additional 4 moderately affected residences are owned by 4 land owners while 14 residences owned by 13 land owners would be mildly affected by the Project during prevailing weather conditions during the most sensitive night period. Consultation with potentially affected receivers is recommended to resolve any issues.

Typical construction noise levels are expected to be acceptable at privately owned residences during all time periods, with the exception of Receiver 125 which would also remain affected by operational noise. Worst case construction noise levels would most likely exceed the conservative operational noise criterion during neutral and prevailing weather conditions in the absence of mitigation measures. A construction noise management plan is therefore recommended to minimise construction noise impacts at this receiver.

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 operational noise levels.

Noise from road traffic associated with construction activities and ongoing operation of the Project would remain within relevant traffic noise criteria at all receivers. No traffic noise mitigation measures are required or have been recommended.

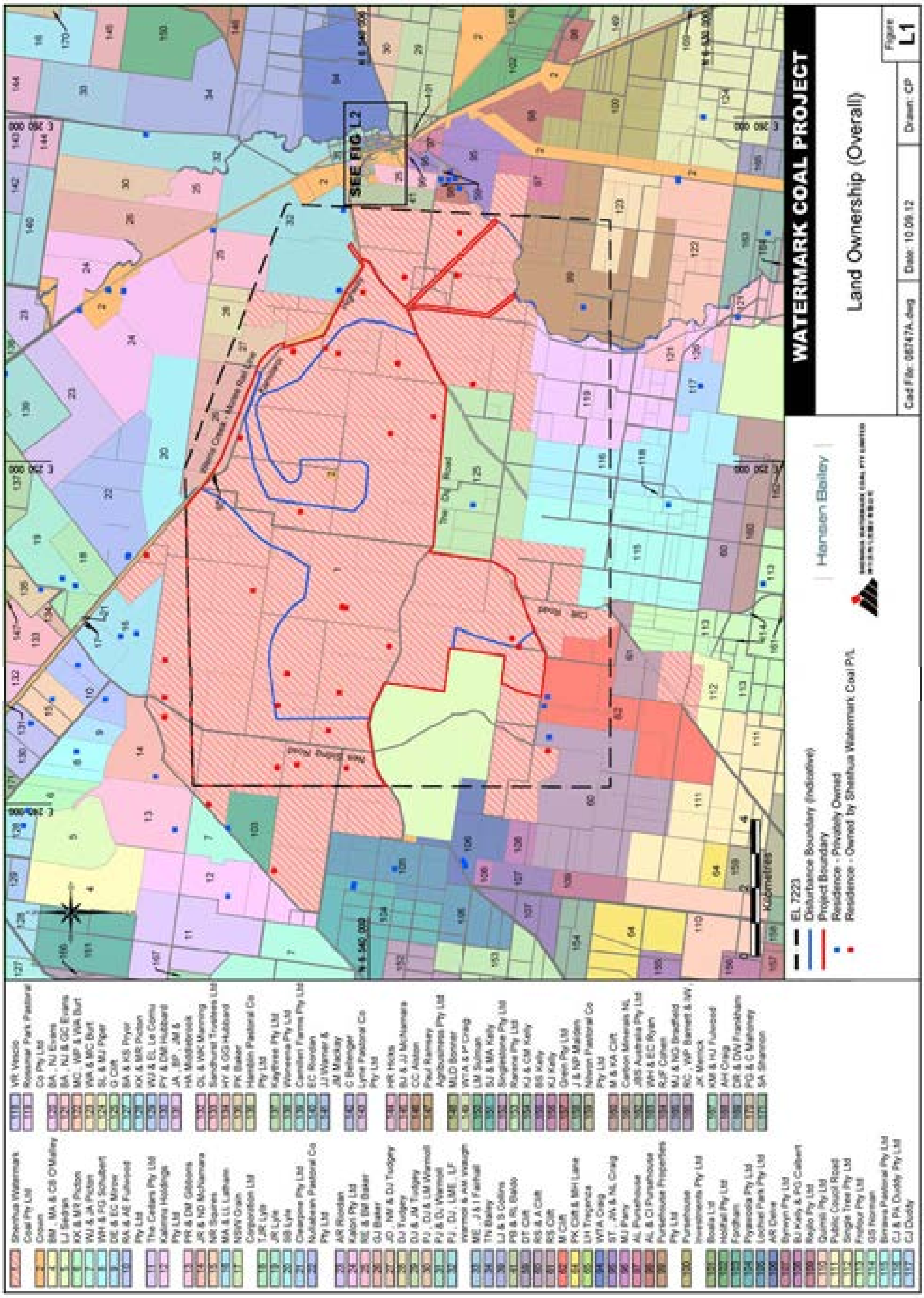
Existing and future background rail traffic noise levels, in the absence of the Project, are expected to exceed relevant noise criteria at two receivers in Breeza. Additional rail traffic noise associated with the Project would increase average rail traffic noise levels by approximately 0.6 to 0.7 dBA at potentially affected receivers, which is considered insignificant.

Low frequency noise levels from the Project are implicitly controlled by the intrusive noise criteria, as intended by the INP, so low frequency noise impacts are unlikely to occur at any privately owned receiver. Cumulative noise levels, with simultaneous operation of the Project and the adjoining Caroona Coal Project, are unlikely to occur given the extended distance to the likely location of the Caroona Coal Project's surface infrastructure. A future environmental assessment of the Caroona Coal Project would include a more detailed cumulative noise assessment when sufficient details are available for the Project.

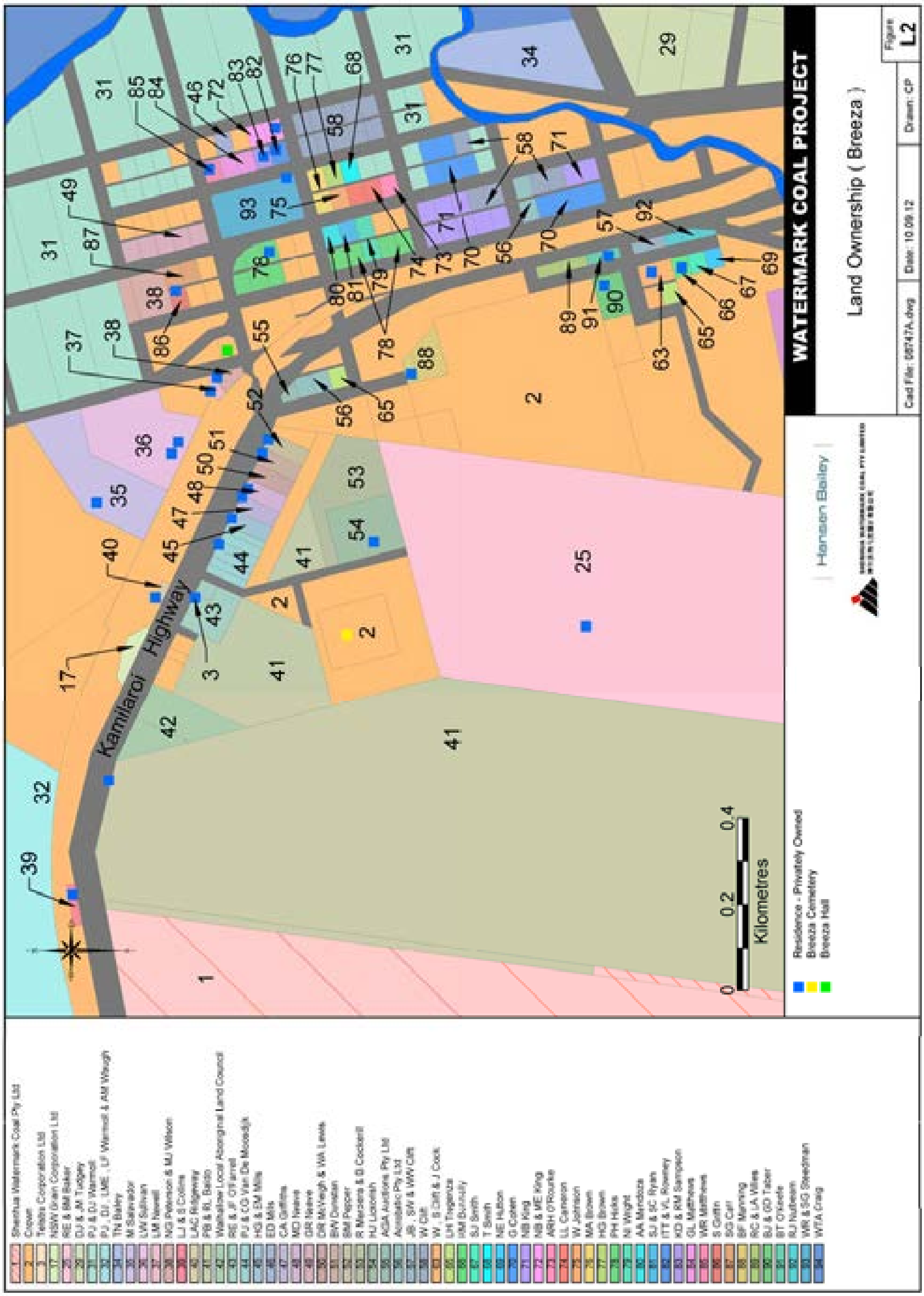
Blasting associated with the Project is unlikely to exceed relevant ground vibration and overpressure criteria at all privately owned residences, given the relatively large distances to nearest sensitive receivers. Blast impacts are expected to be acceptable at identified sensitive heritage structures, although a blasting vulnerability study by a suitably qualified and experienced structural engineer is recommended to confirm the adopted criteria and minimise the risk of damage to sensitive structures owned by Shenhua Watermark.

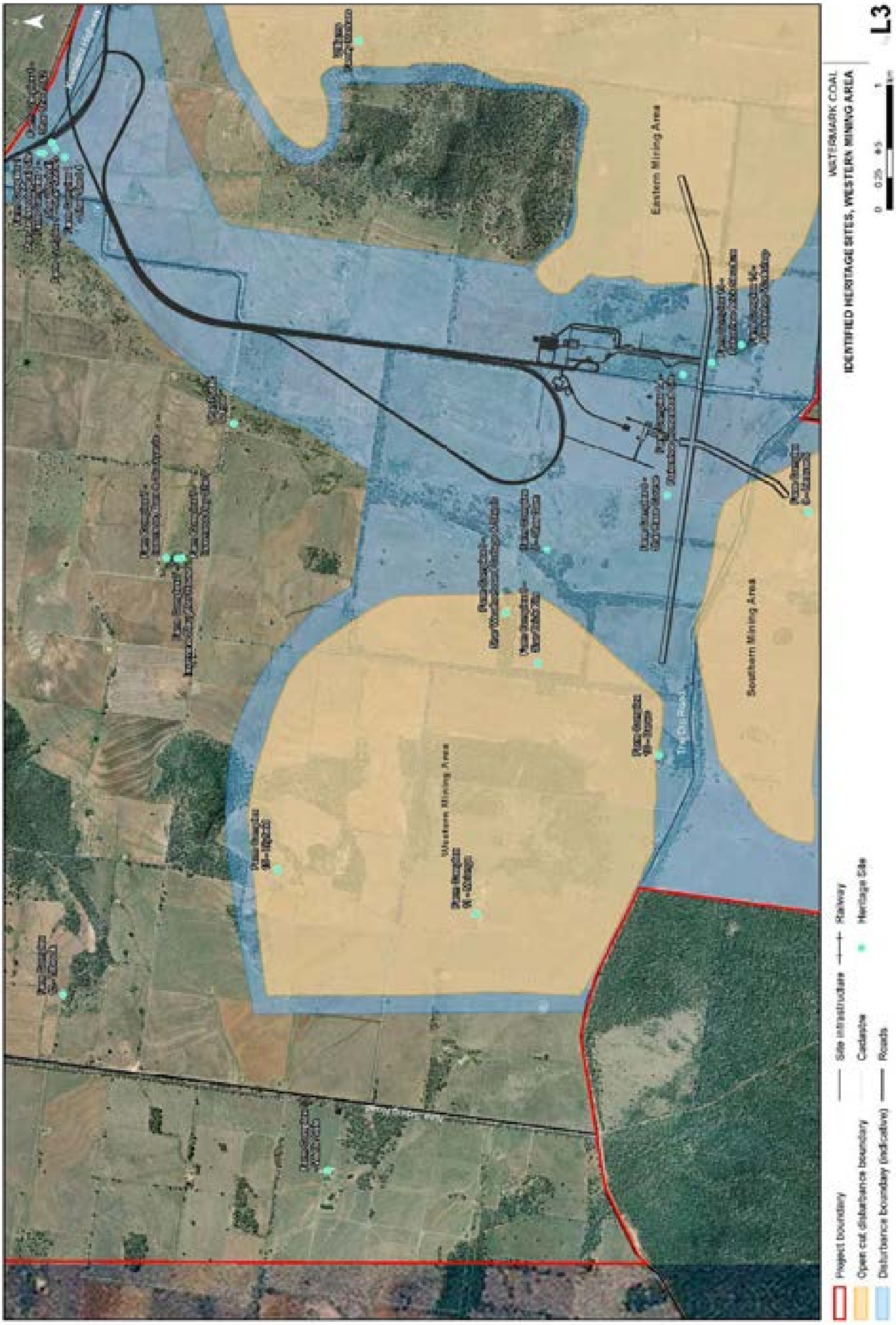
A detailed blast management plan is recommended to control ground vibration levels to residences and sensitive structures and to minimise disruption to the community due to local road closures that may be intermittently required.

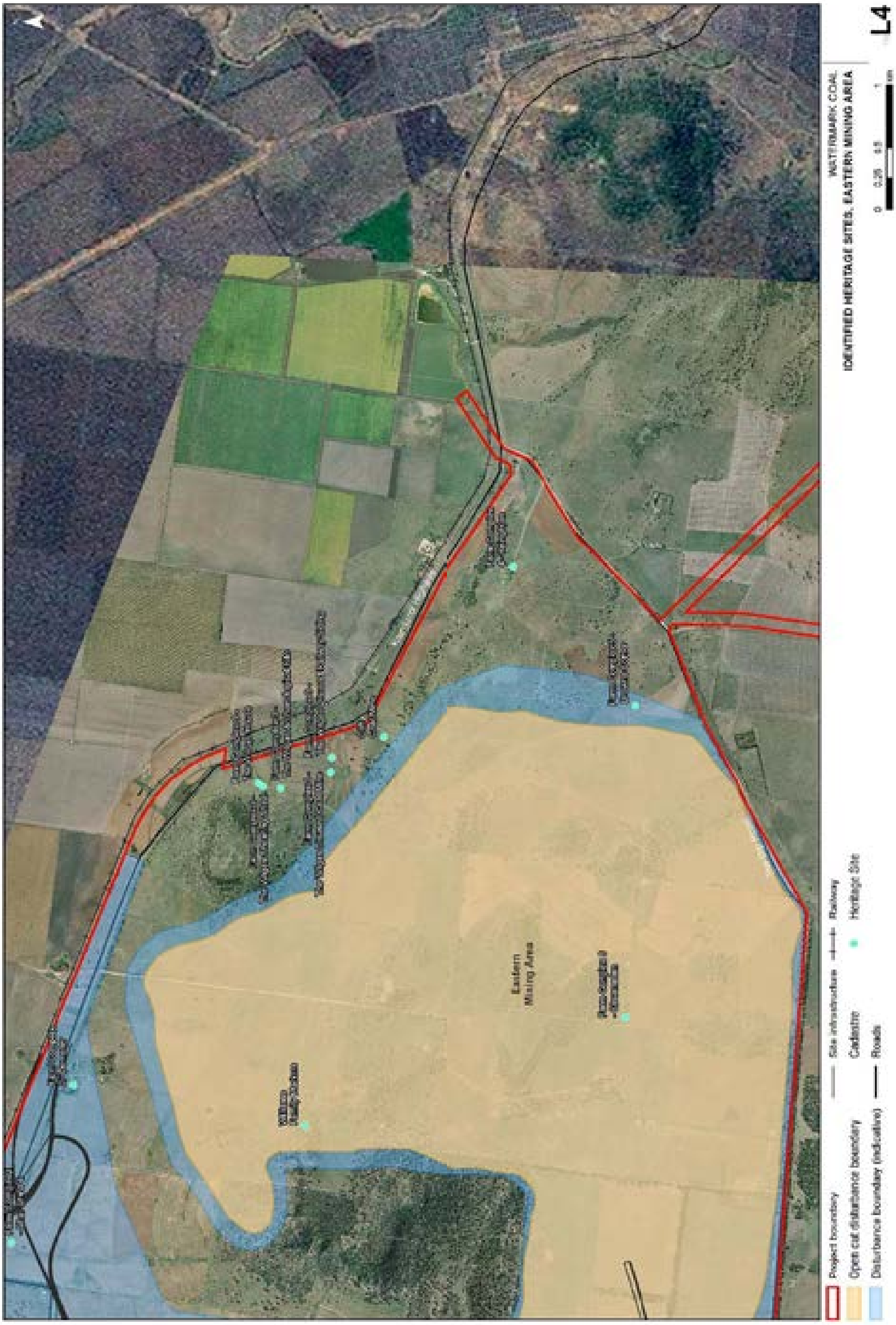
APPENDIX A – NOISE CONTOUR FIGURES



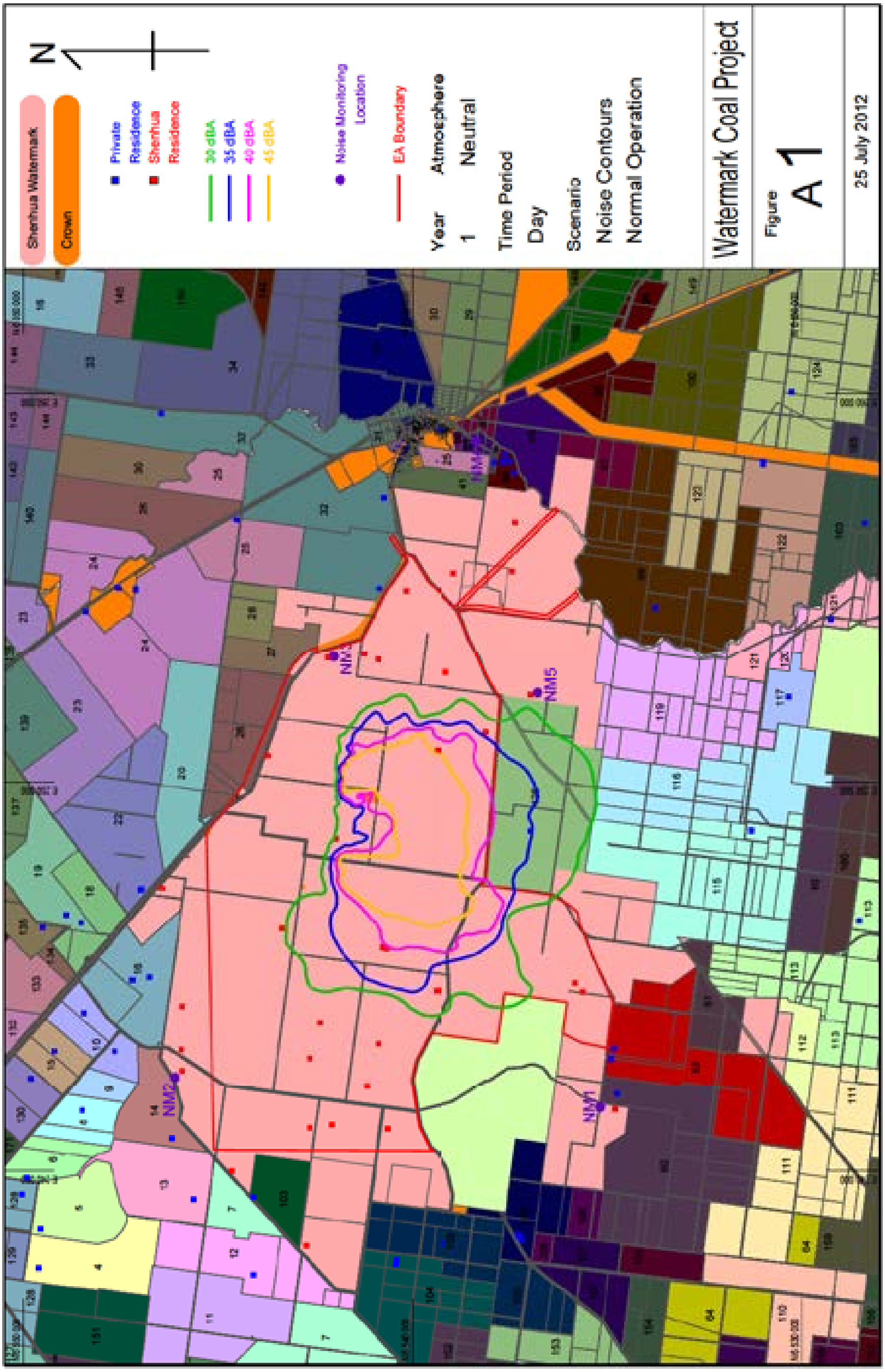
BRIDGES Acoustics


WATERMARK COAL PROJECT
Land Ownership (Breeza)
Figure L2
Kamilaroi Highway
Kilometres
0 0.2 0.4
Residence - Privately Owned
Breeza Cemetery
Breeza Hall
Hansen Bailey

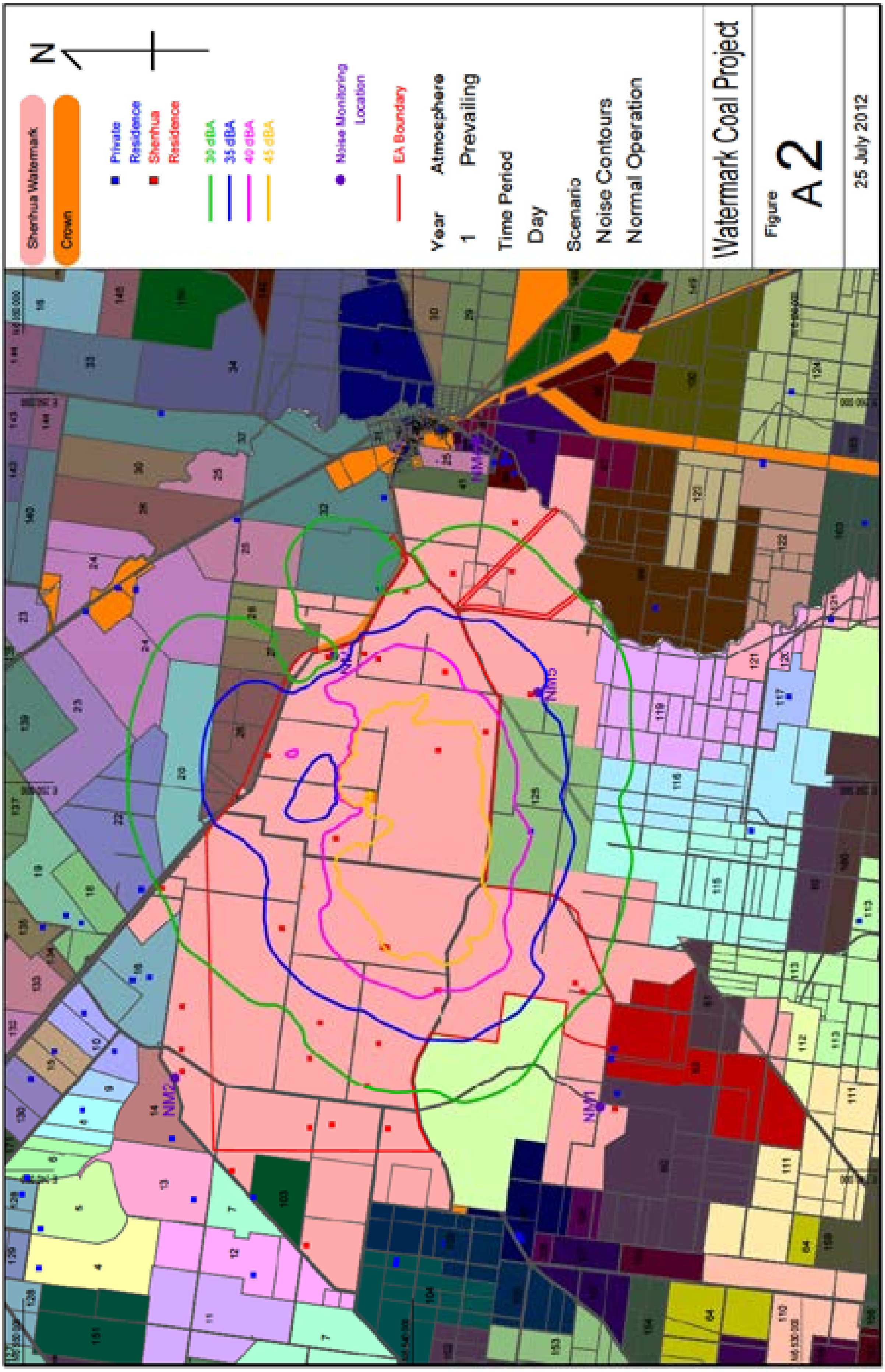

WATERMARK COAL
IDENTIFIED HERITAGE SITES, WESTERN MINING AREA
L3
Eastern Mining Area
Southern Mining Area
Western Mining Area
Project boundary
Open cut disturbance boundary
Disturbance boundary (indicative)
Site infrastructure
Cadastre
Roads
Railway
Heritage Site



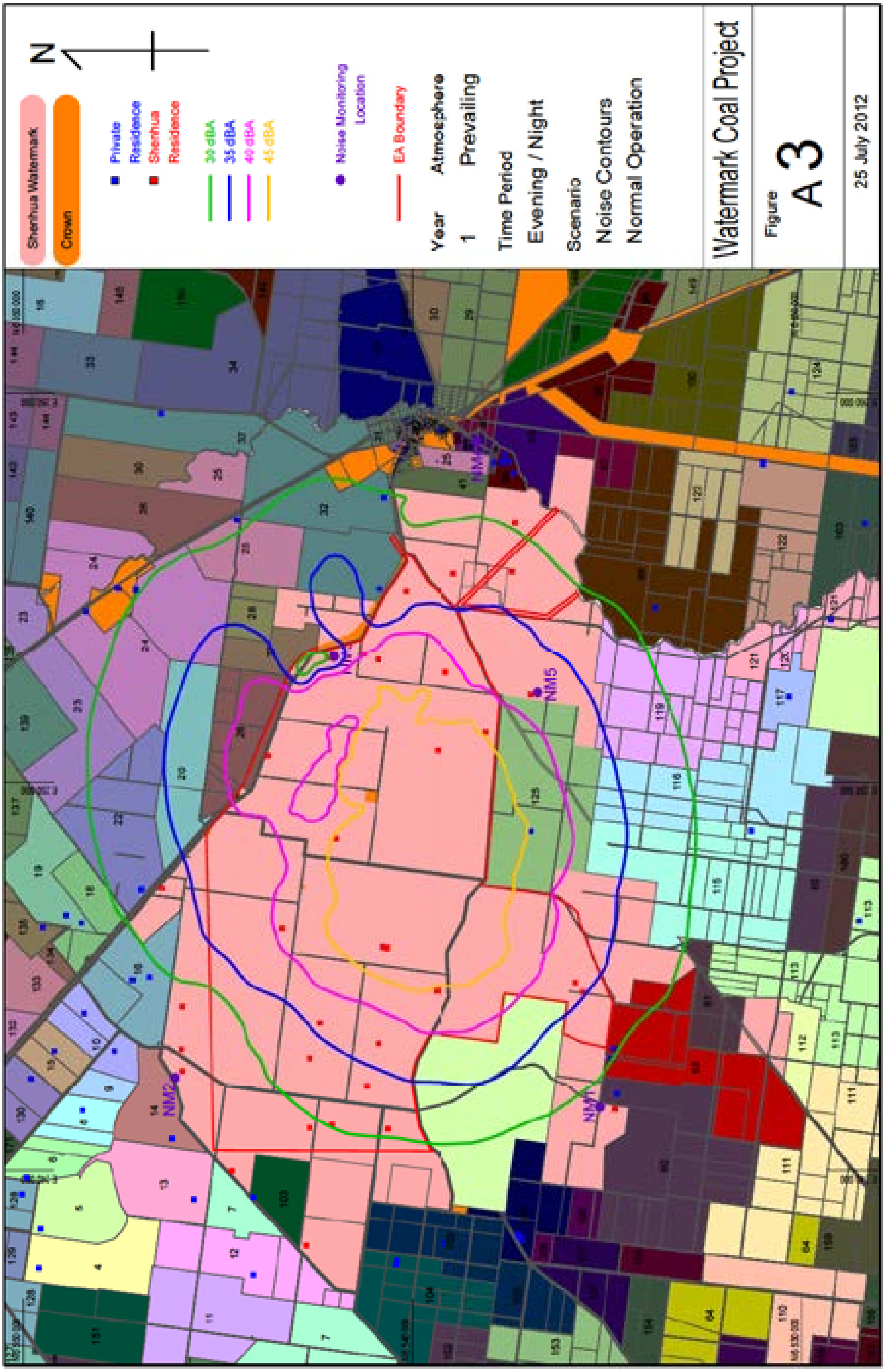
L4
WATERMARK COAL
IDENTIFIED HERITAGE SITES, EASTERN MINING AREA
0 0.25 0.5 1 km
Project boundary
Open cut disturbance boundary
Disturbance boundary (indicative)
Site infrastructure
Cadastre
Roads
Railway
Heritage Site
Eastern Mining Area

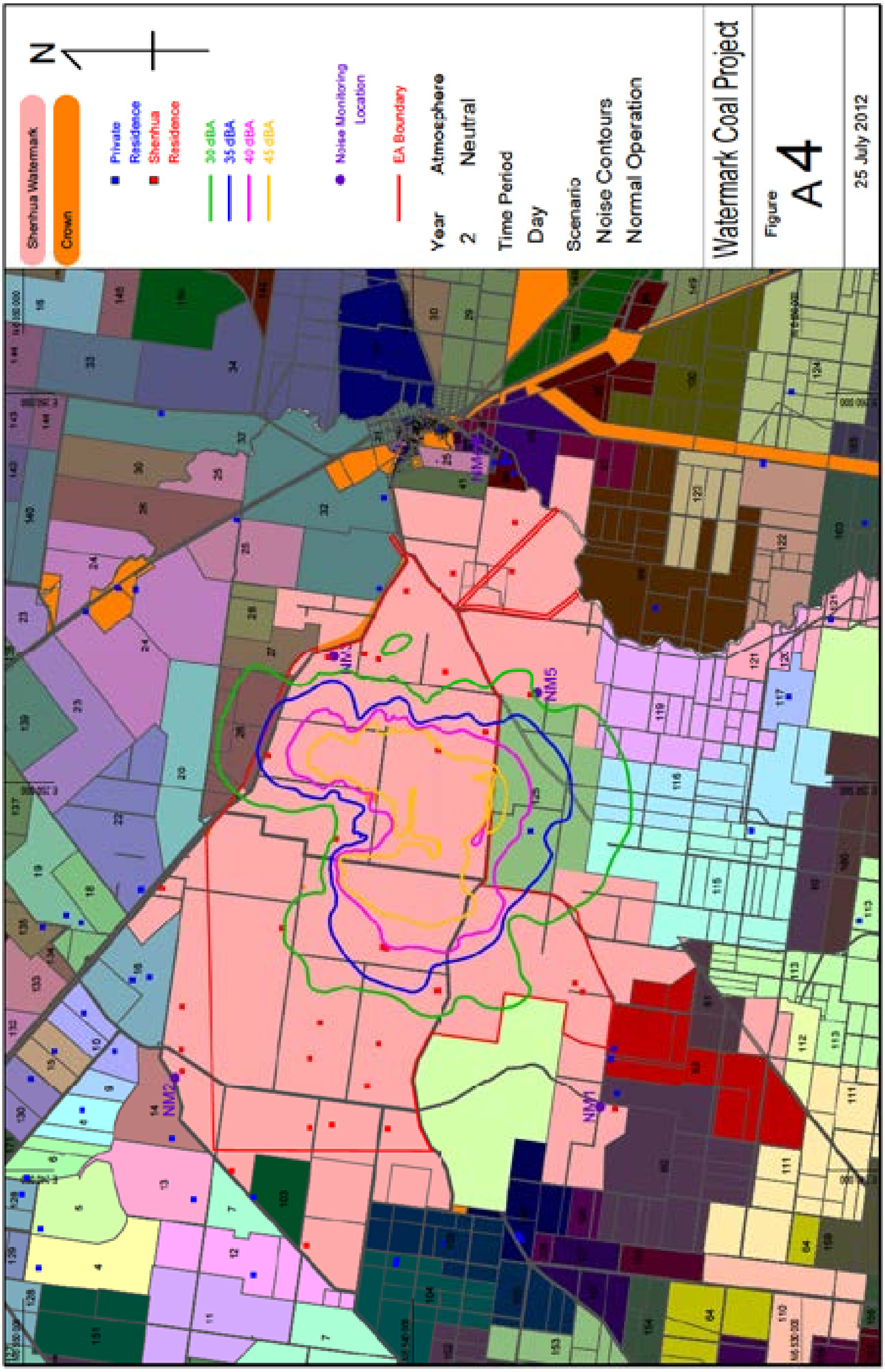


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year 1
Atmosphere Neutral
Time Period Day
Scenario Noise Contours Normal Operation
Watermark Coal Project
Figure A1
25 July 2012
NM1
NM2
NM5

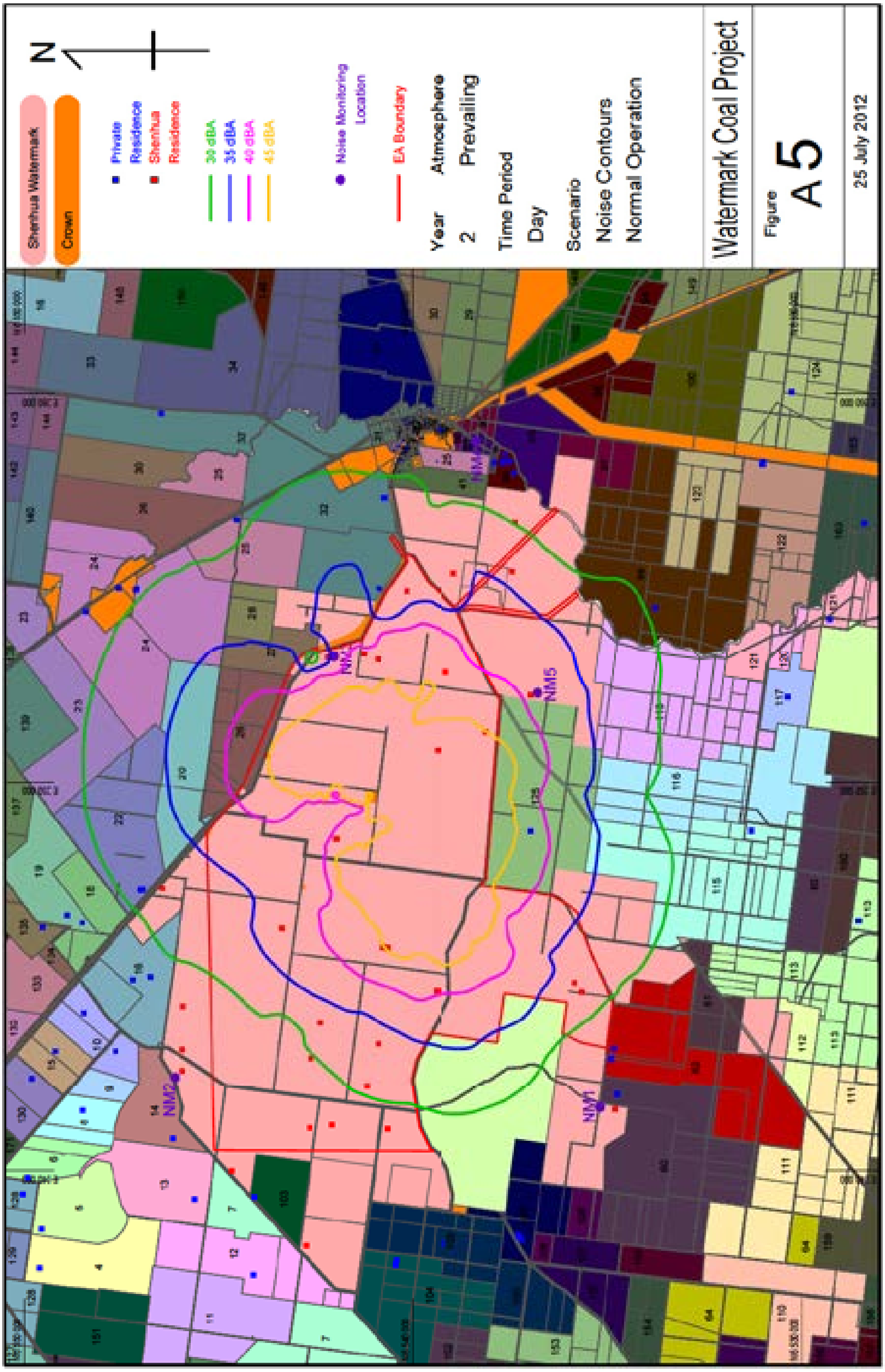


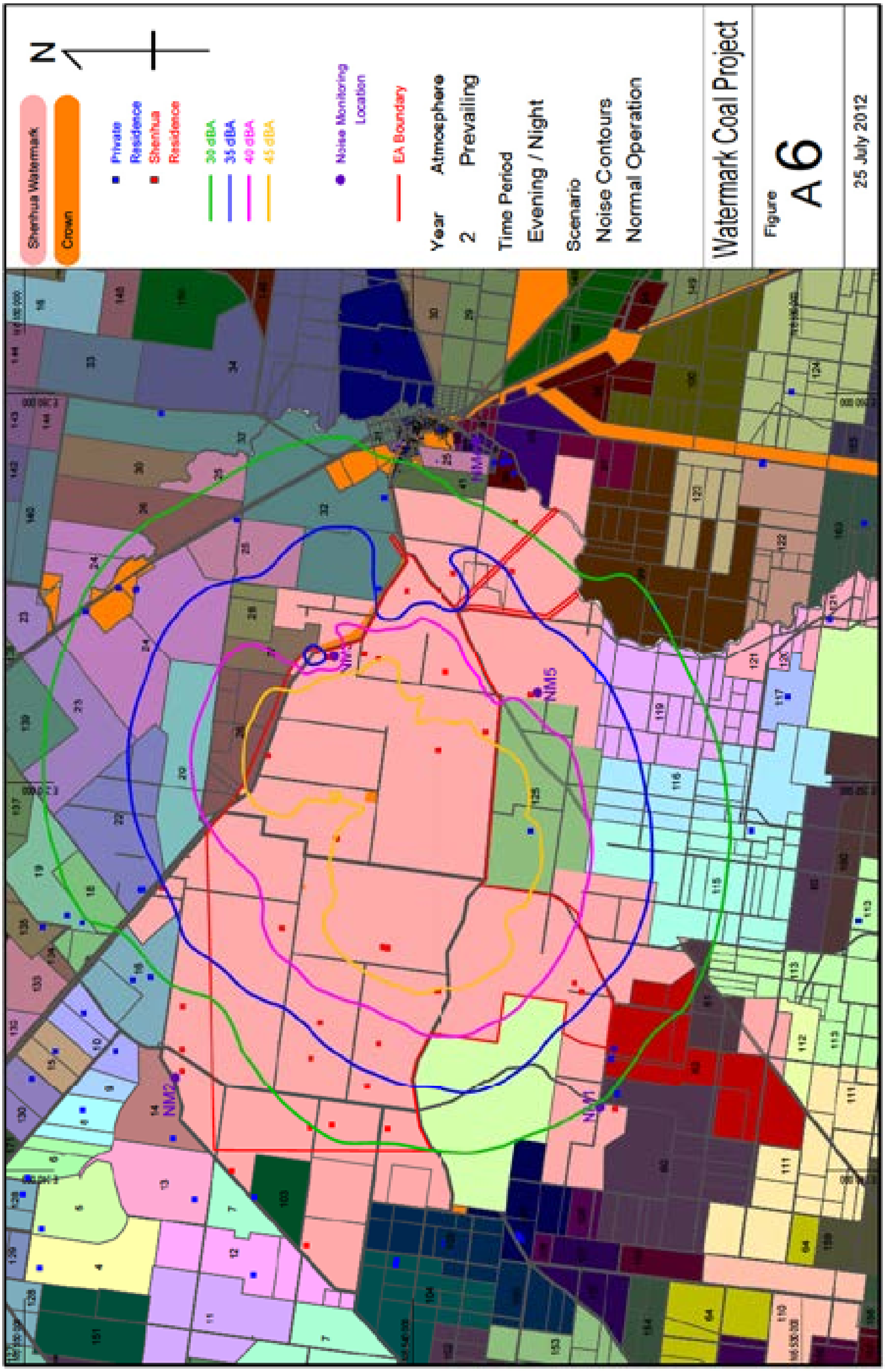
BRIDGES Acoustics

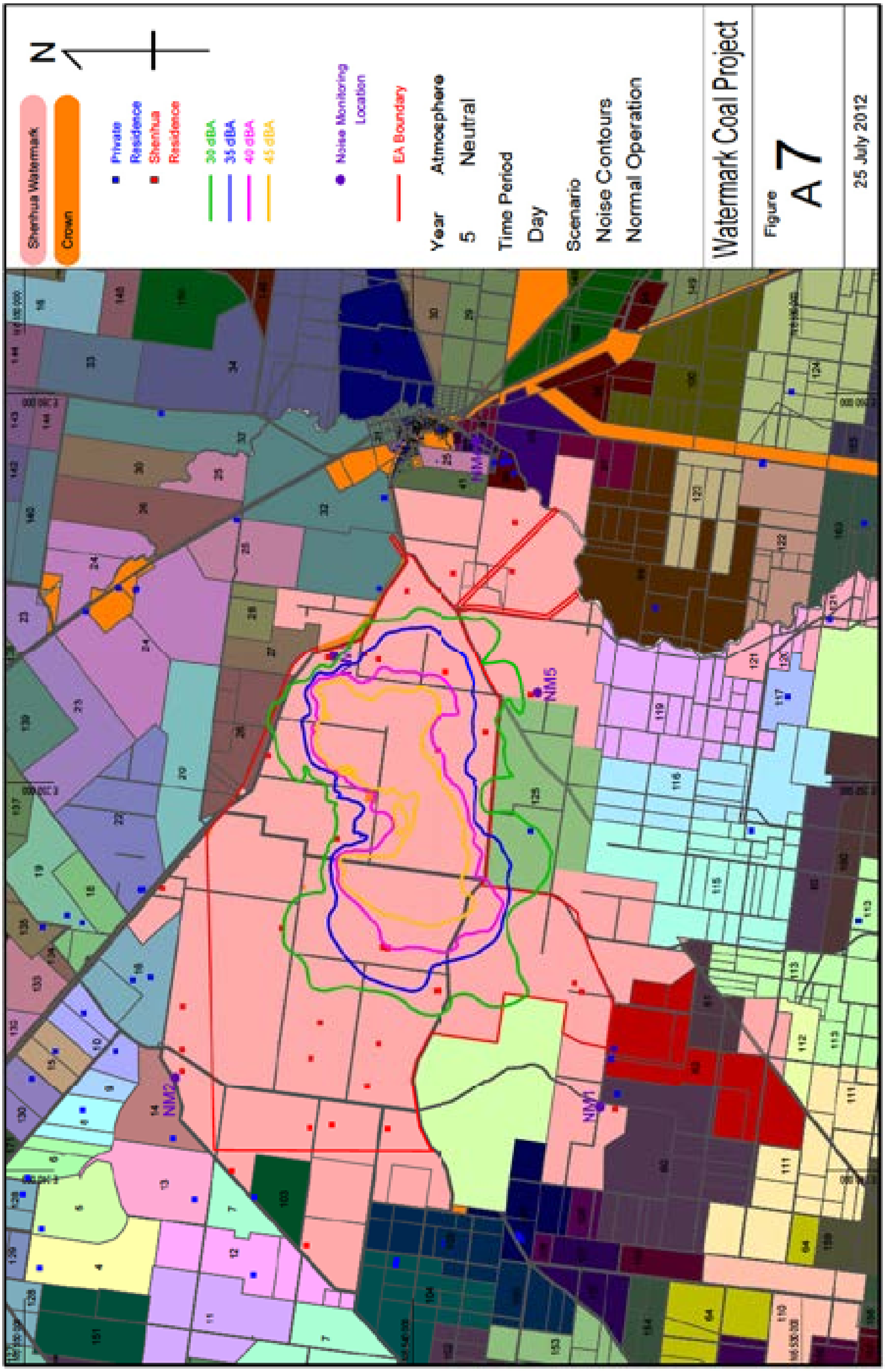

N
Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
1
Atmosphere
Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 3
25 July 2012
NM1
NM2
NM5

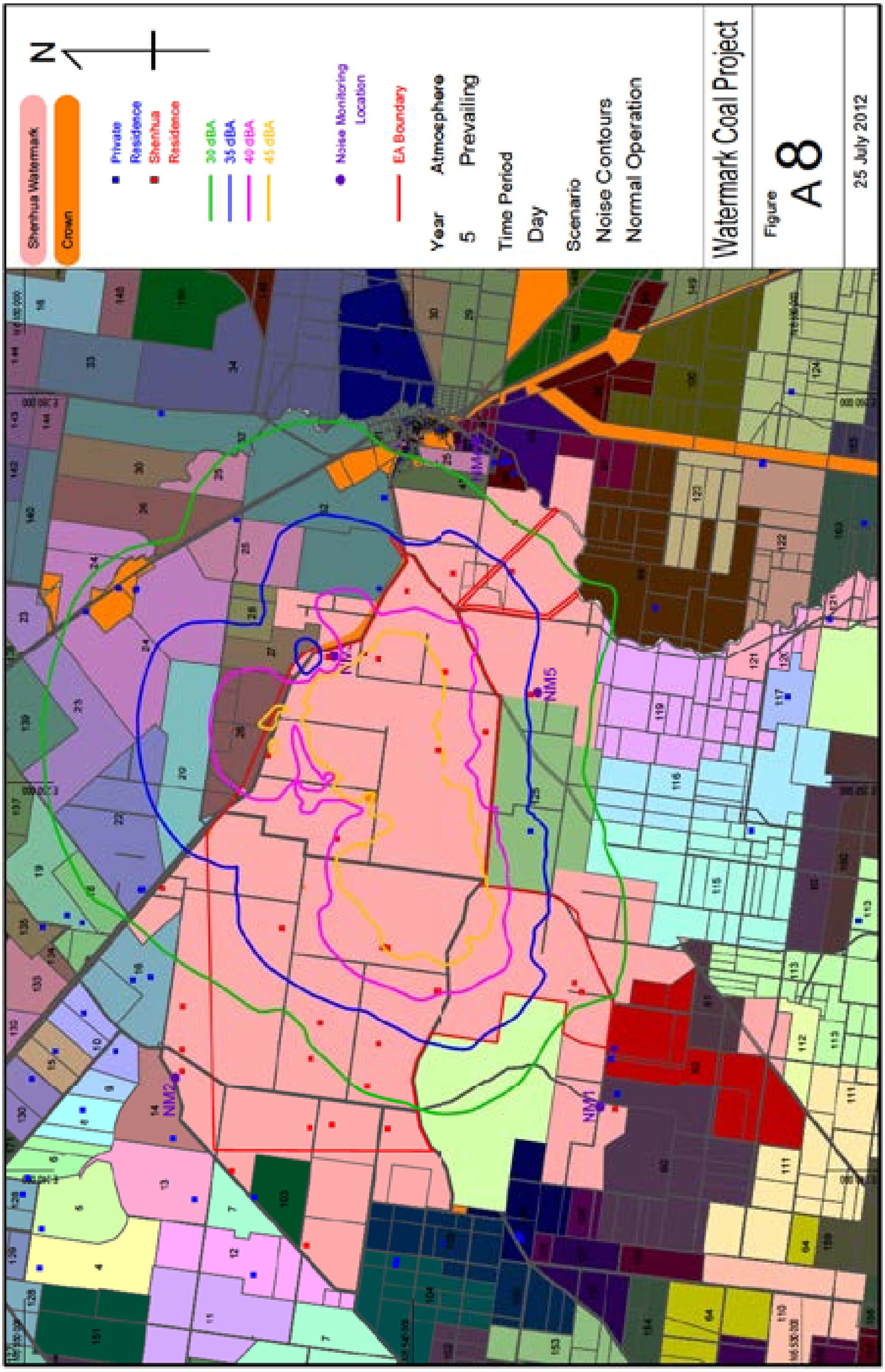


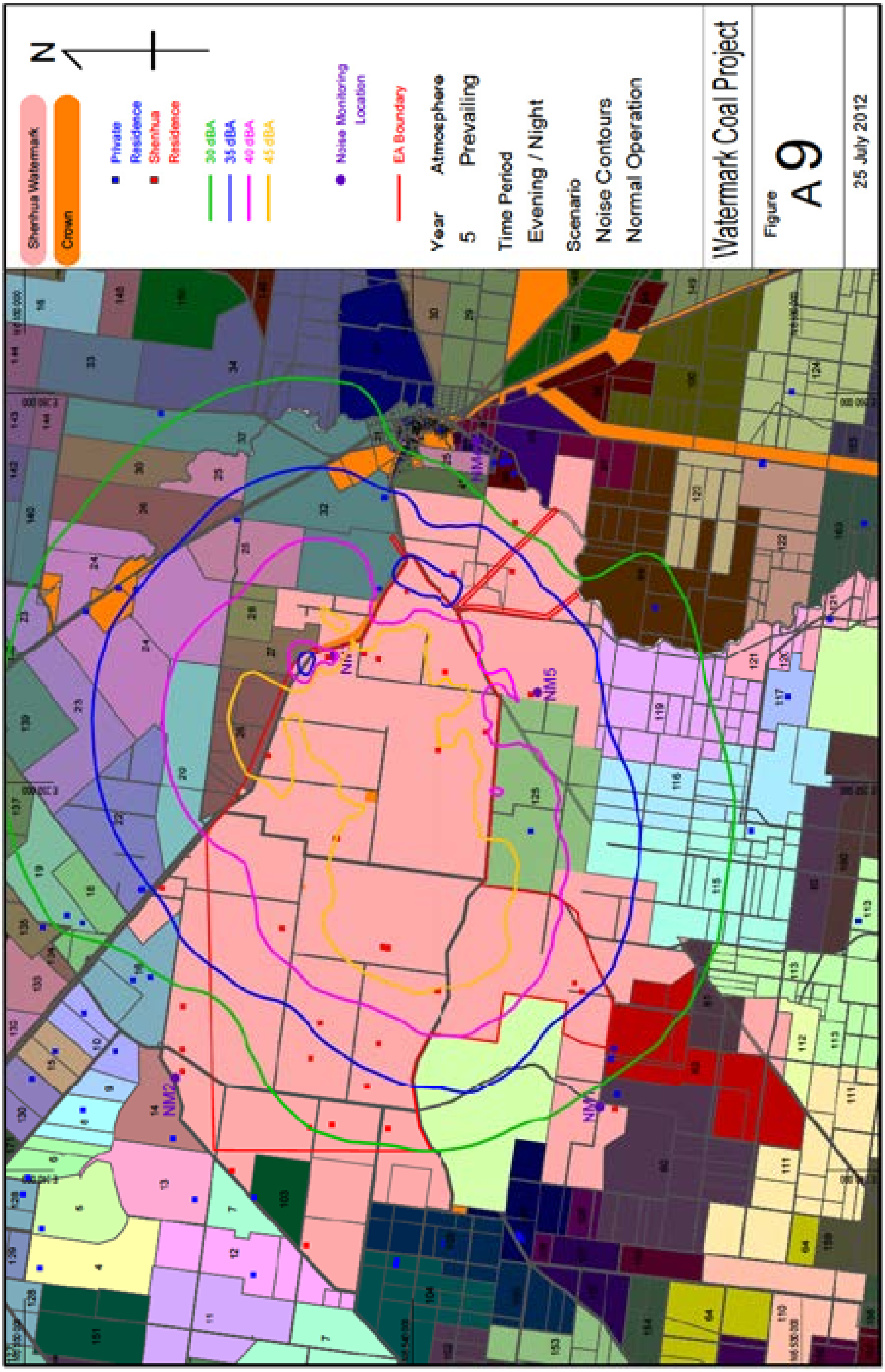
BRIDGES Acoustics

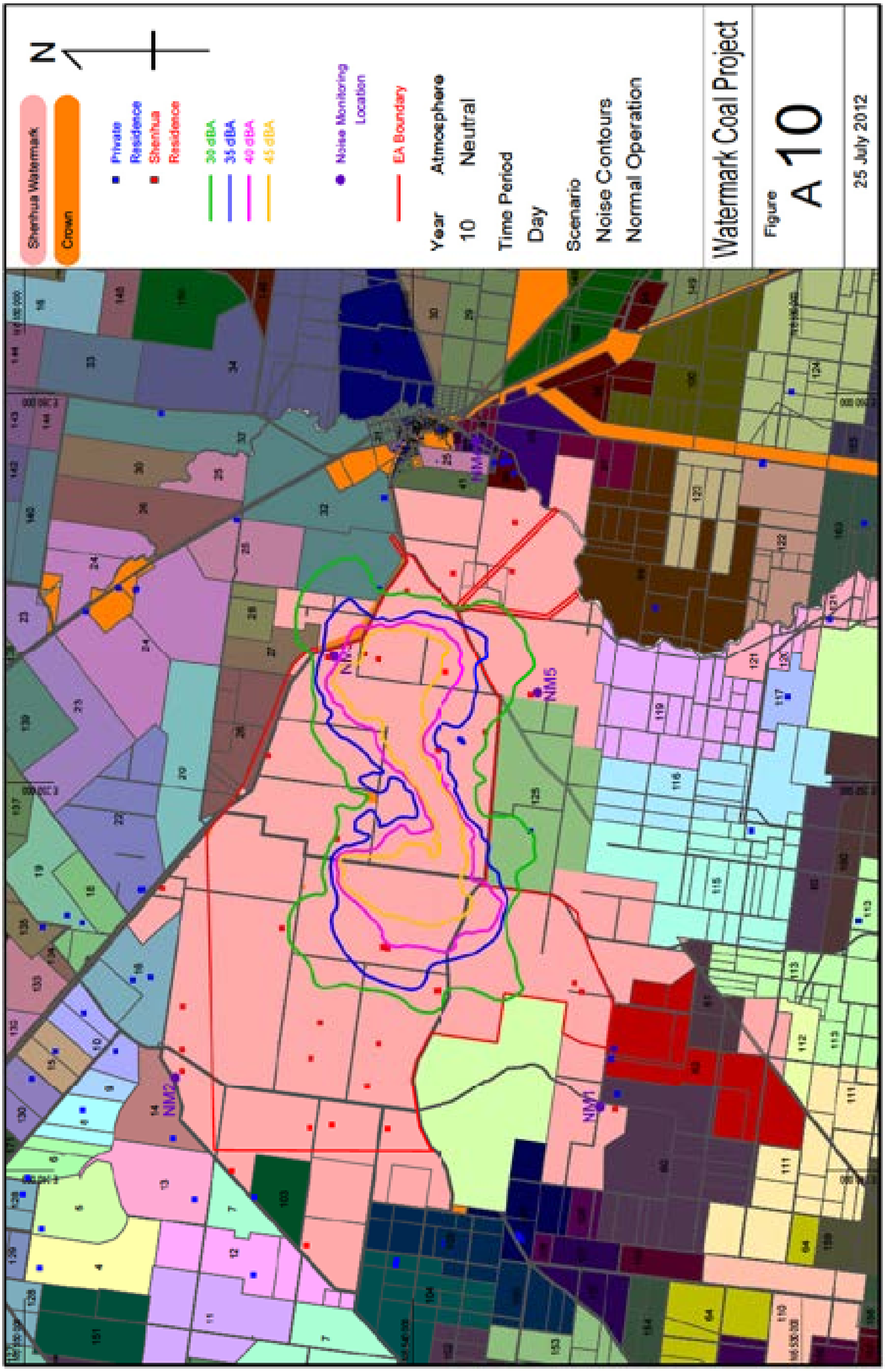

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
2
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A5
25 July 2012
NM1
NM2
NM3
NM5


N
Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
2
Atmosphere
Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A6
25 July 2012

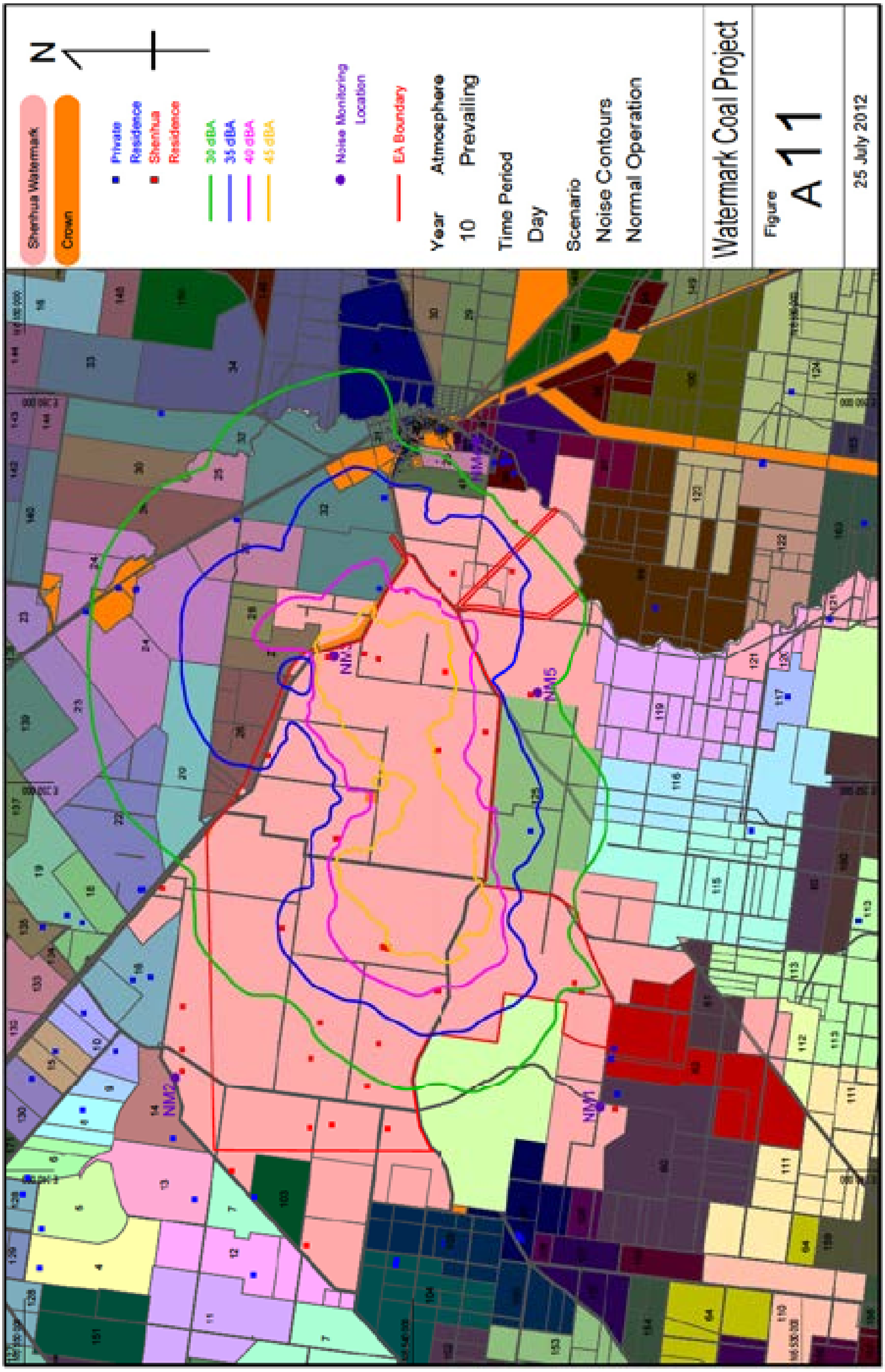

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year 5
Atmosphere Neutral
Time Period Day
Scenario Noise Contours Normal Operation
Watermark Coal Project
Figure A7
25 July 2012
NM1
NM2
NM5

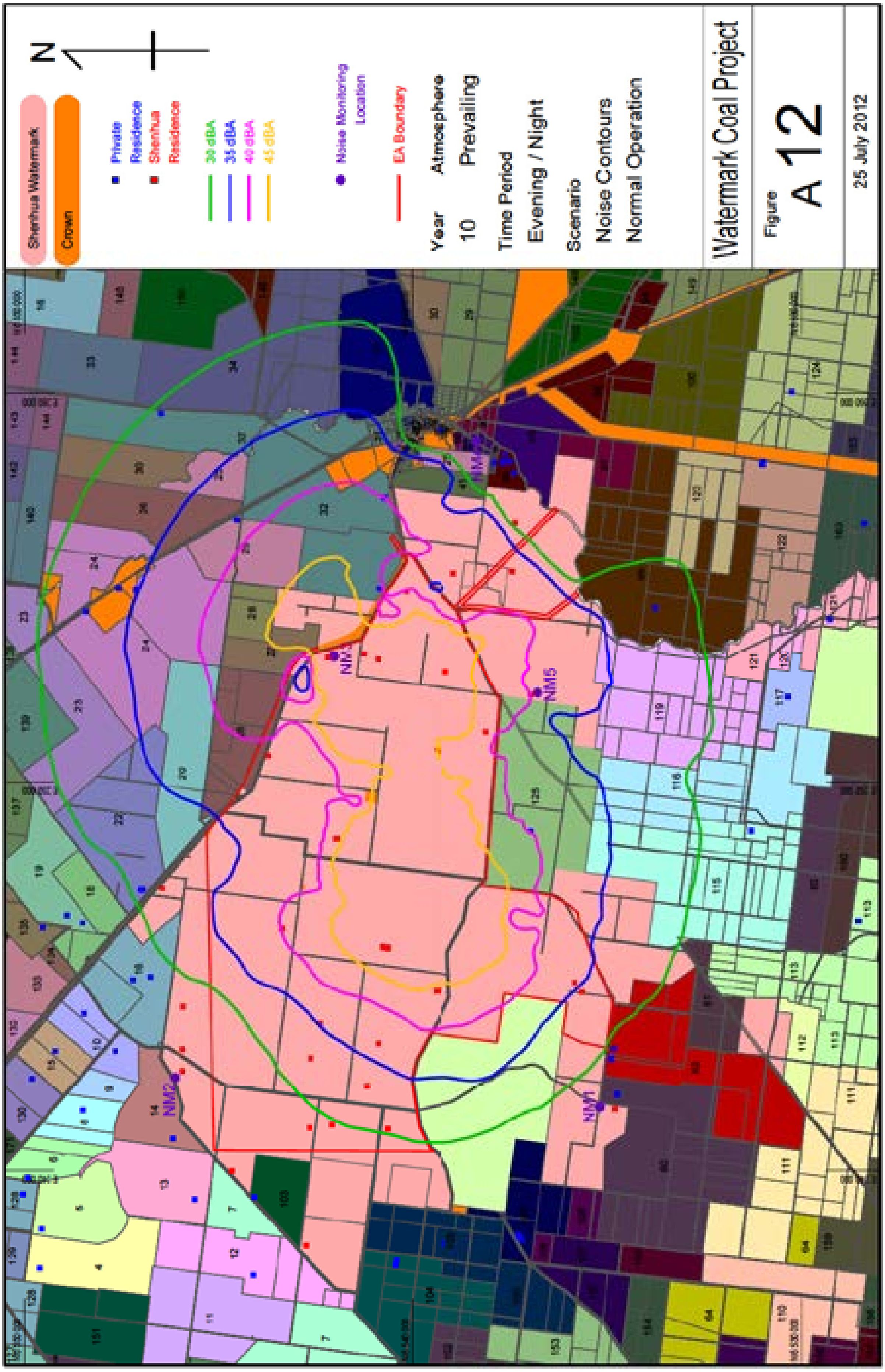

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
5
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A8
25 July 2012
NM1
NM2
NM5


N
Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year 5
Atmosphere Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure A9
25 July 2012
NM2
NM5



BRIDGES Acoustics


Shenhua Watermark
Crown
N
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
10
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 11
25 July 2012
NM1
NM2
NM5



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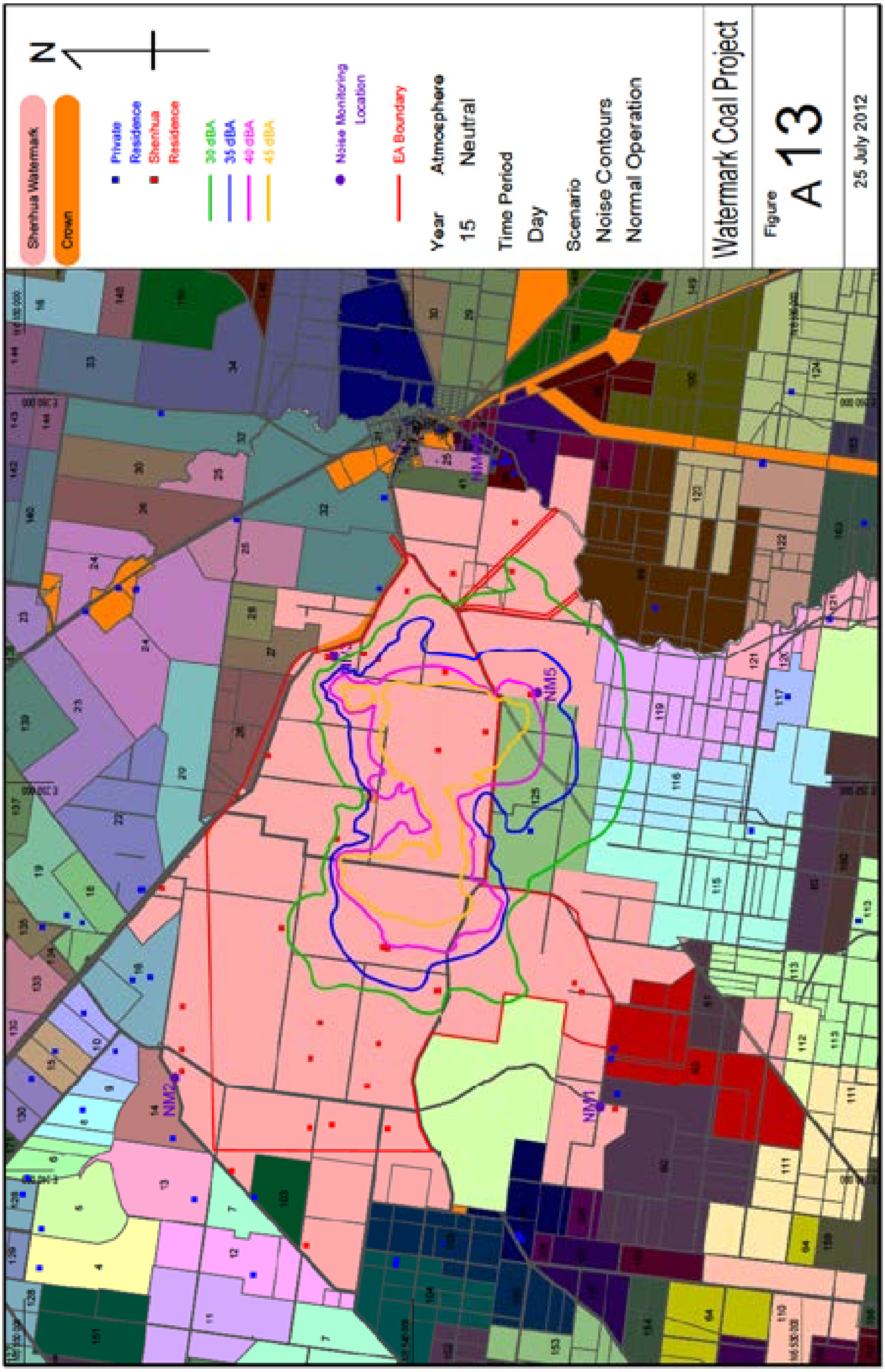
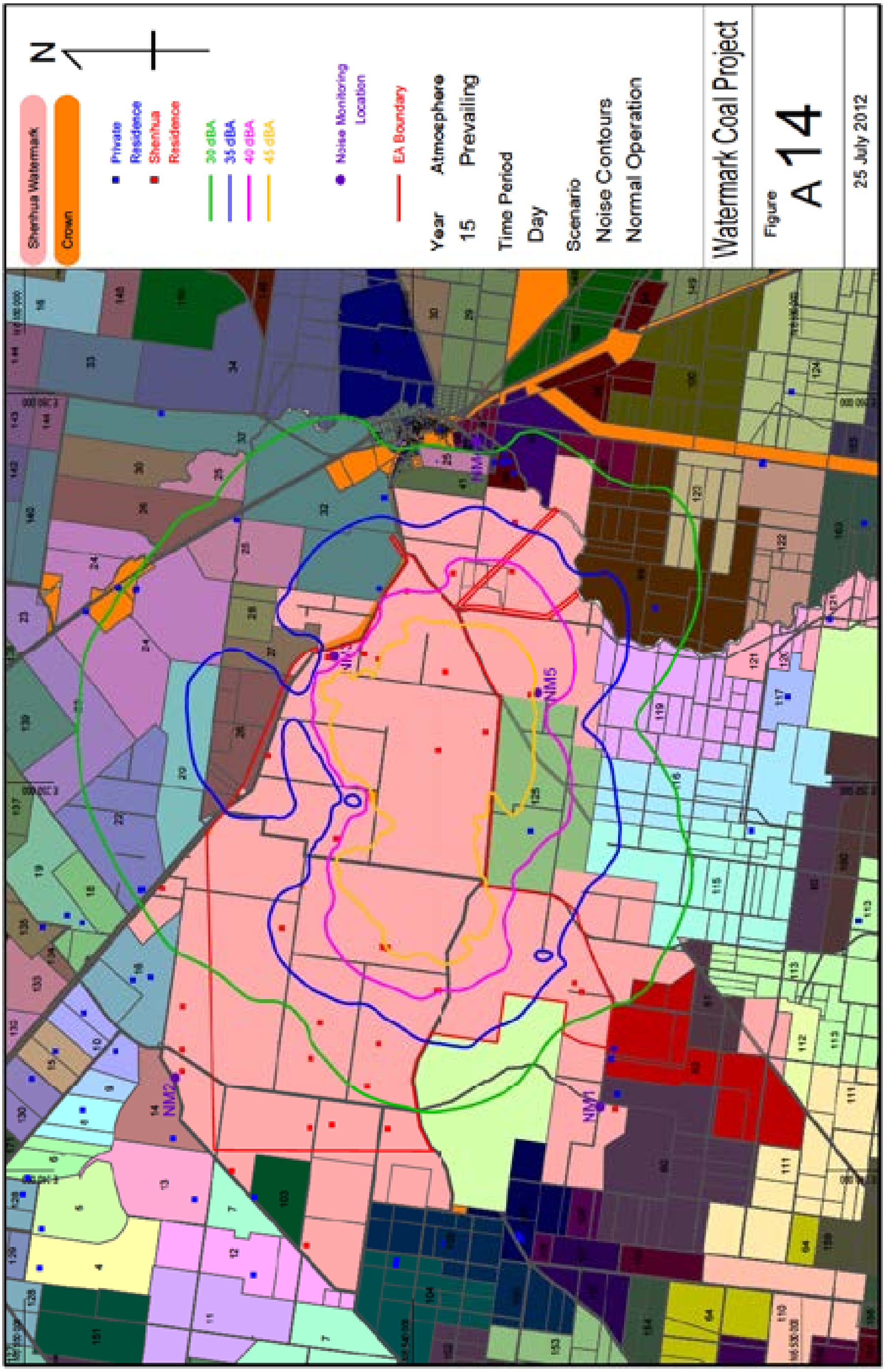
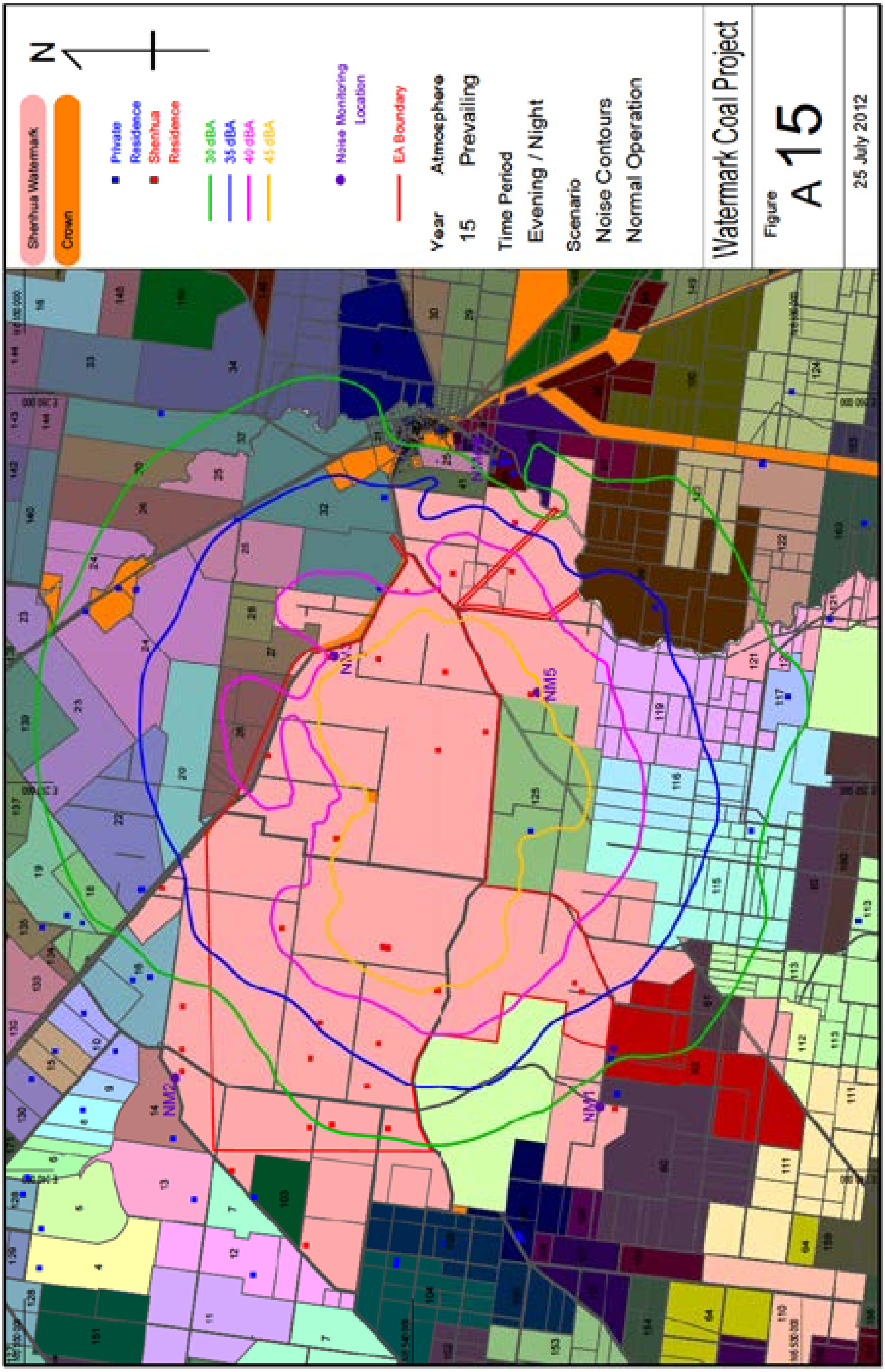
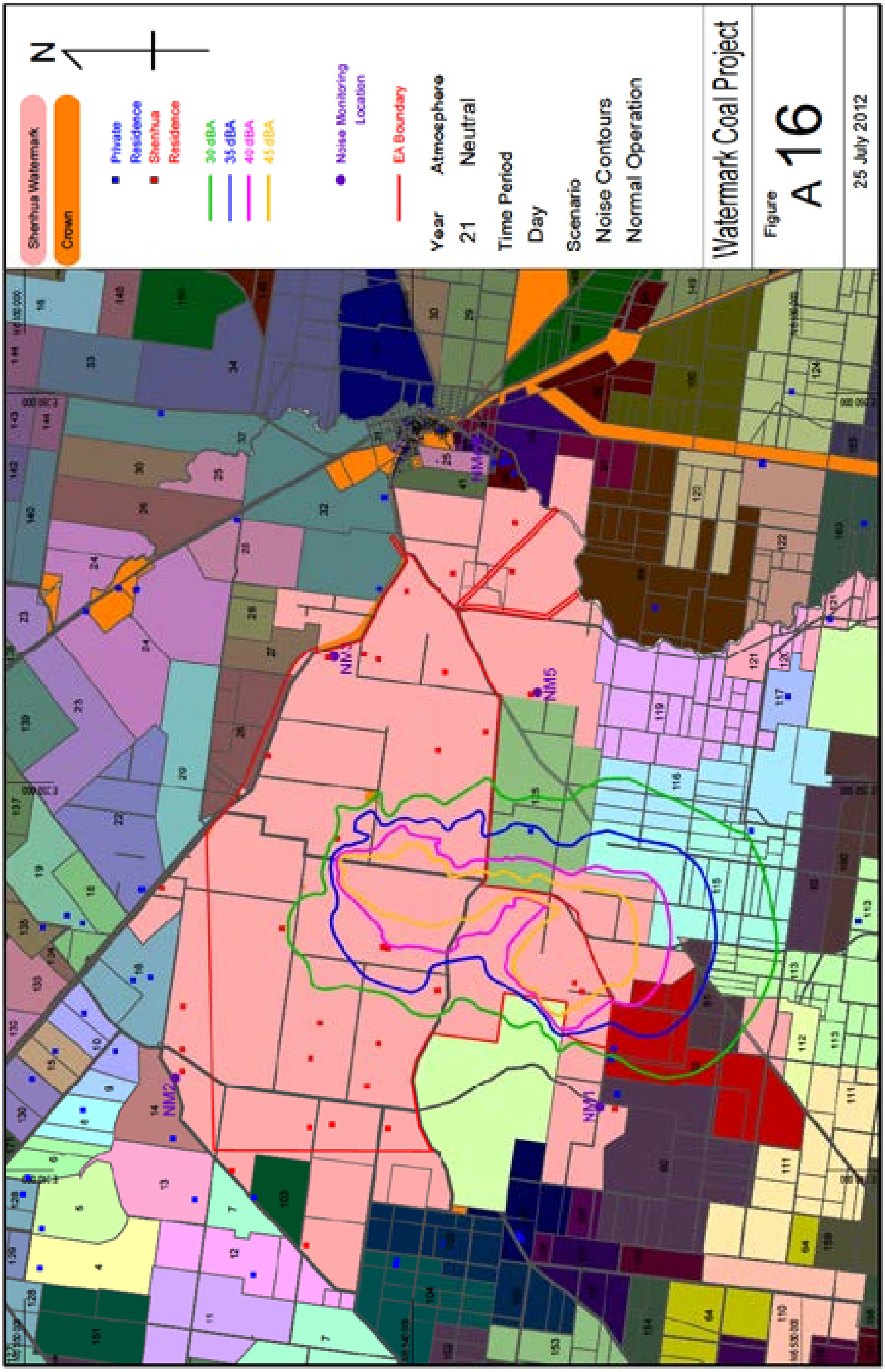
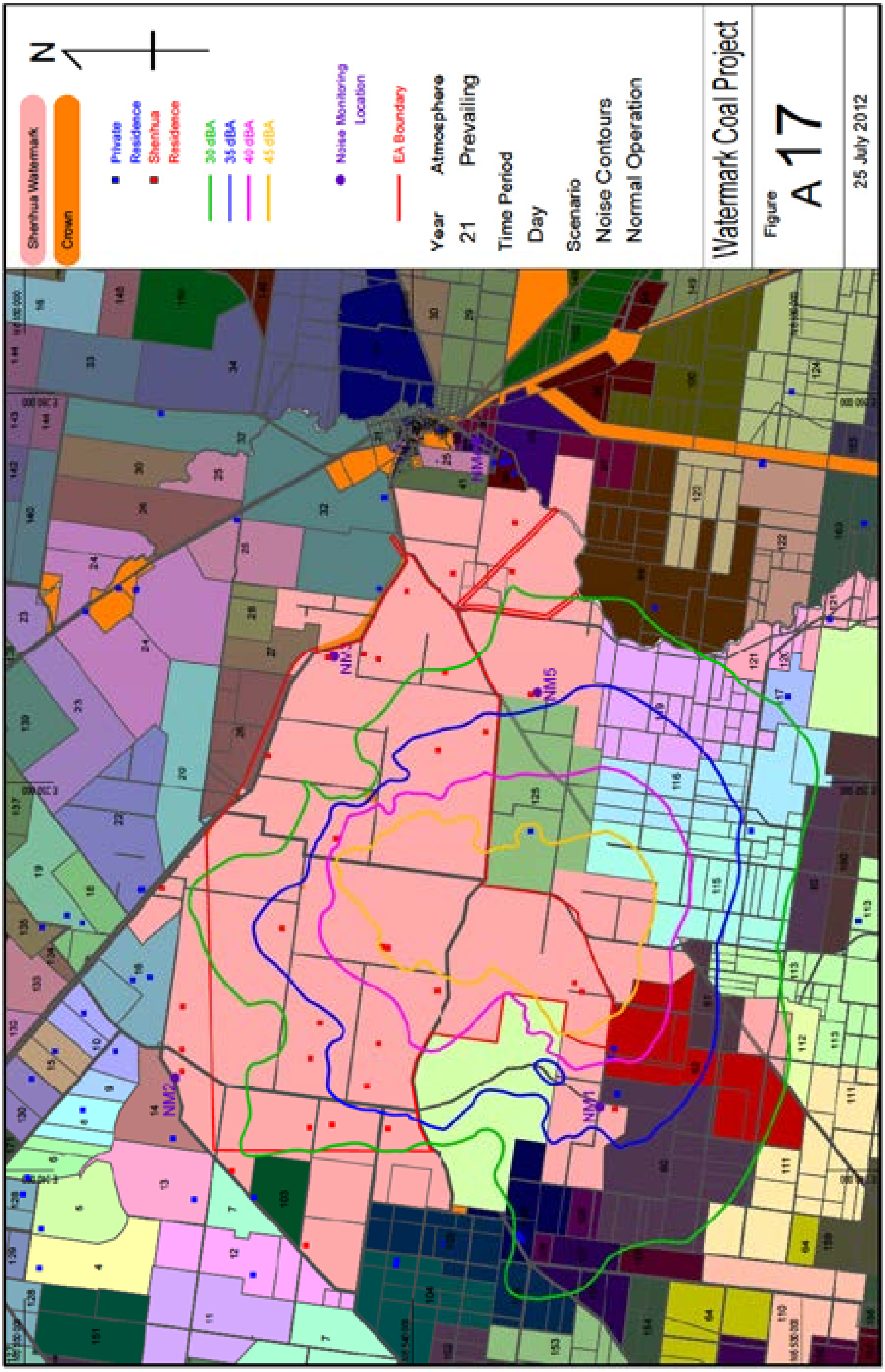

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
15
Atmosphere
Neutral
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 13
25 July 2012
NM1
NM2
NM5

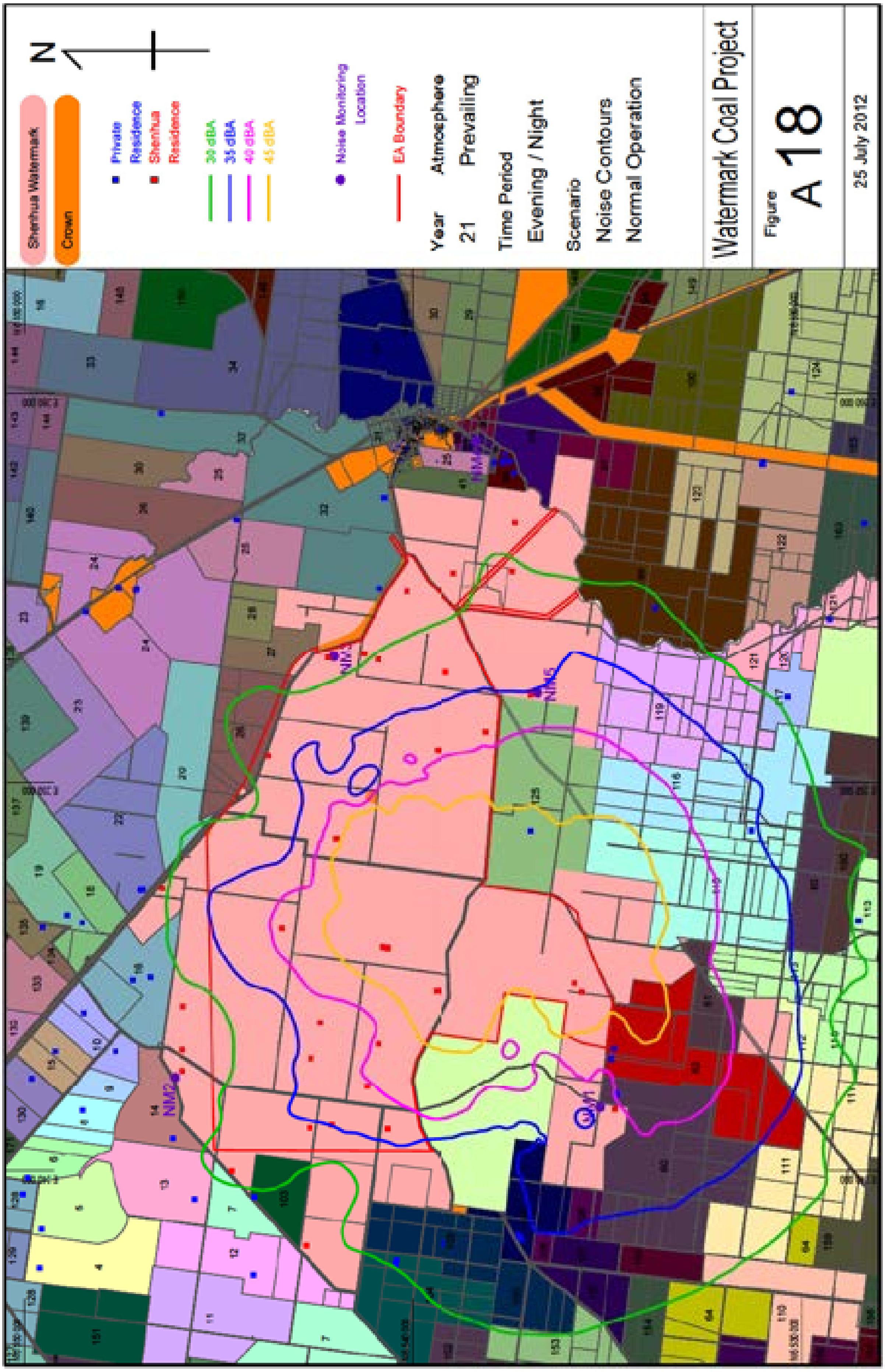


BRIDGES Acoustics


Shenhua Watermark
Crown
N
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
15
Atmosphere
Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 15
25 July 2012
NM1
NM2
NM5


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
21
Atmosphere
Neutral
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 16
25 July 2012
NM1
NM2
NM3
NM4
NM5


N
Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
21
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A17
25 July 2012
NM1
NM2
NM3
NM5



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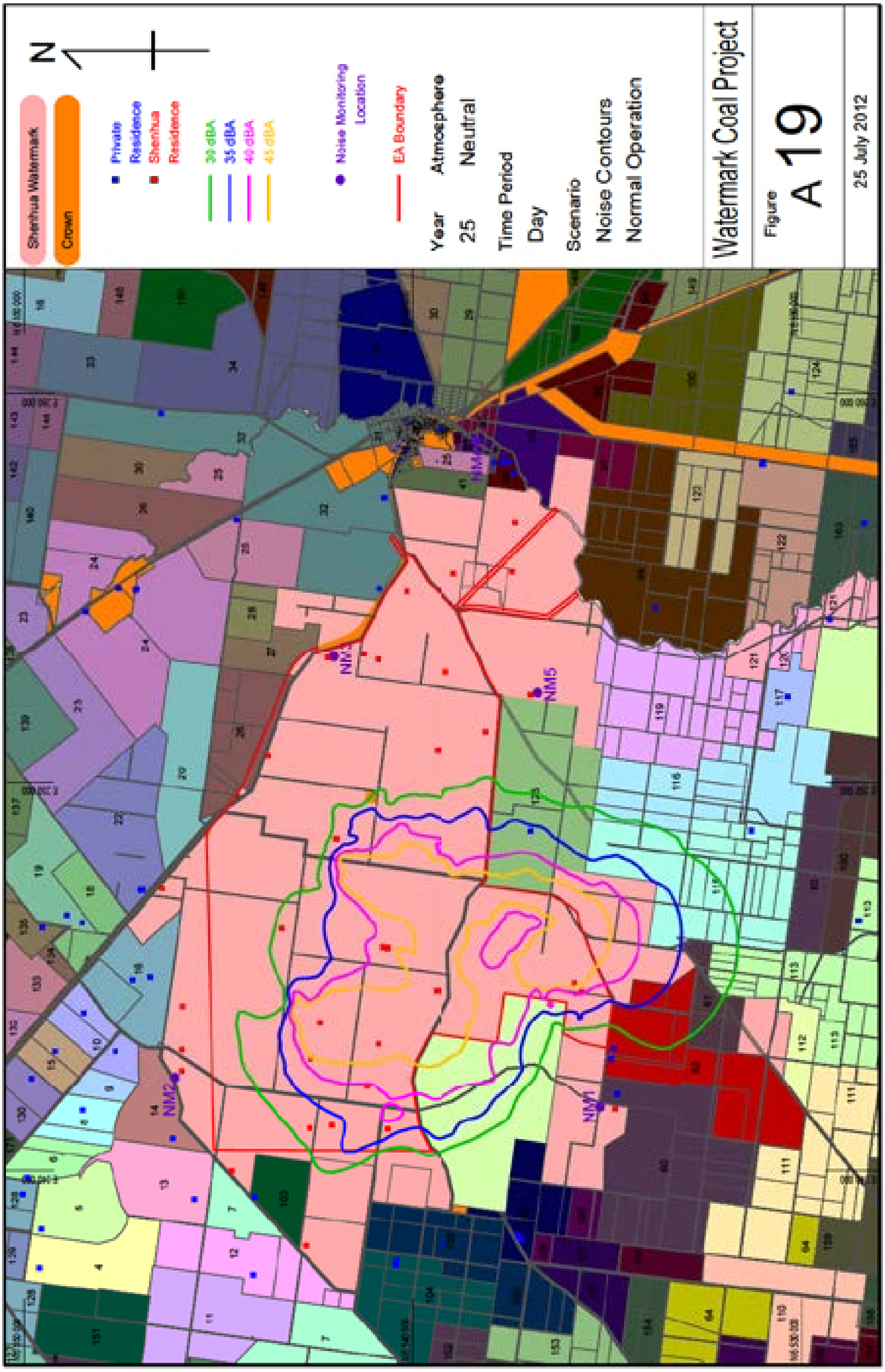
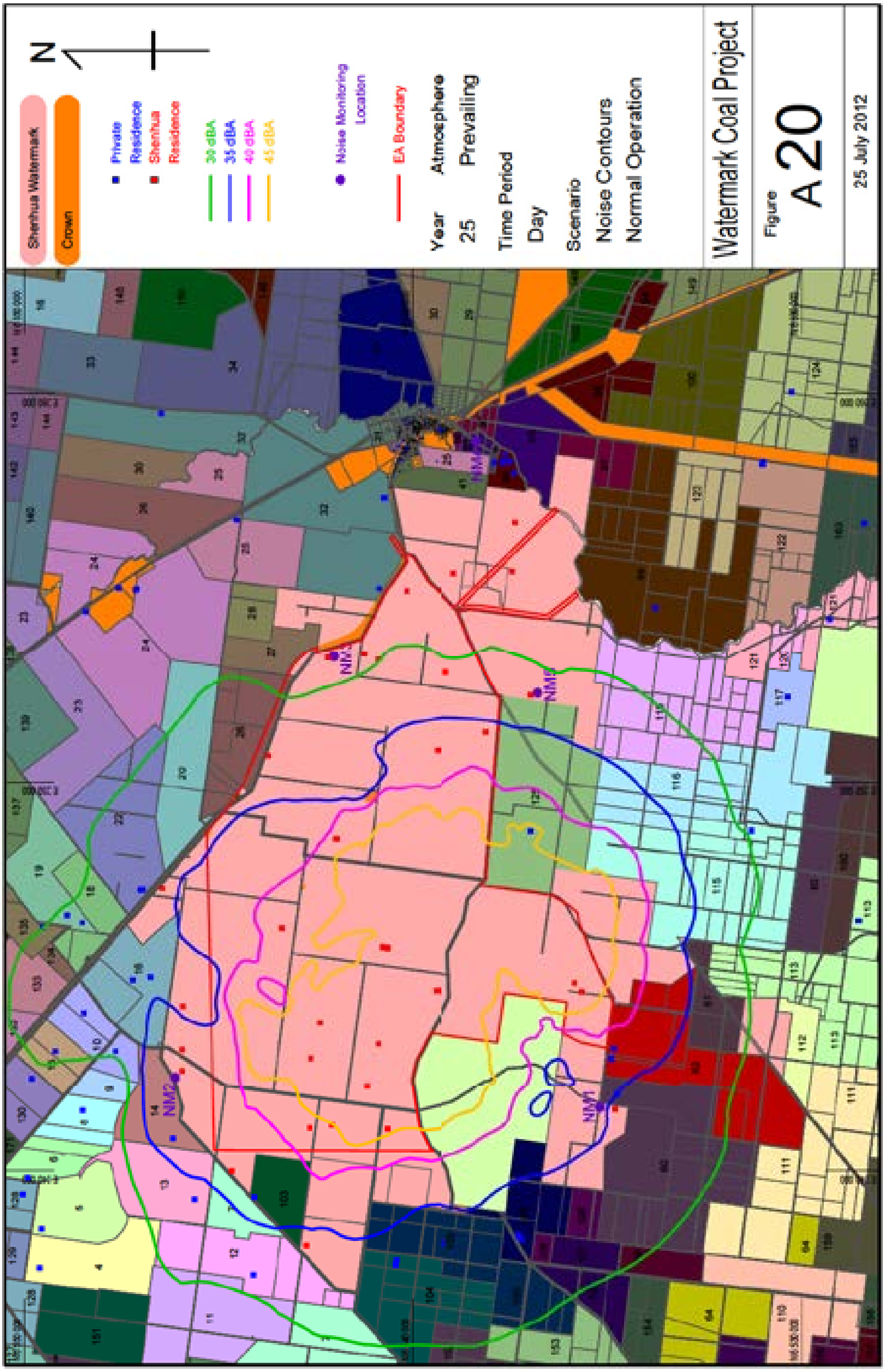
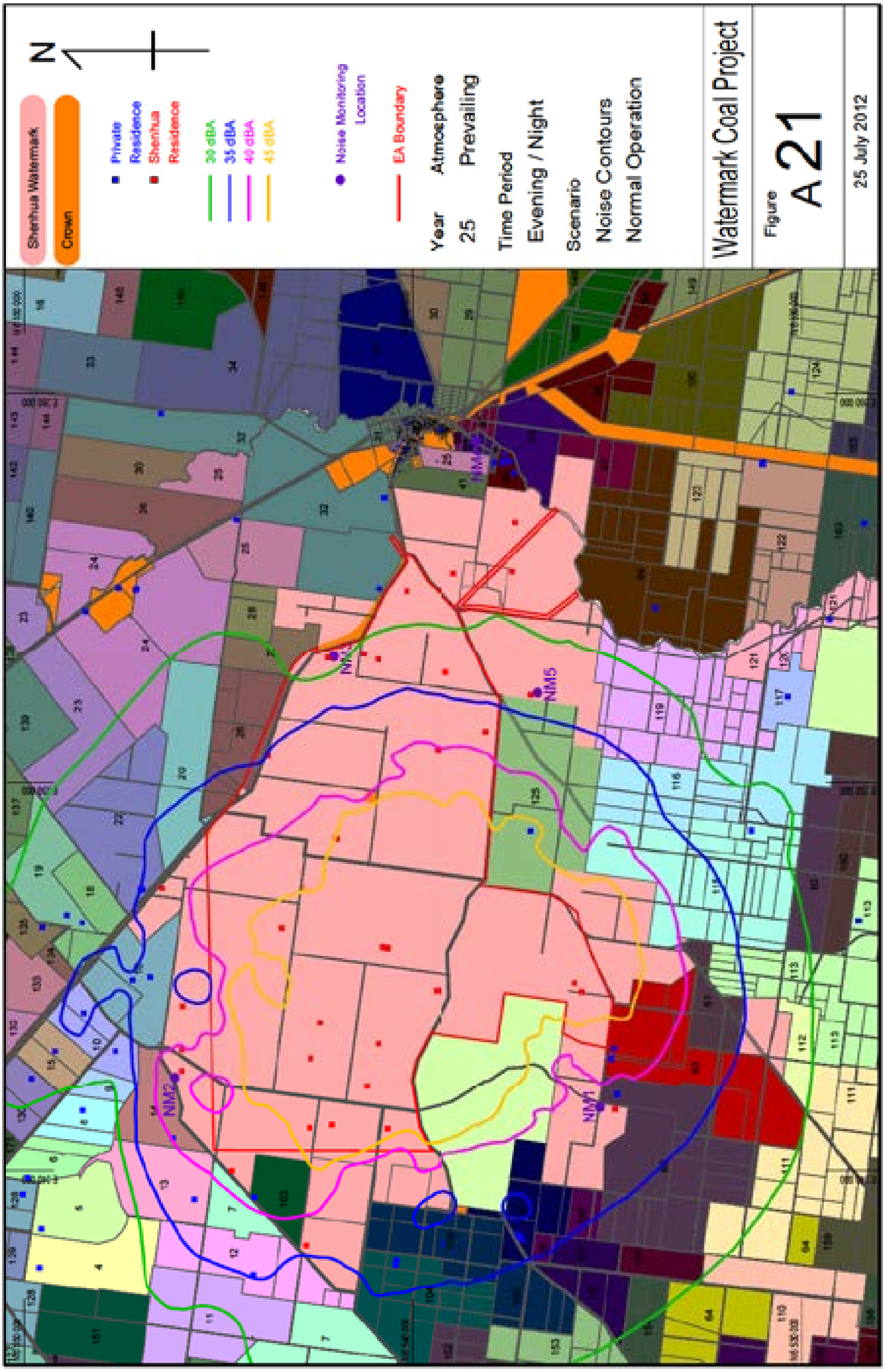
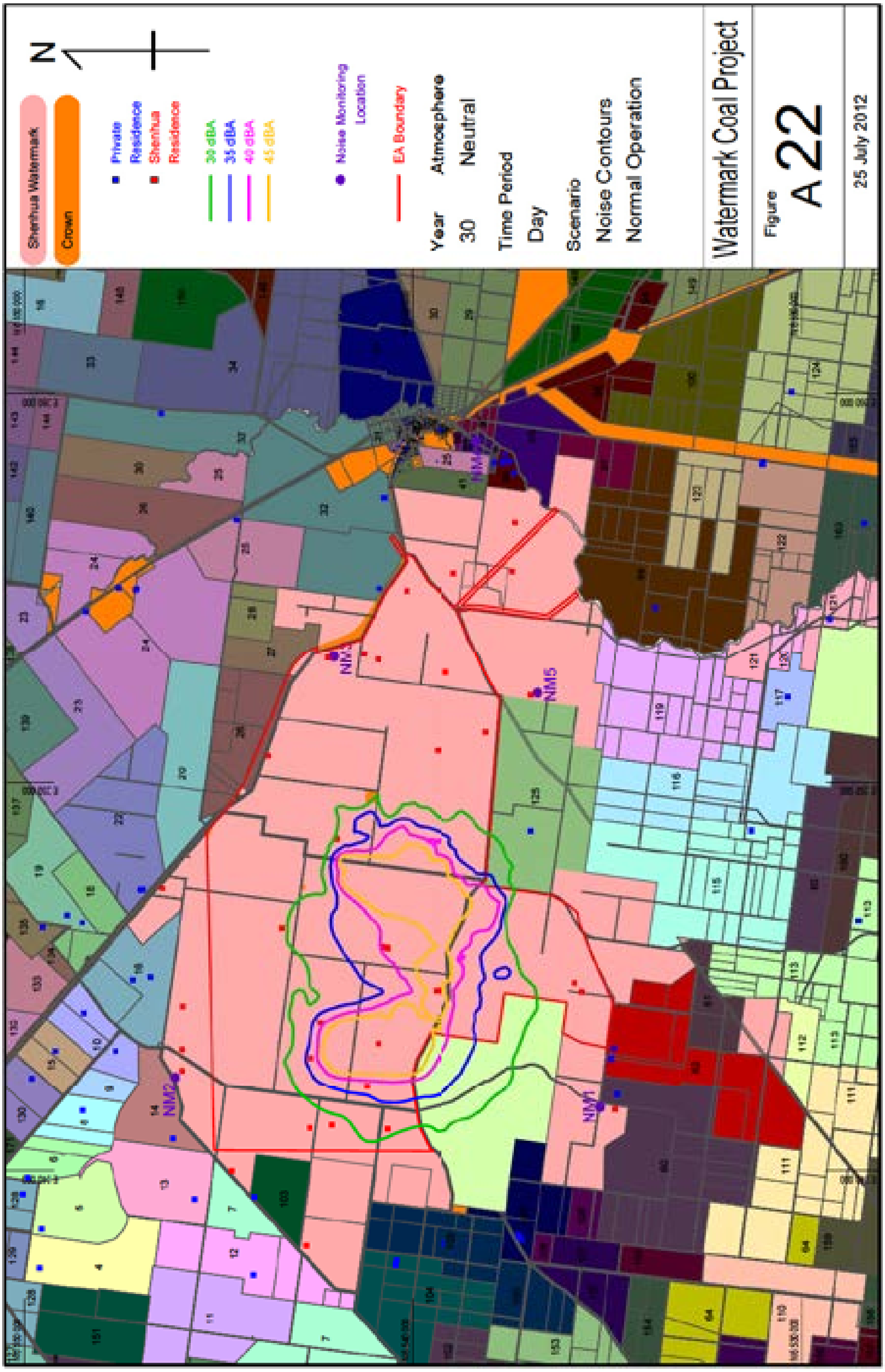

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
25
Atmosphere
Neutral
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A19
25 July 2012
NM1
NM2
NM3
NM4
NM5

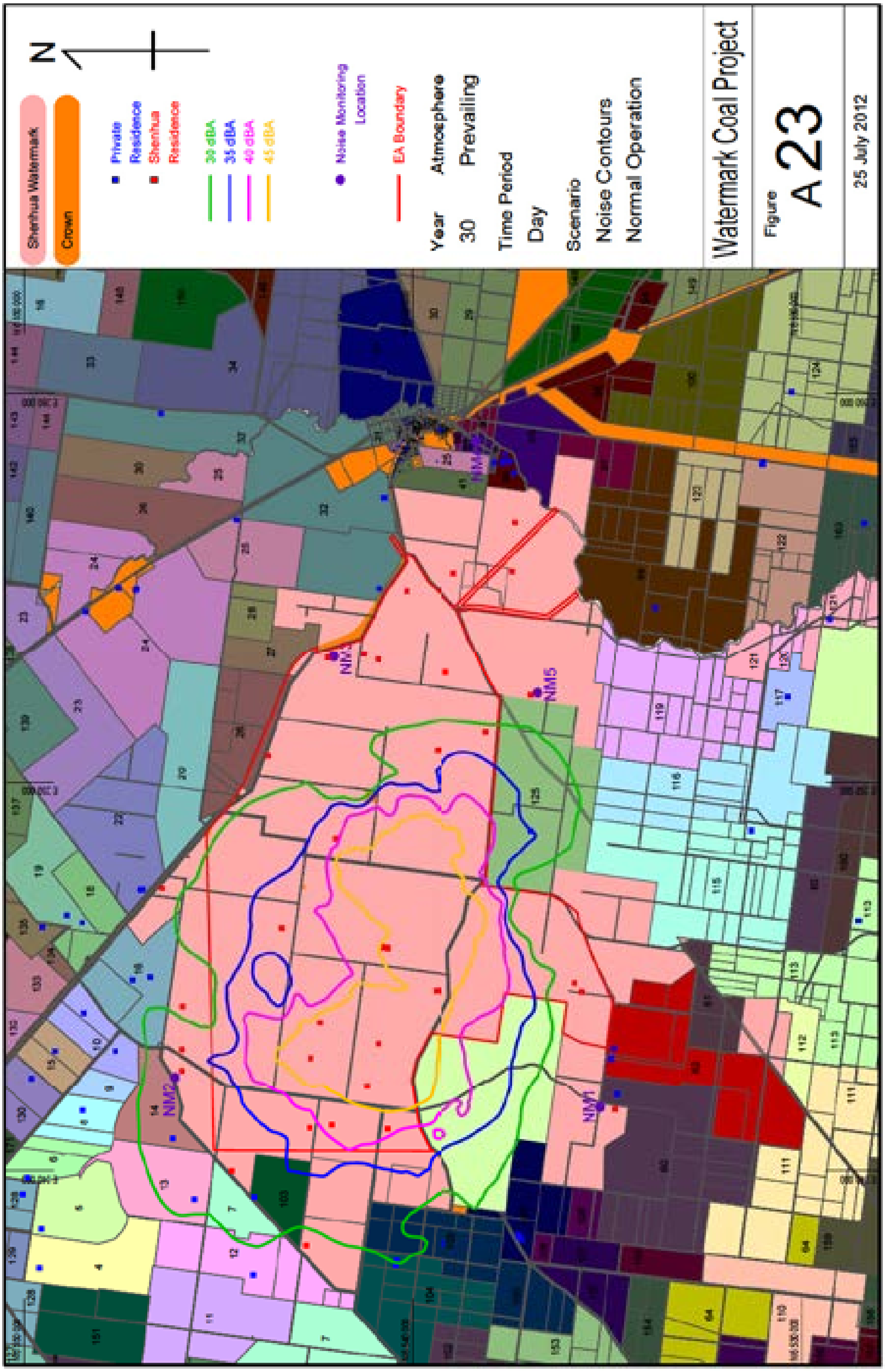


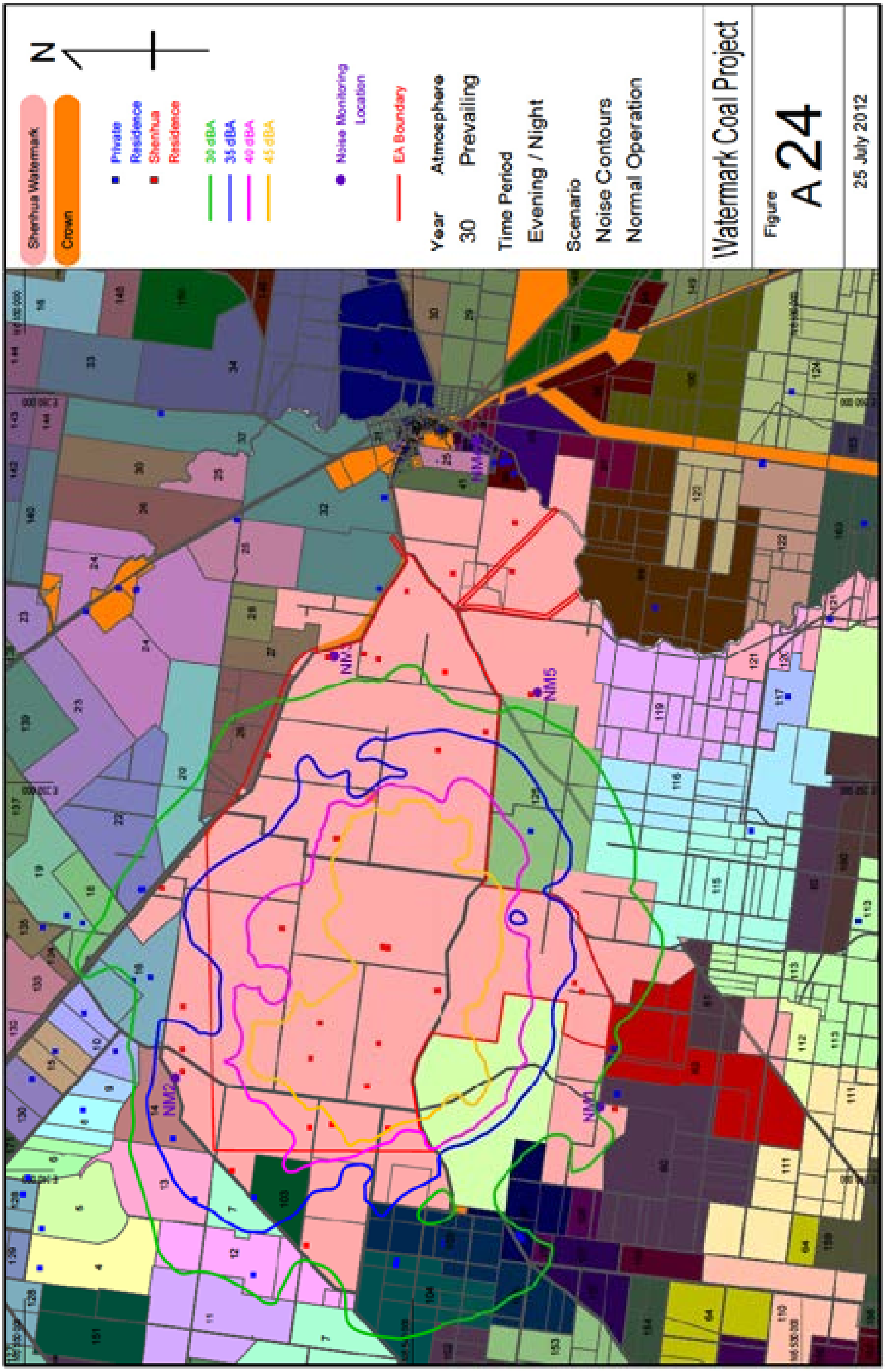
Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
25
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 20
25 July 2012

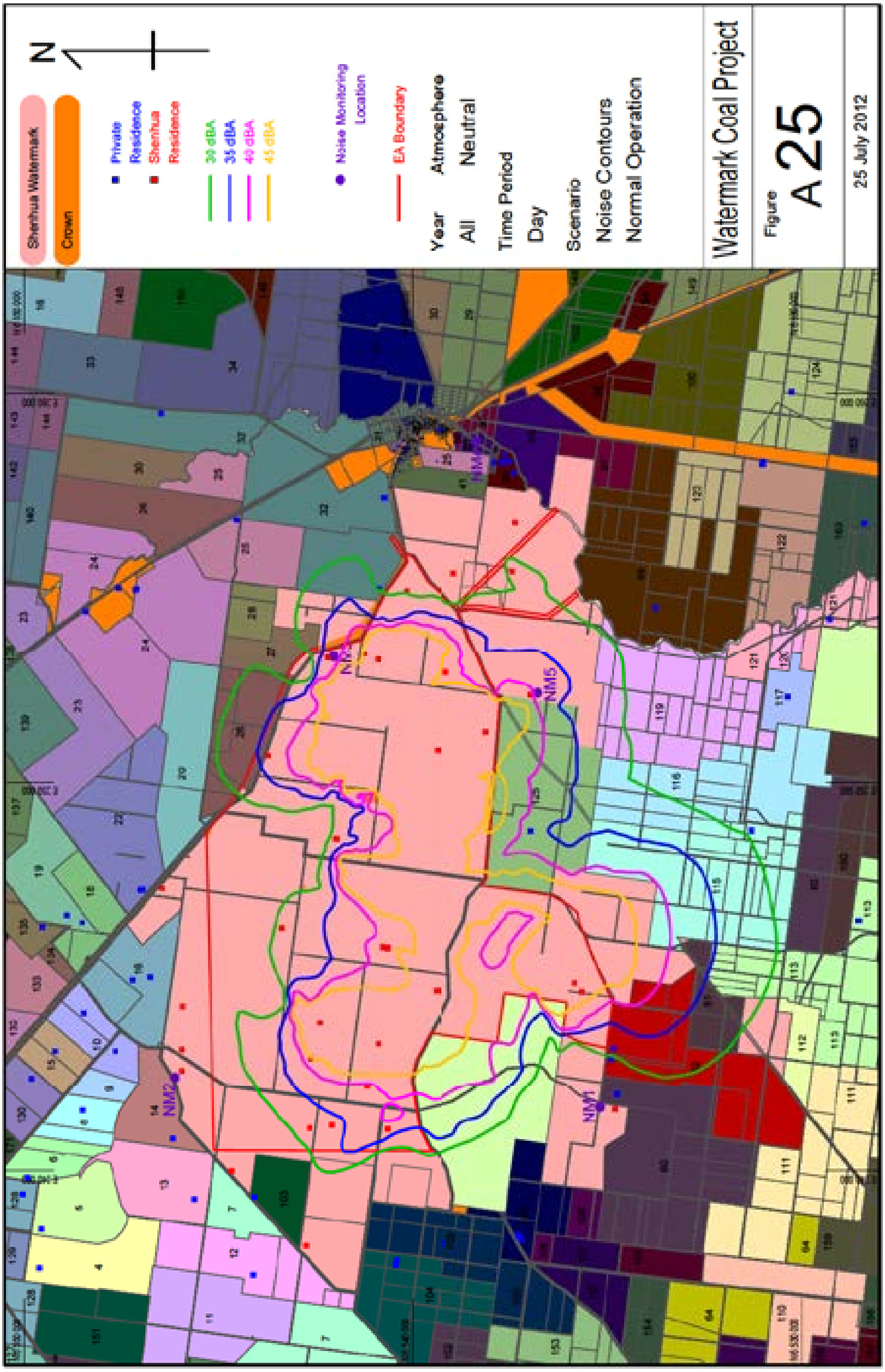

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year 25
Atmosphere Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 21
25 July 2012
NM1
NM2
NM5

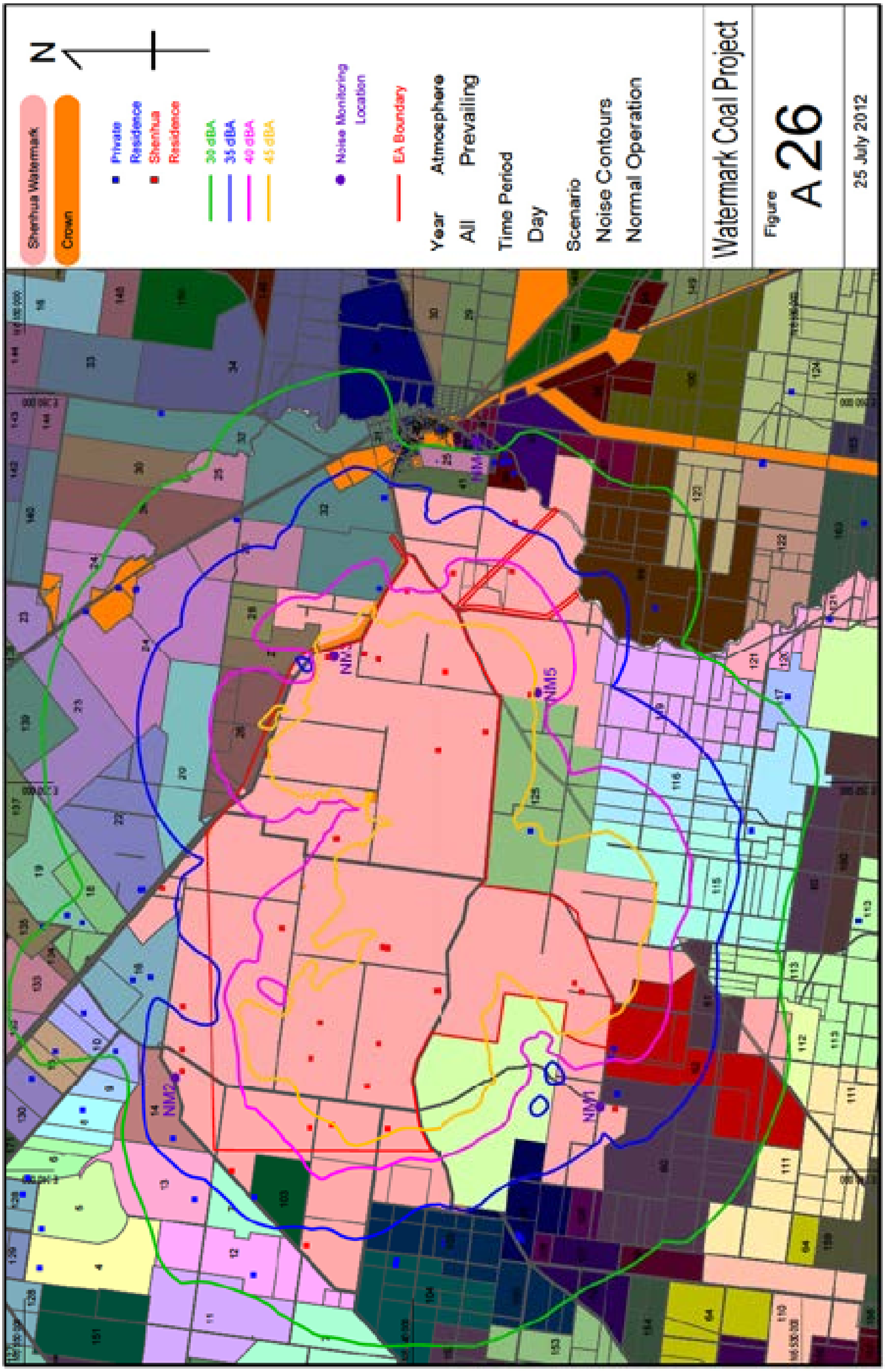


Shenhua Watermark
Crown
N
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
30
Atmosphere
Neutral
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A22
25 July 2012
NM1
NM2
NM3
NM4
NM5

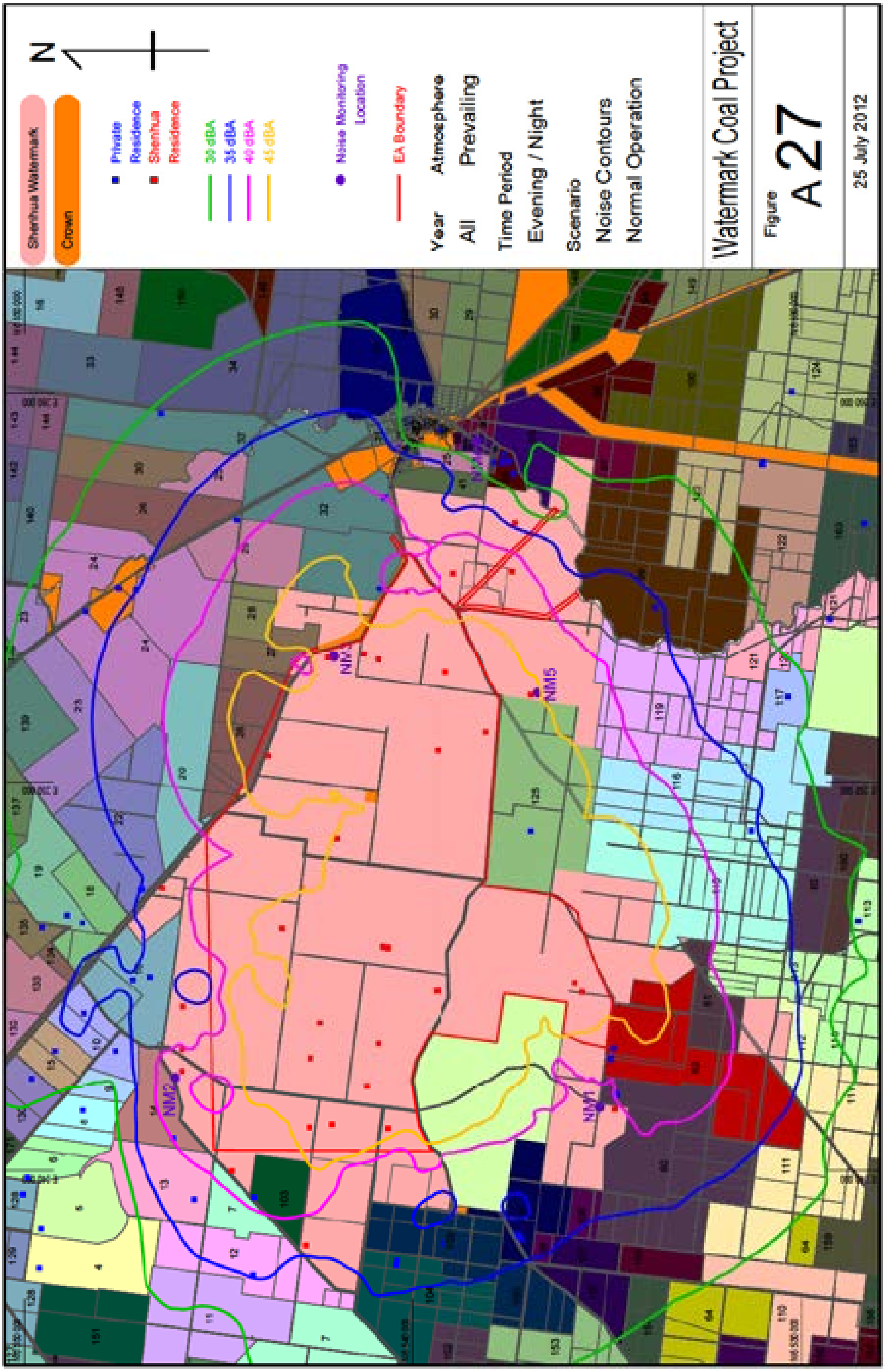

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
30
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A23
25 July 2012
N
NM1
NM2
NM3
NM5

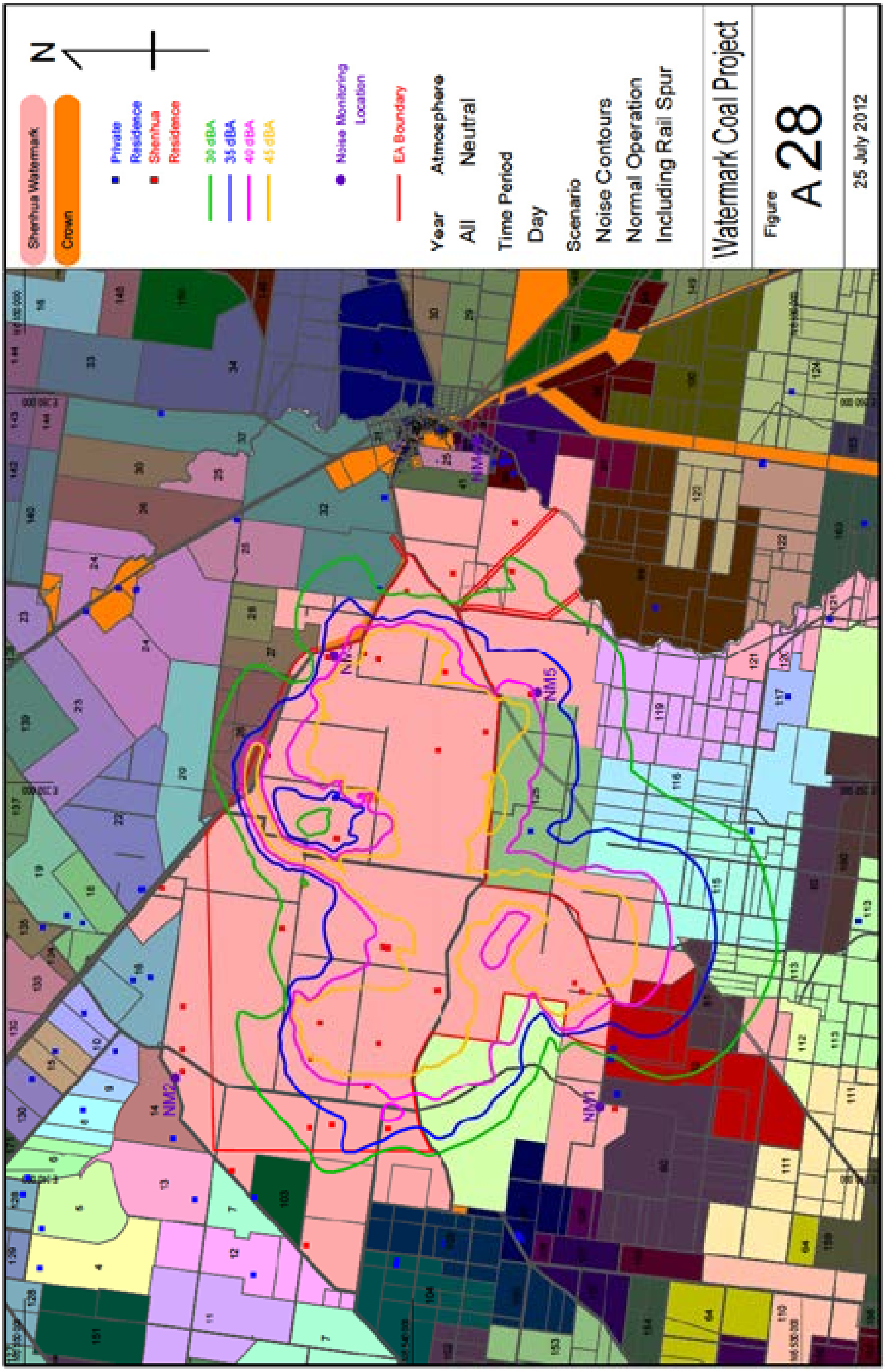

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
30
Atmosphere
Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A 24
25 July 2012
NM1
NM2
NM3
NM4
NM5


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year All
Atmosphere Neutral
Time Period Day
Scenario Noise Contours Normal Operation
Watermark Coal Project
Figure A 25
25 July 2012
NM1
NM2
NM5

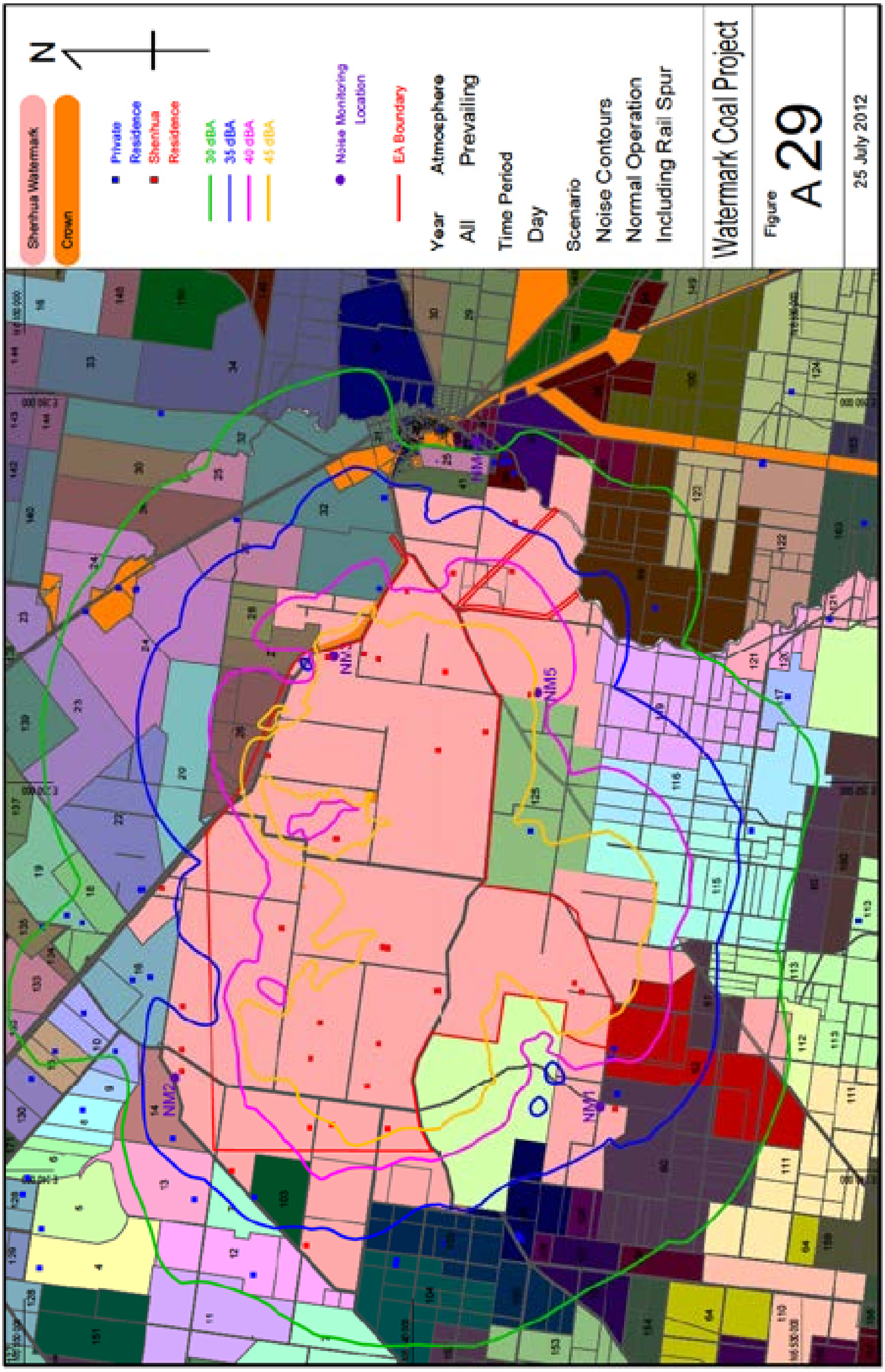


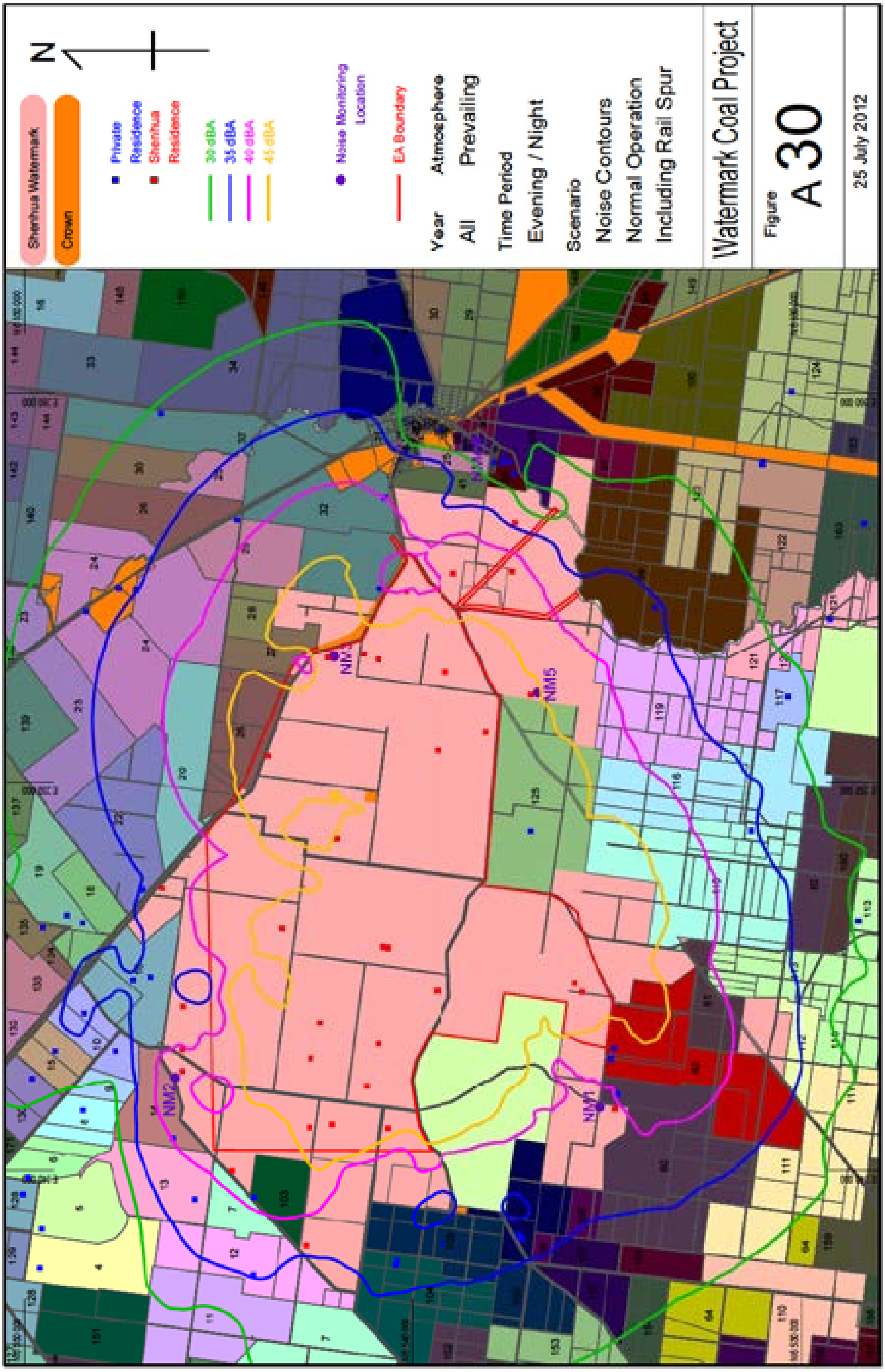
BRIDGES Acoustics


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
Normal Operation
Watermark Coal Project
Figure
A27
25 July 2012
NM1
NM2
NM5

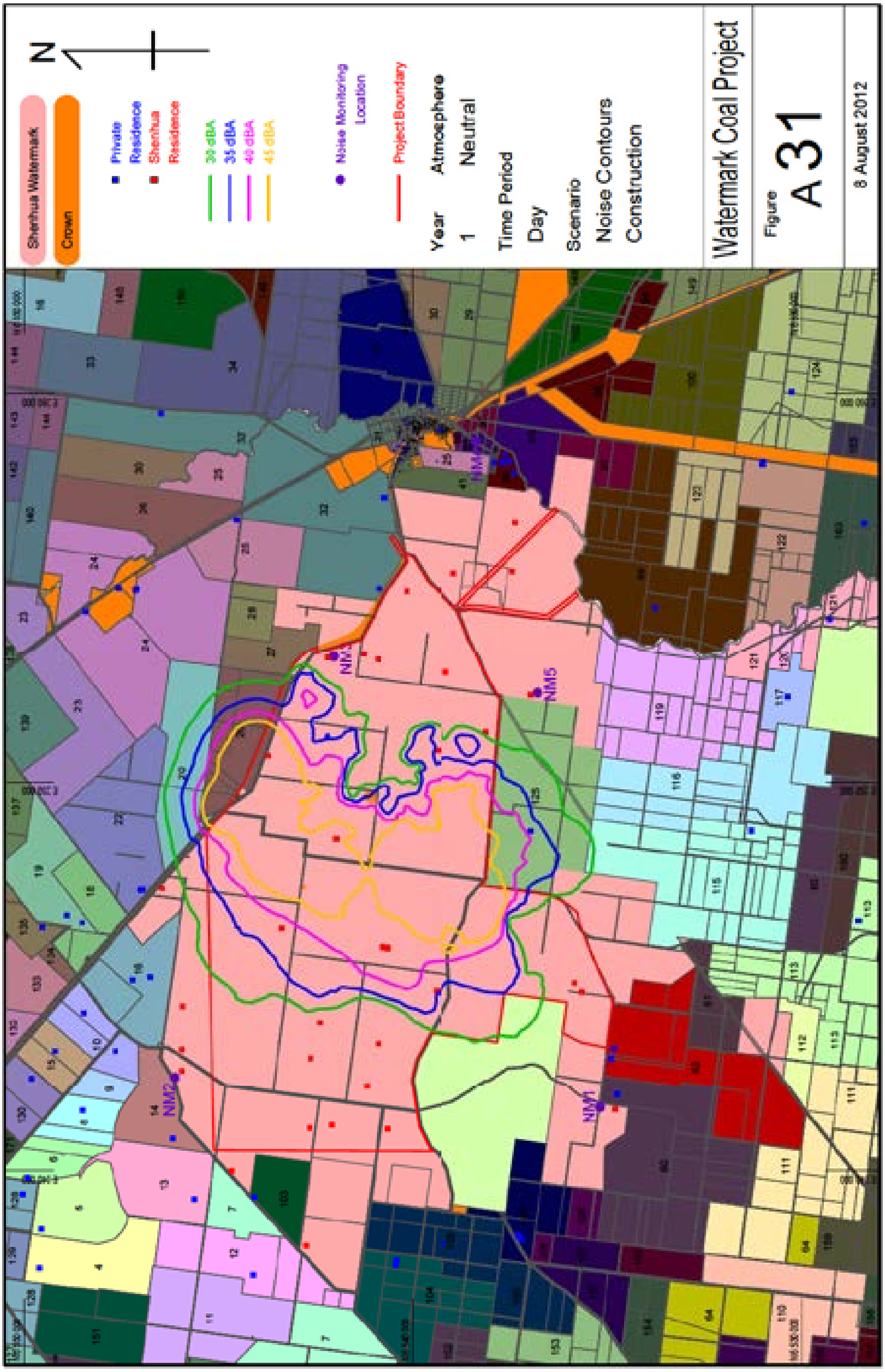


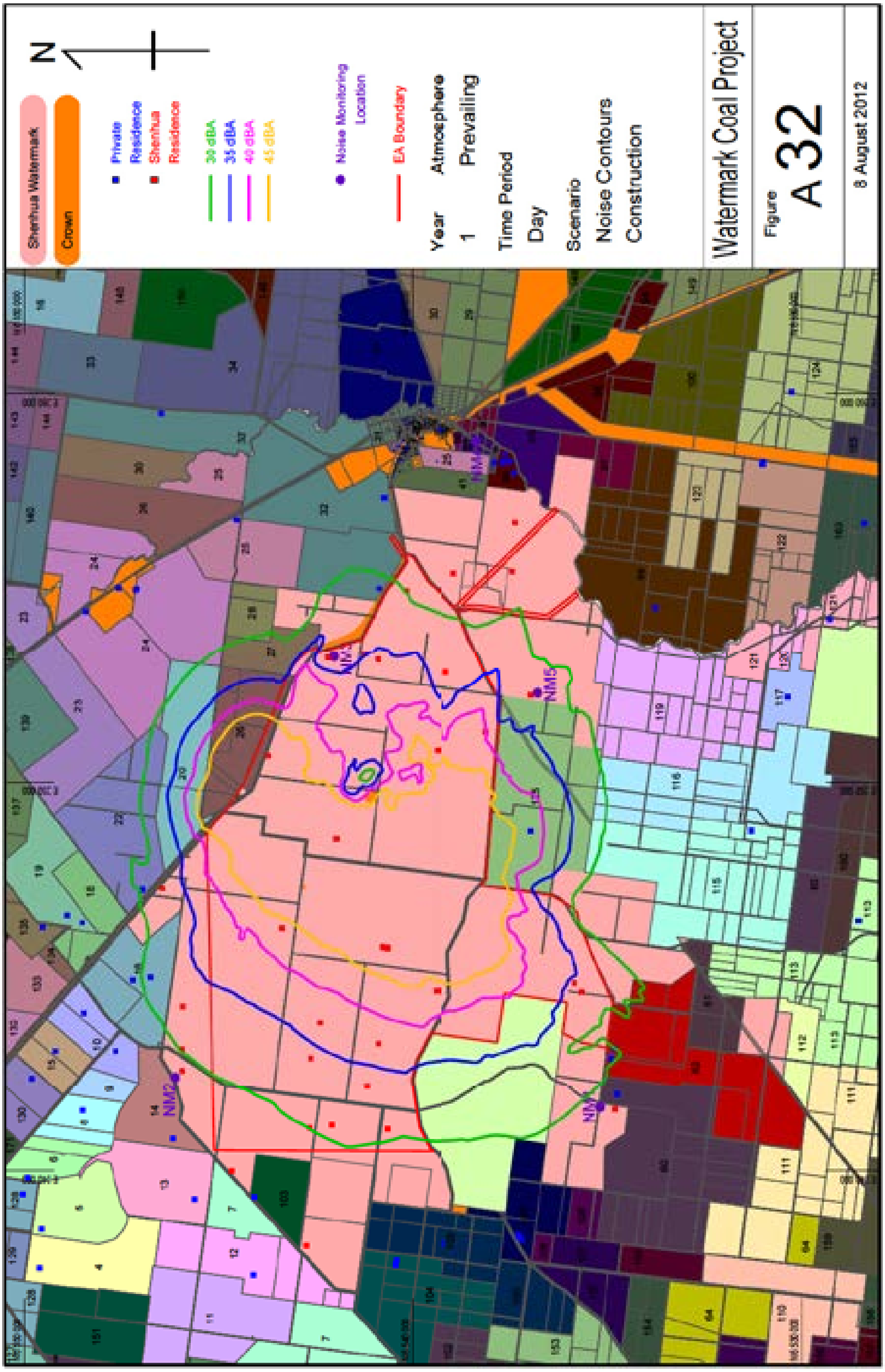
BRIDGES Acoustics


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Normal Operation
Including Rail Spur
Watermark Coal Project
Figure
A 29
25 July 2012
NM1
NM2
NM5

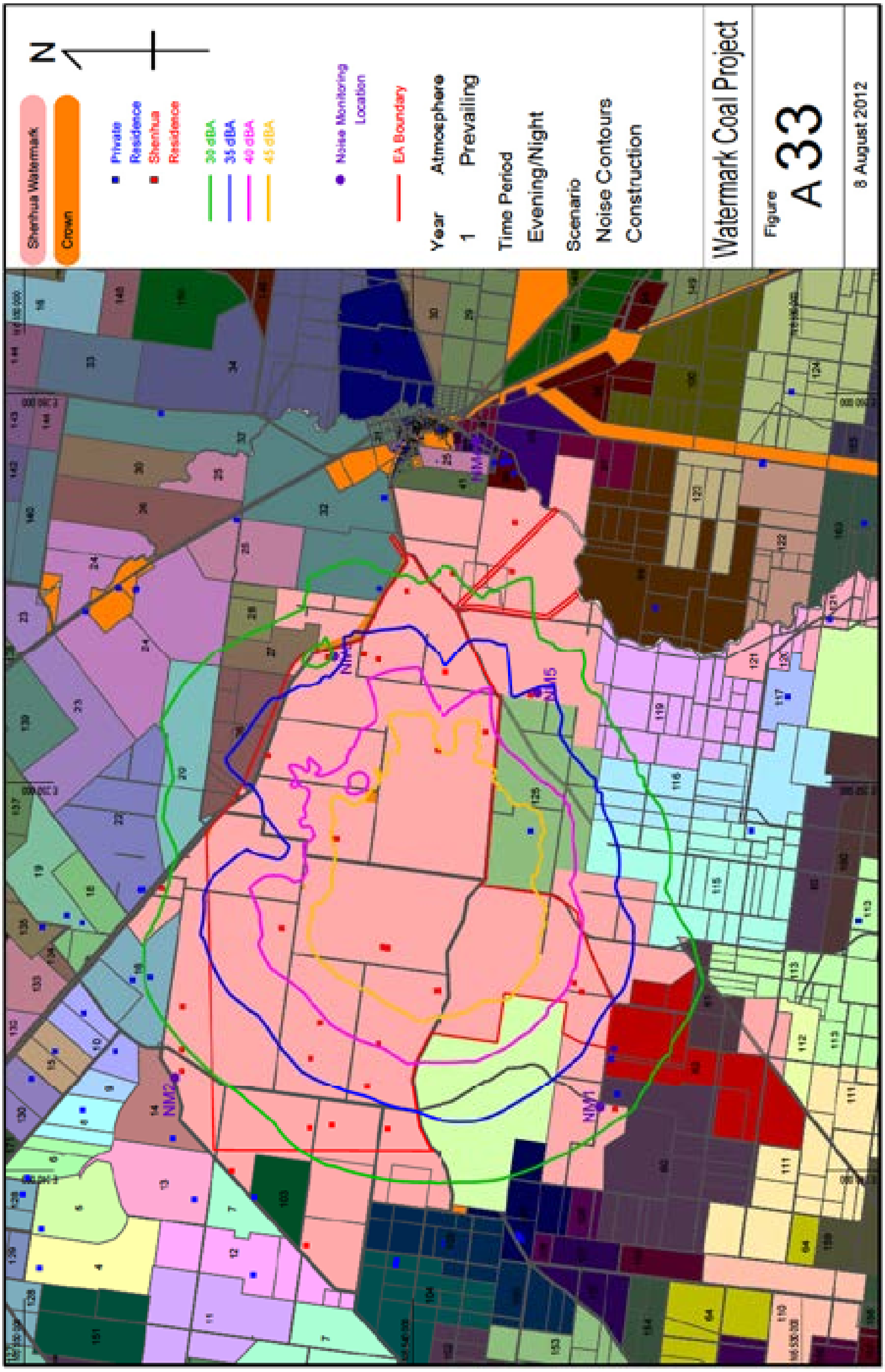


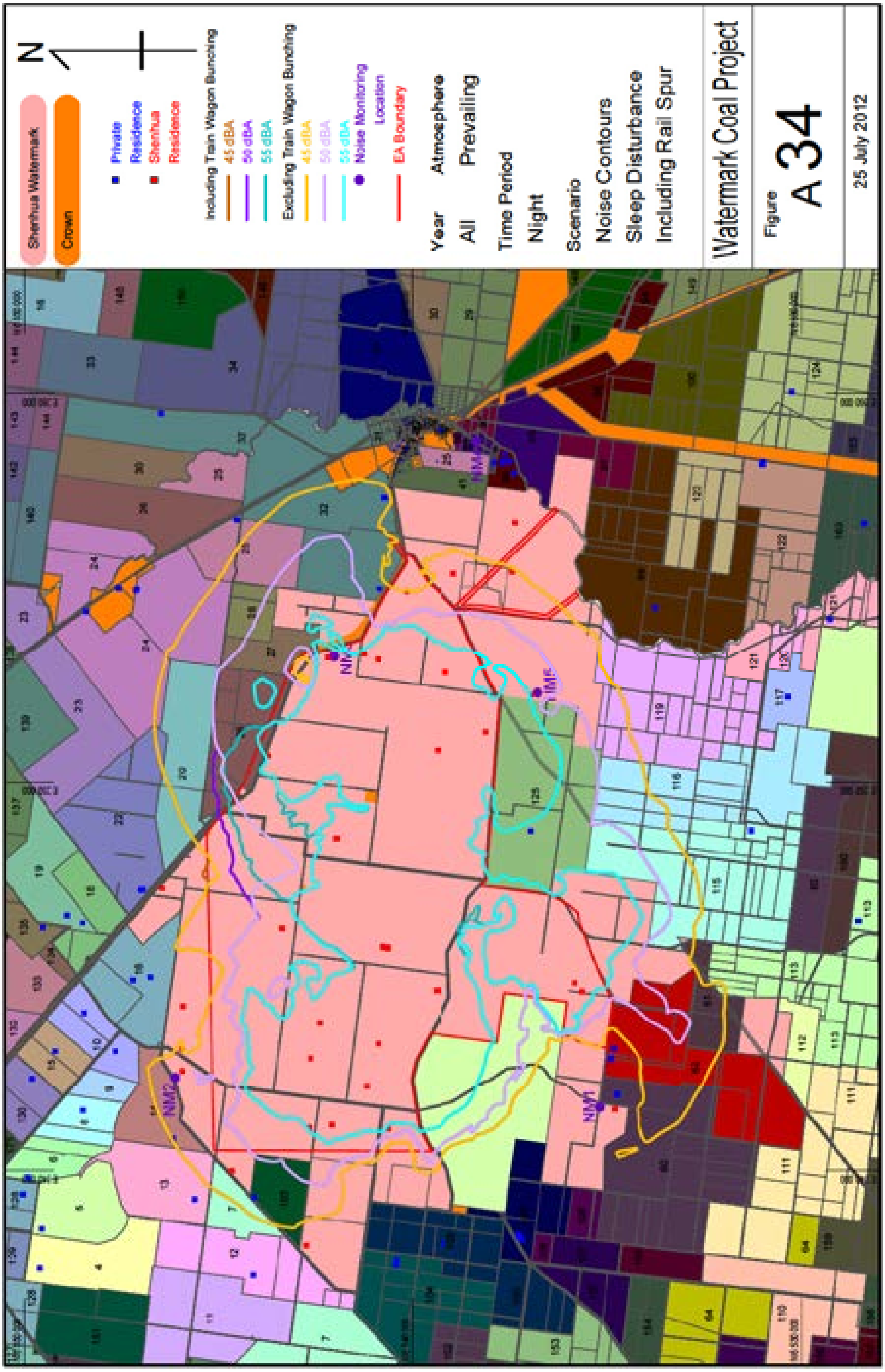
BRIDGES Acoustics


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
Project Boundary
Year 1
Atmosphere Neutral
Time Period Day
Scenario Noise Contours Construction
Watermark Coal Project
Figure A 31
8 August 2012
NM1
NM2
NM5

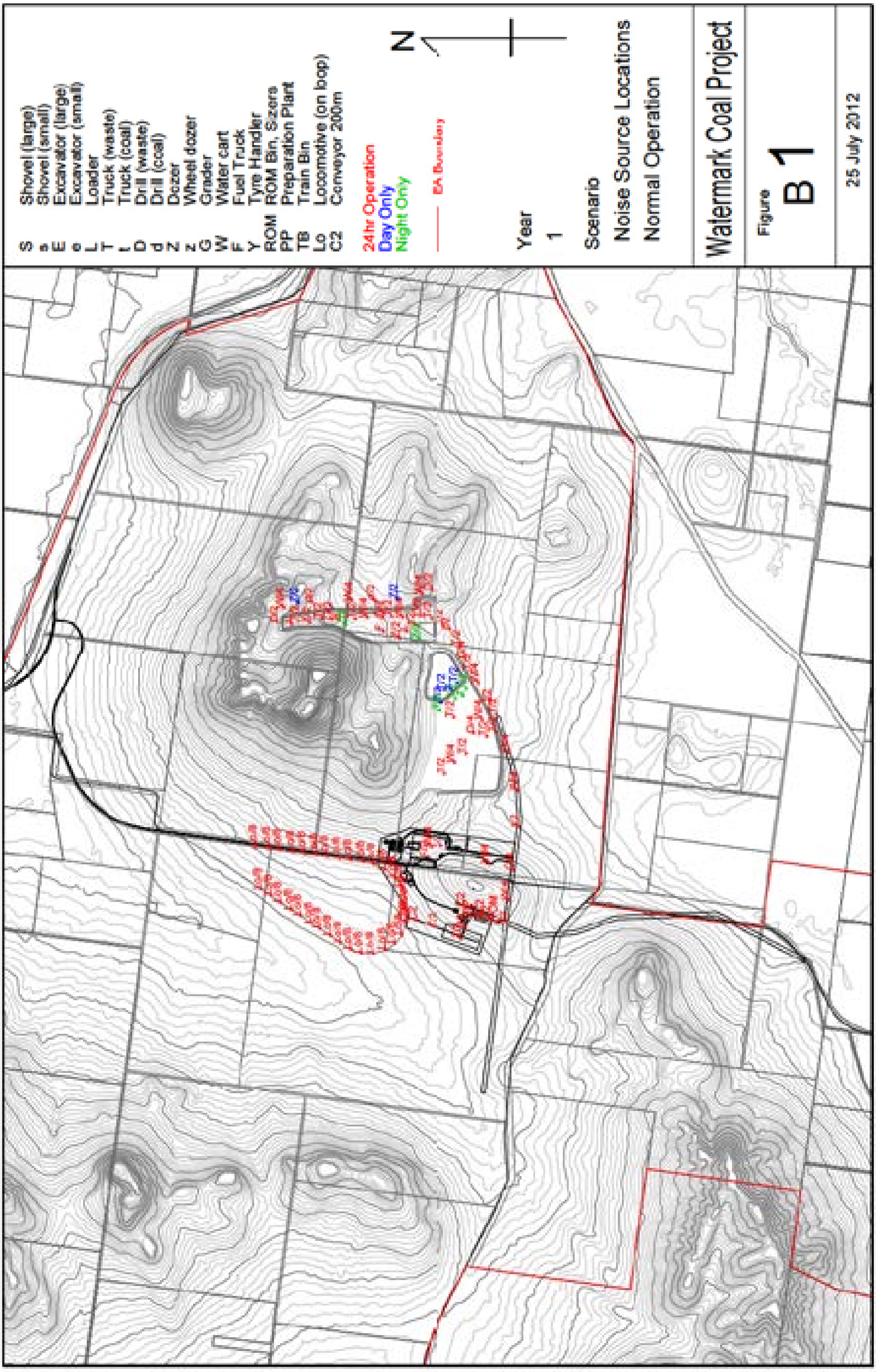


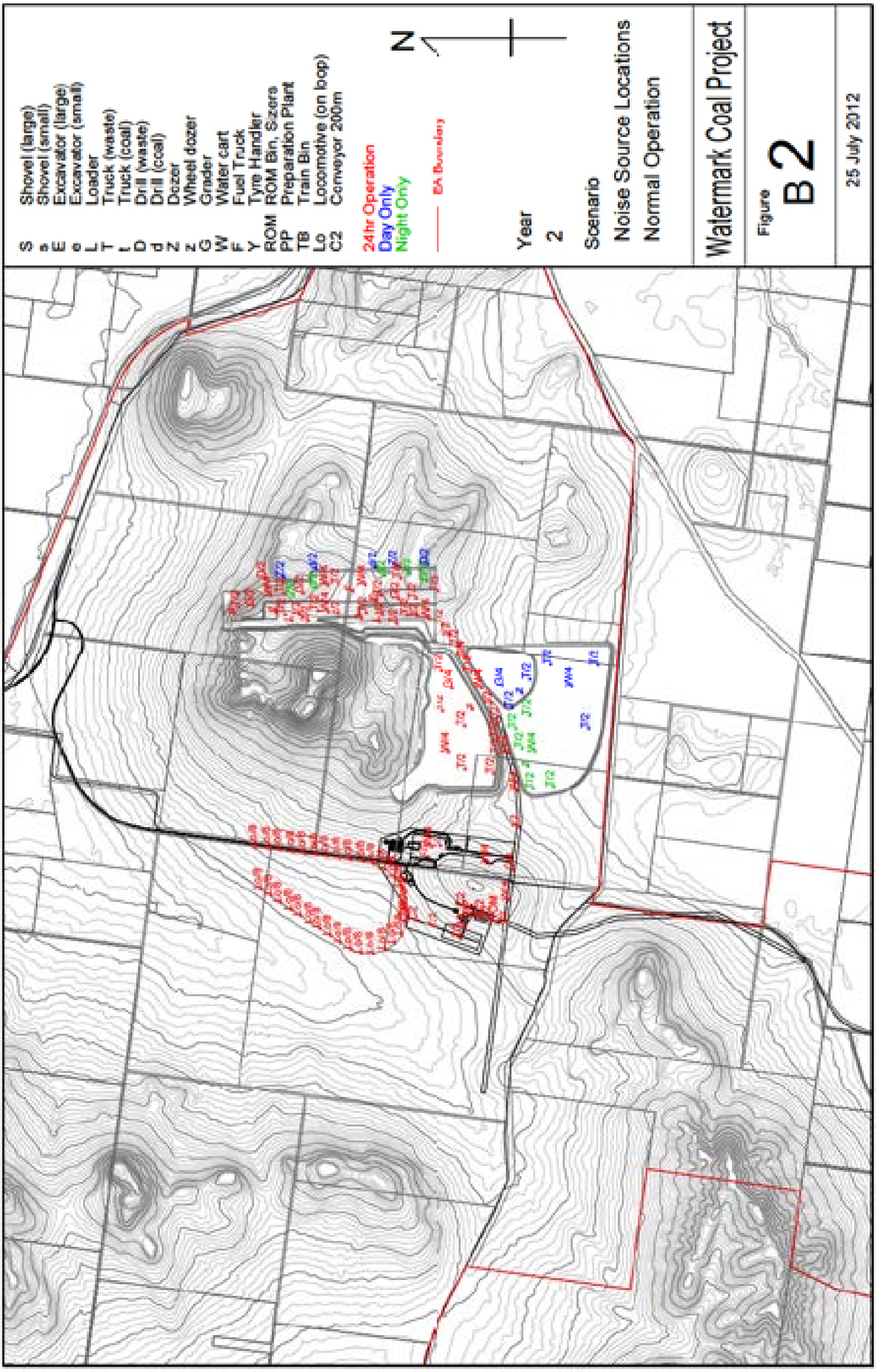
BRIDGES Acoustics

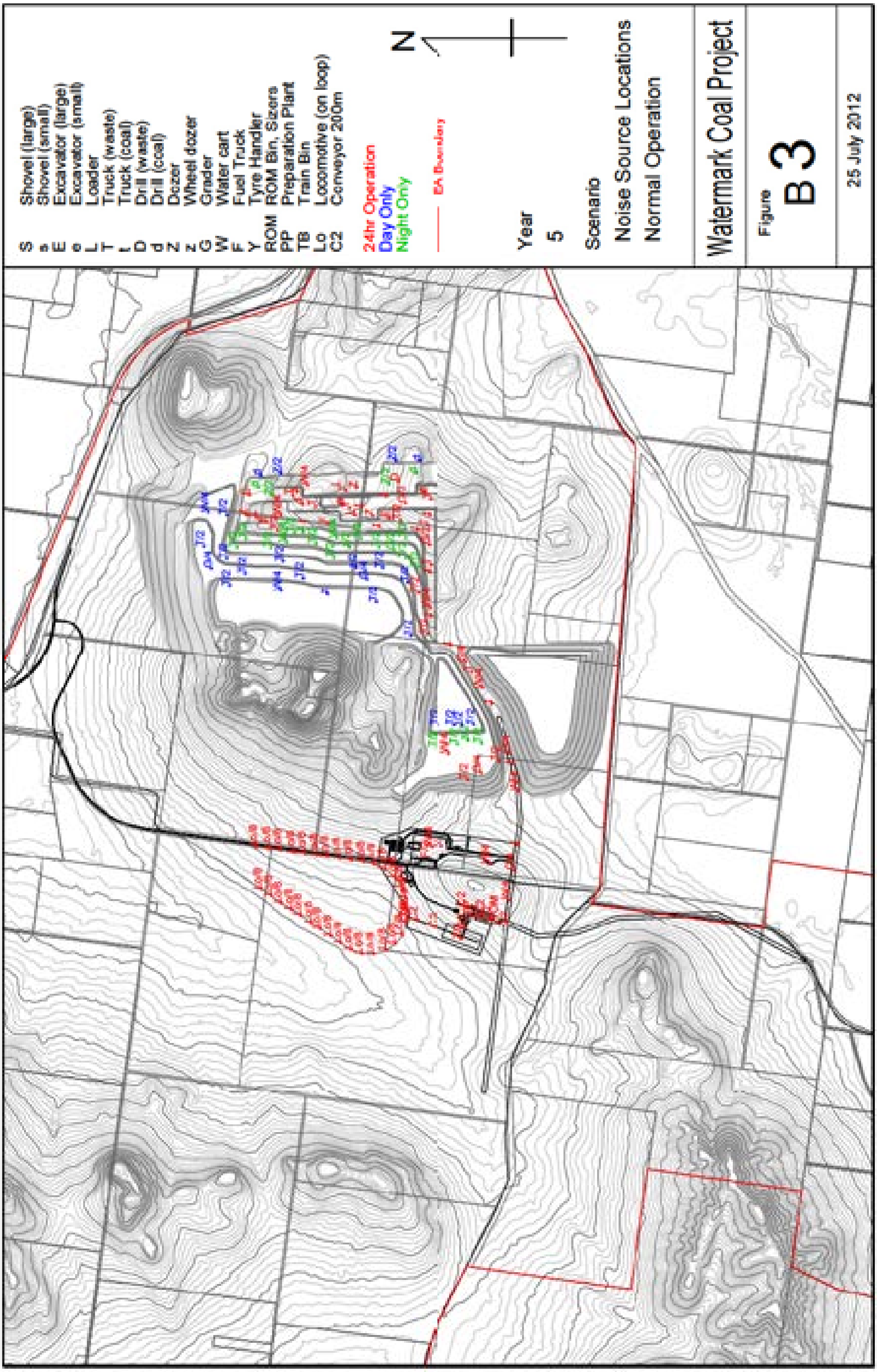

Shenhua Watermark
Crown
N
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
1
Atmosphere
Prevailing
Time Period
Evening/Night
Scenario
Noise Contours
Construction
Watermark Coal Project
Figure
A 33
8 August 2012

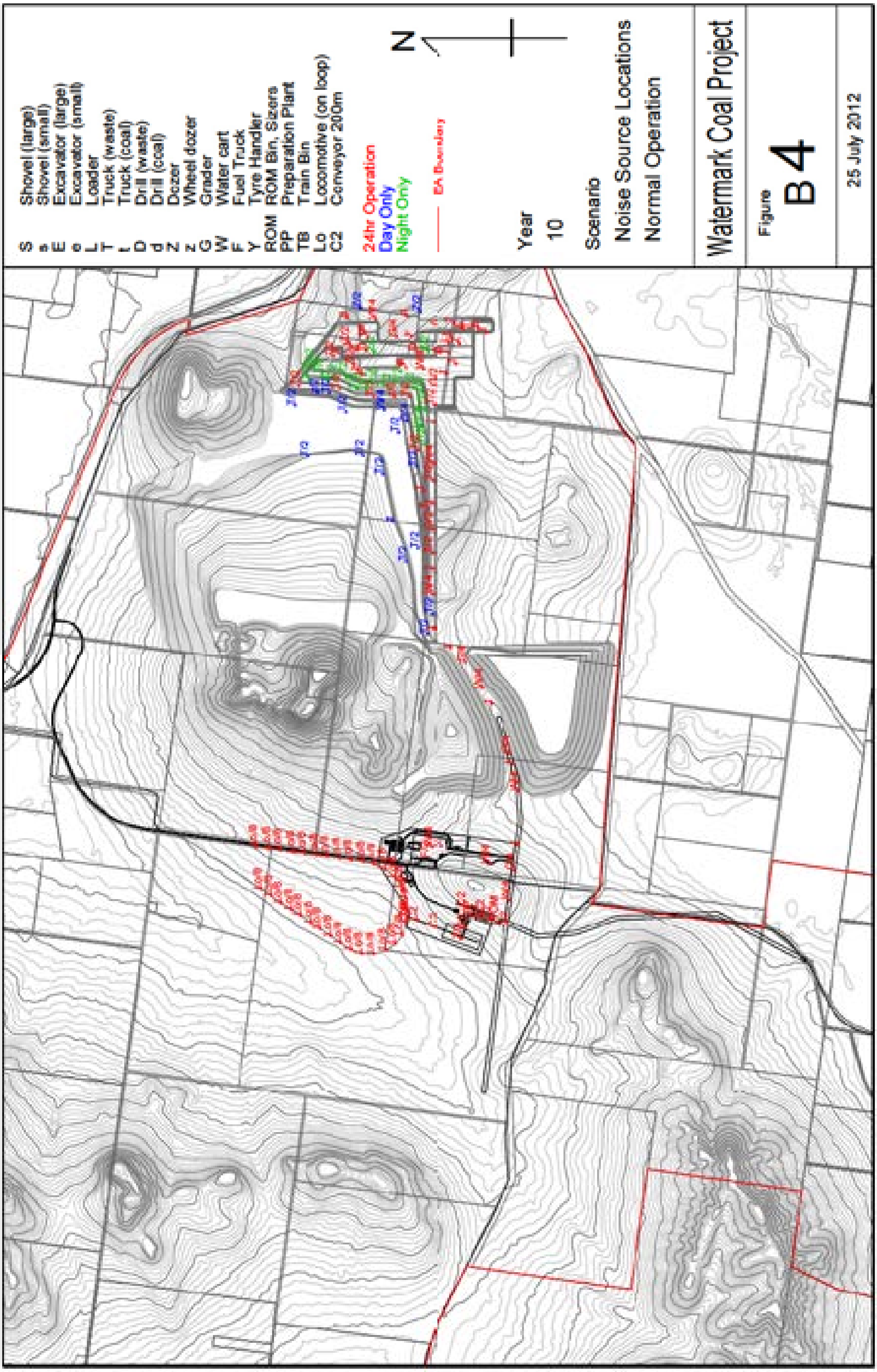

Shenhua Watermark
Crown
Private Residence
Shenhua Residence
Including Train Wagon Bunching
45 dBA
50 dBA
55 dBA
Excluding Train Wagon Bunching
45 dBA
50 dBA
55 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Night
Scenario
Noise Contours
Sleep Disturbance
Including Rail Spur
Watermark Coal Project
Figure
A34
25 July 2012

APPENDIX B – NOISE SOURCE LOCATION FIGURES


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
N Dozer
n Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
1
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B1
25 July 2012


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
Z Dozer
z Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
2
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B2
25 July 2012


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
N Dozer
n Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
5
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B3
25 July 2012


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
N Dozer
n Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
10
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B4
25 July 2012

S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
Z Dozer
z Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
15
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B5
25 July 2012

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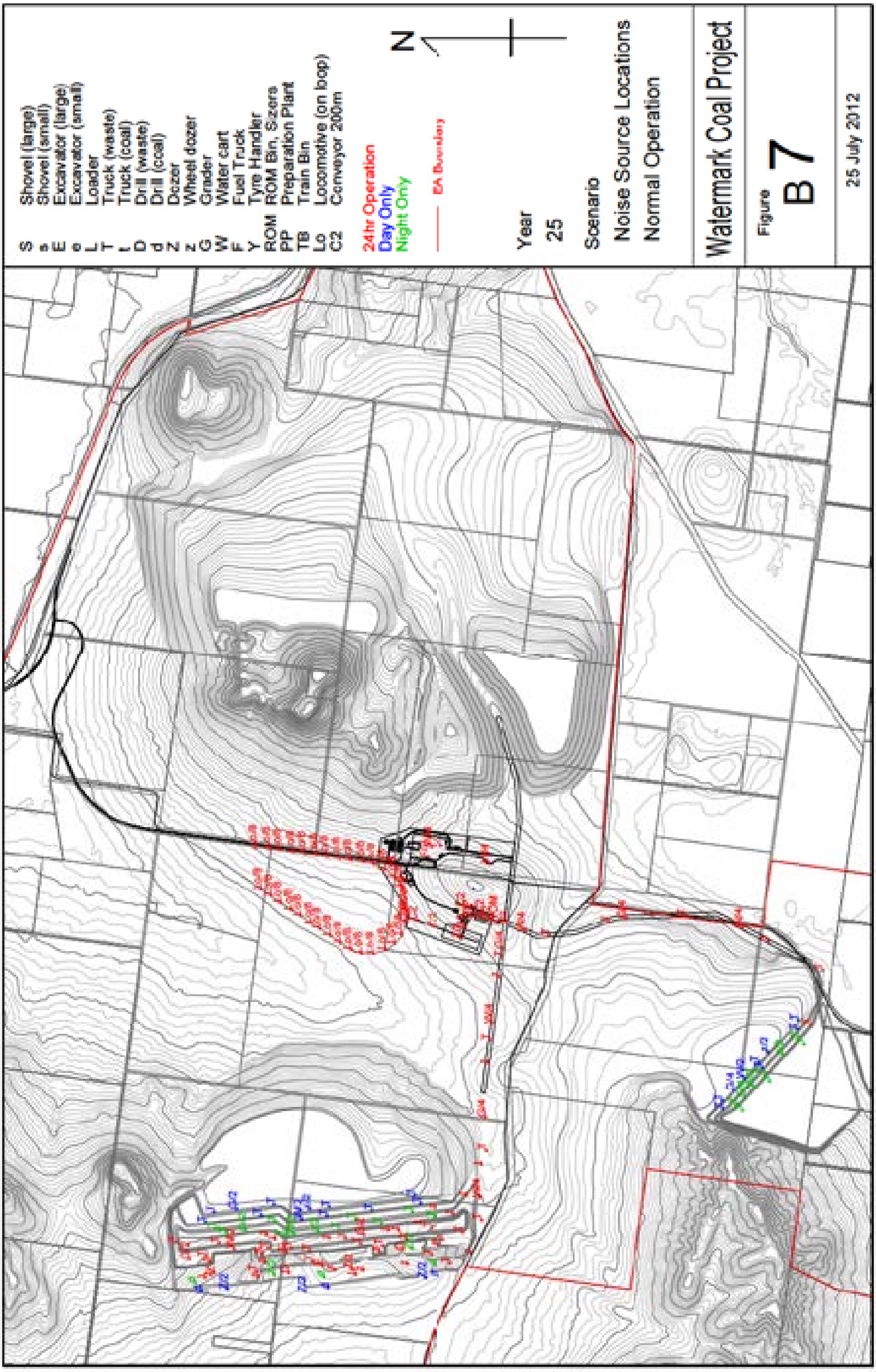
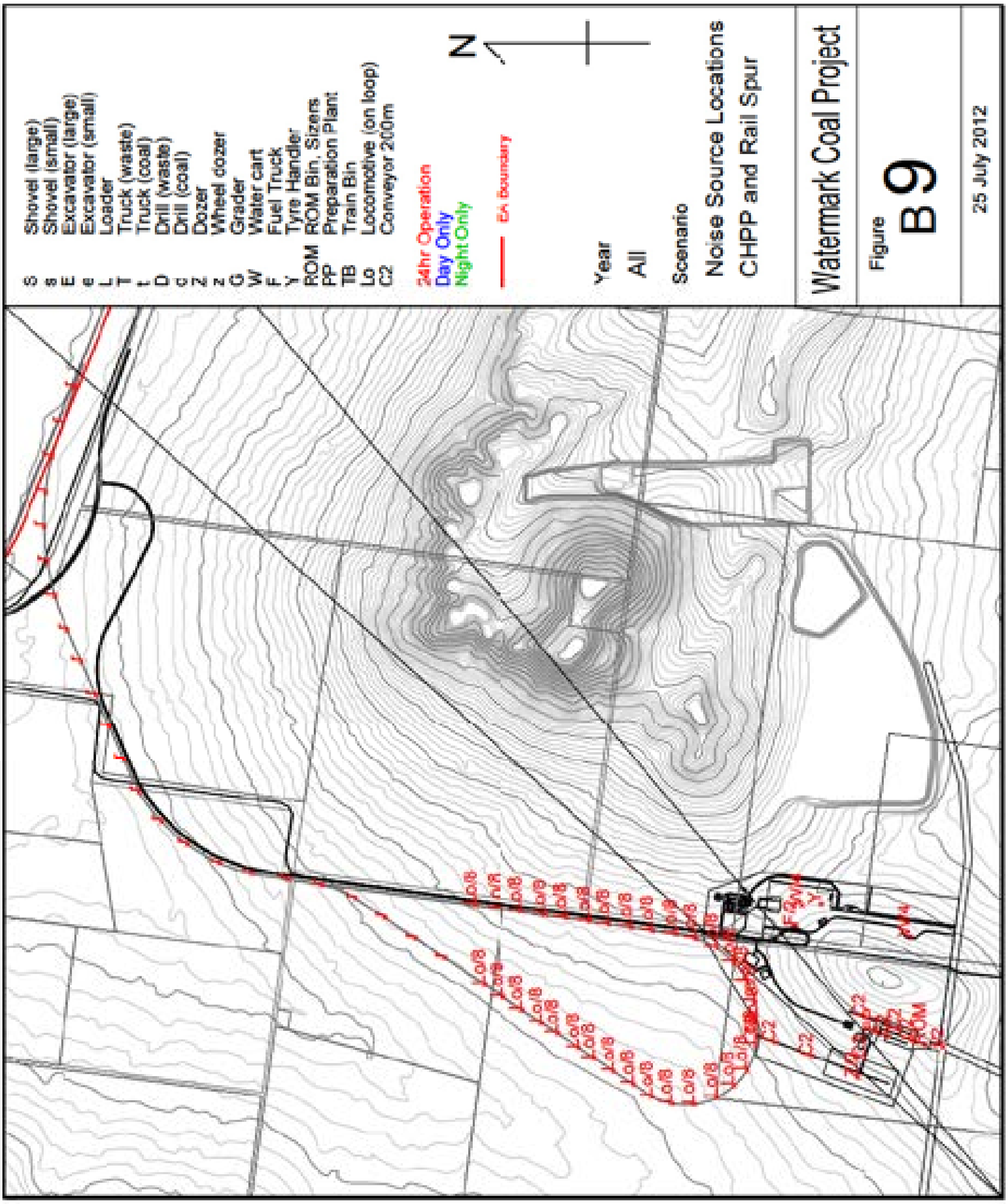
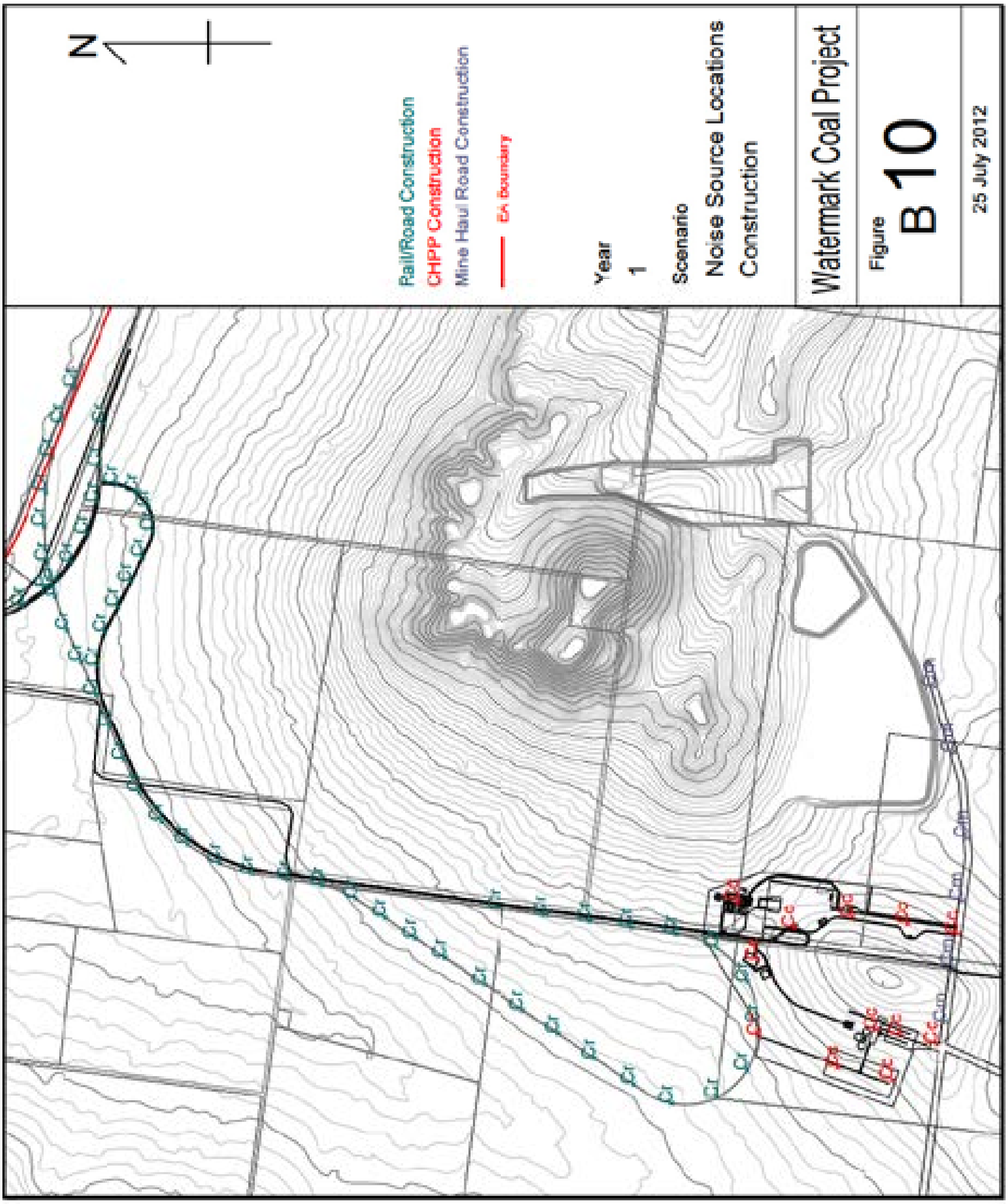


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
N Dozer
n Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on bop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
25
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B7
25 July 2012


S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
Z Dozer
z Wheel dozer
G Grader
W Water cart
F Fuel Truck
Y Tyre Handler
ROM ROM Bin, Sizers
PP Preparation Plant
TB Train Bin
Lo Locomotive (on loop)
C2 Conveyor 200m
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
30
Scenario
Noise Source Locations
Normal Operation
Watermark Coal Project
Figure
B8
25 July 2012



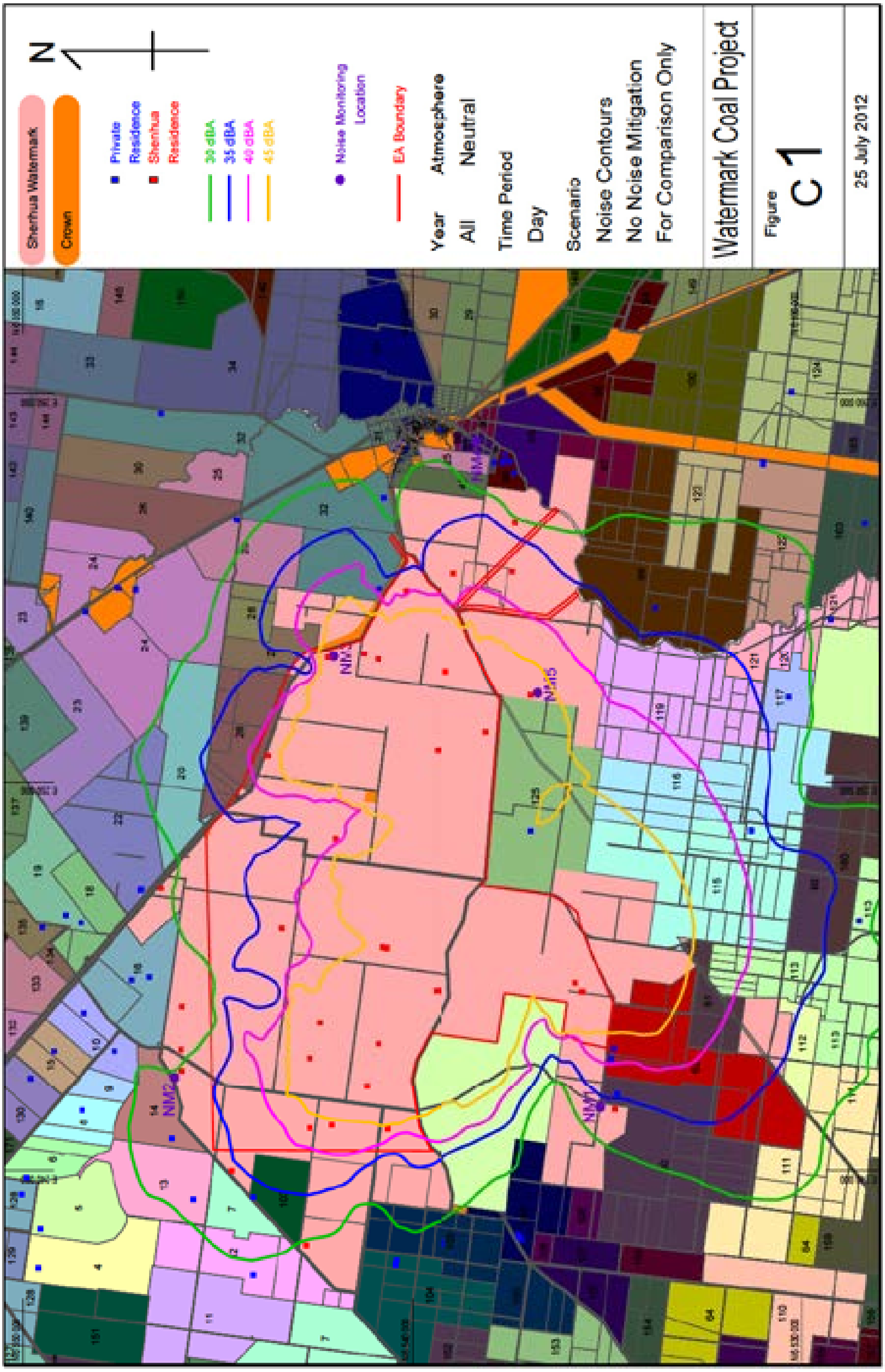
S Shovel (large)
s Shovel (small)
E Excavator (large)
e Excavator (small)
L Loader
T Truck (waste)
t Truck (coal)
D Drill (waste)
d Drill (coal)
C Dozer
Z Wheel dozer
z Grader
G Water cart
W Fuel Truck
F Tyre Handler
Y ROM Bin, Sizers
ROM Preparation Plant
PP Train Bin
TB Locomotive (on loop)
Lo Conveyor 200m
C2
24hr Operation
Day Only
Night Only
EA Boundary
N
Year
All
Scenario
Noise Source Locations
CHPP and Rail Spur
Watermark Coal Project
Figure
B9
25 July 2012

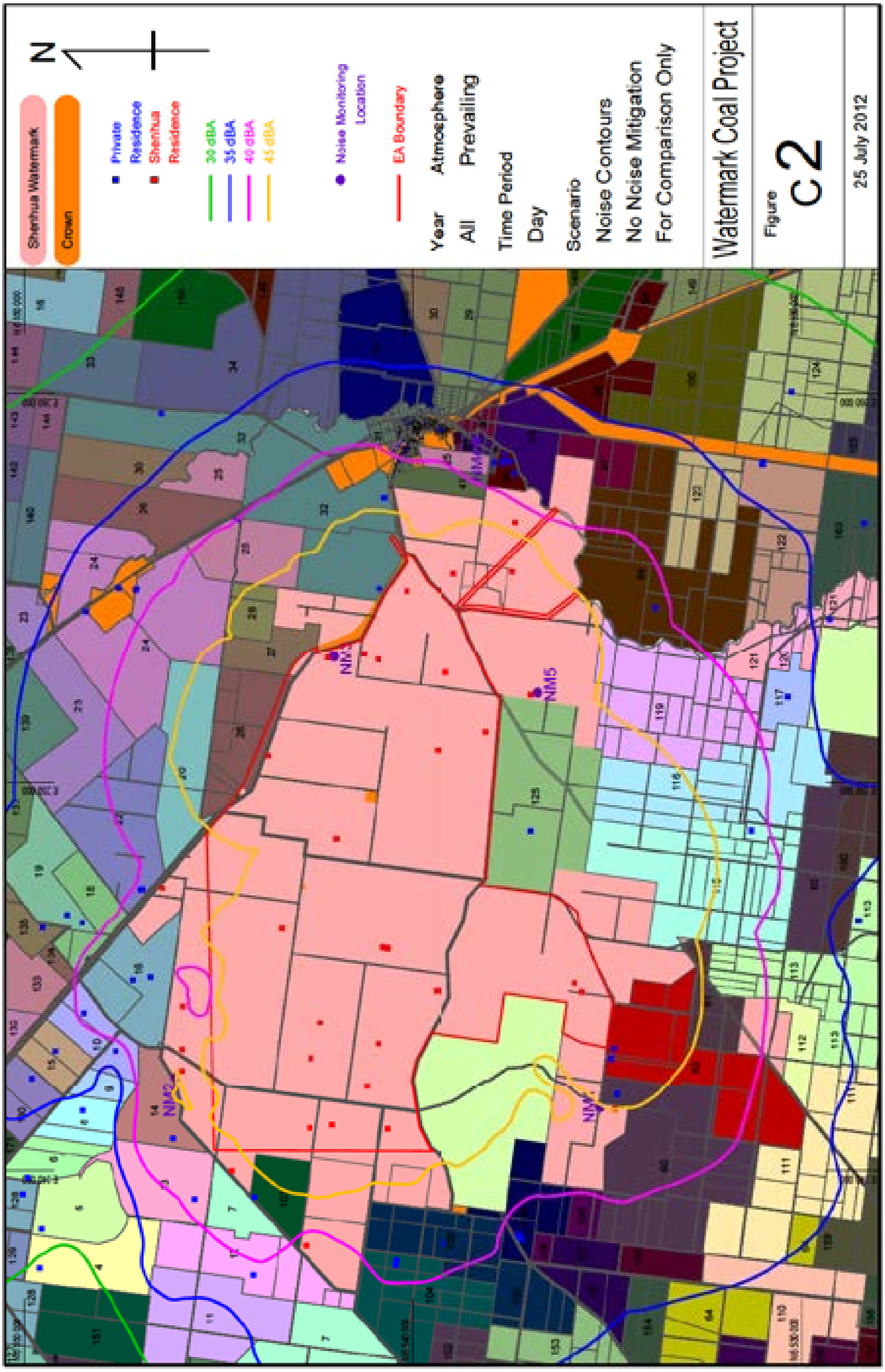

N
Rail/Road Construction
CHPP Construction
Mine Haul Road Construction
EA Boundary
Year
1
Scenario
Noise Source Locations
Construction
Watermark Coal Project
Figure
B 10
25 July 2012

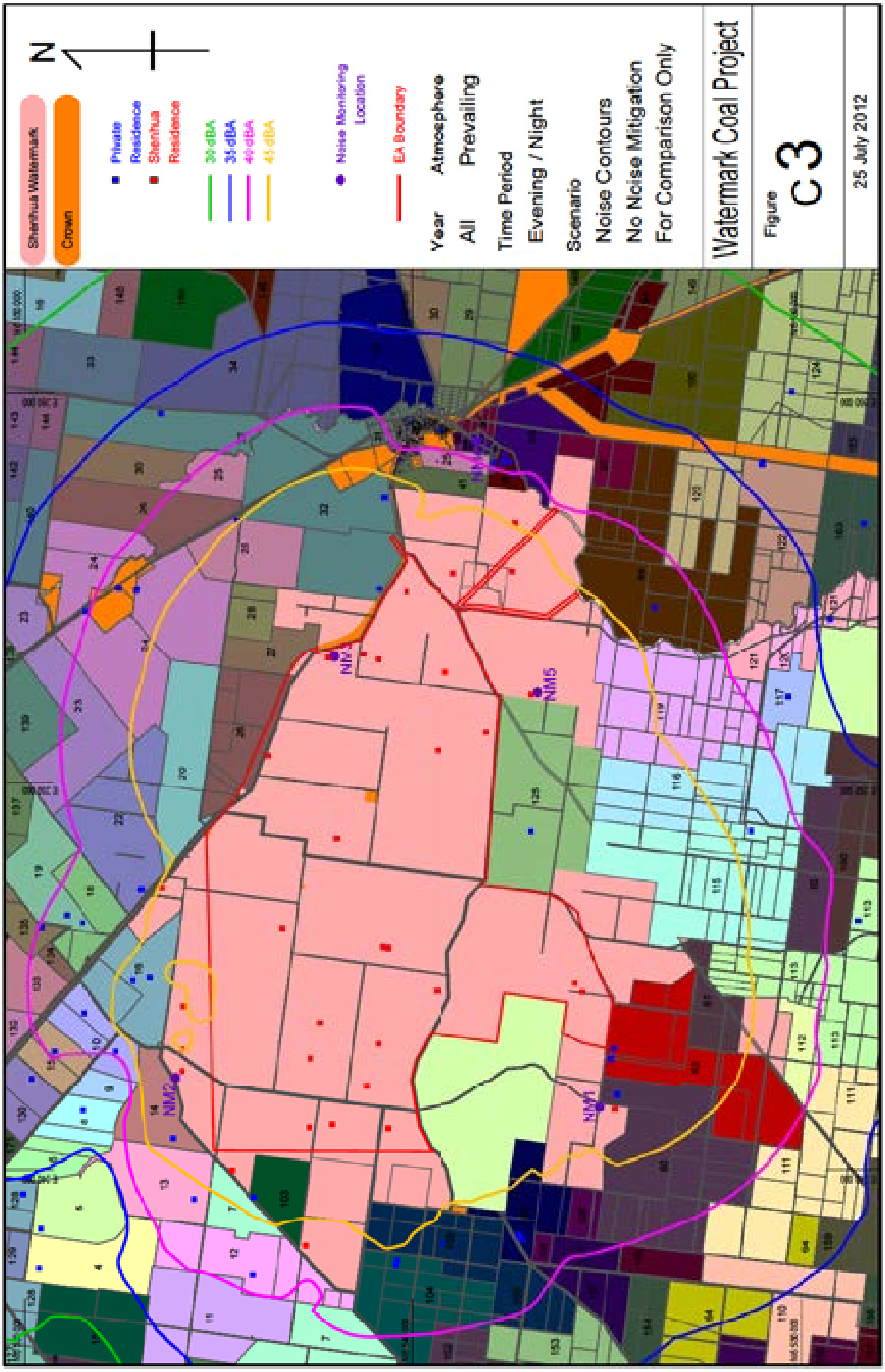
APPENDIX C – ALTERNATIVE CASE NOISE CONTOUR FIGURES

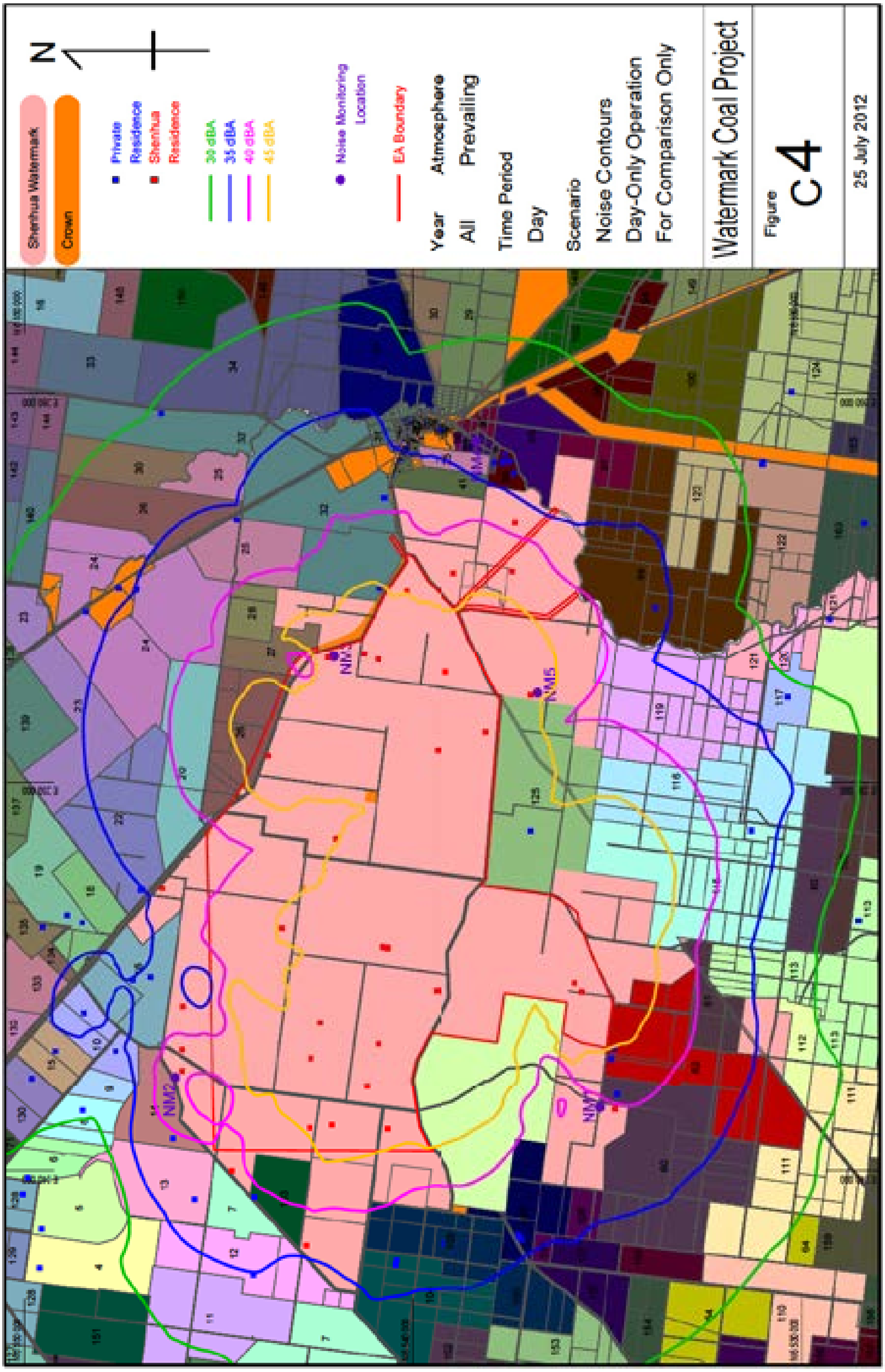
Noise contour figures for these alternative cases do not represent proposed noise levels associated with the Project. The noise contour figures have been presented for comparison purposes only.

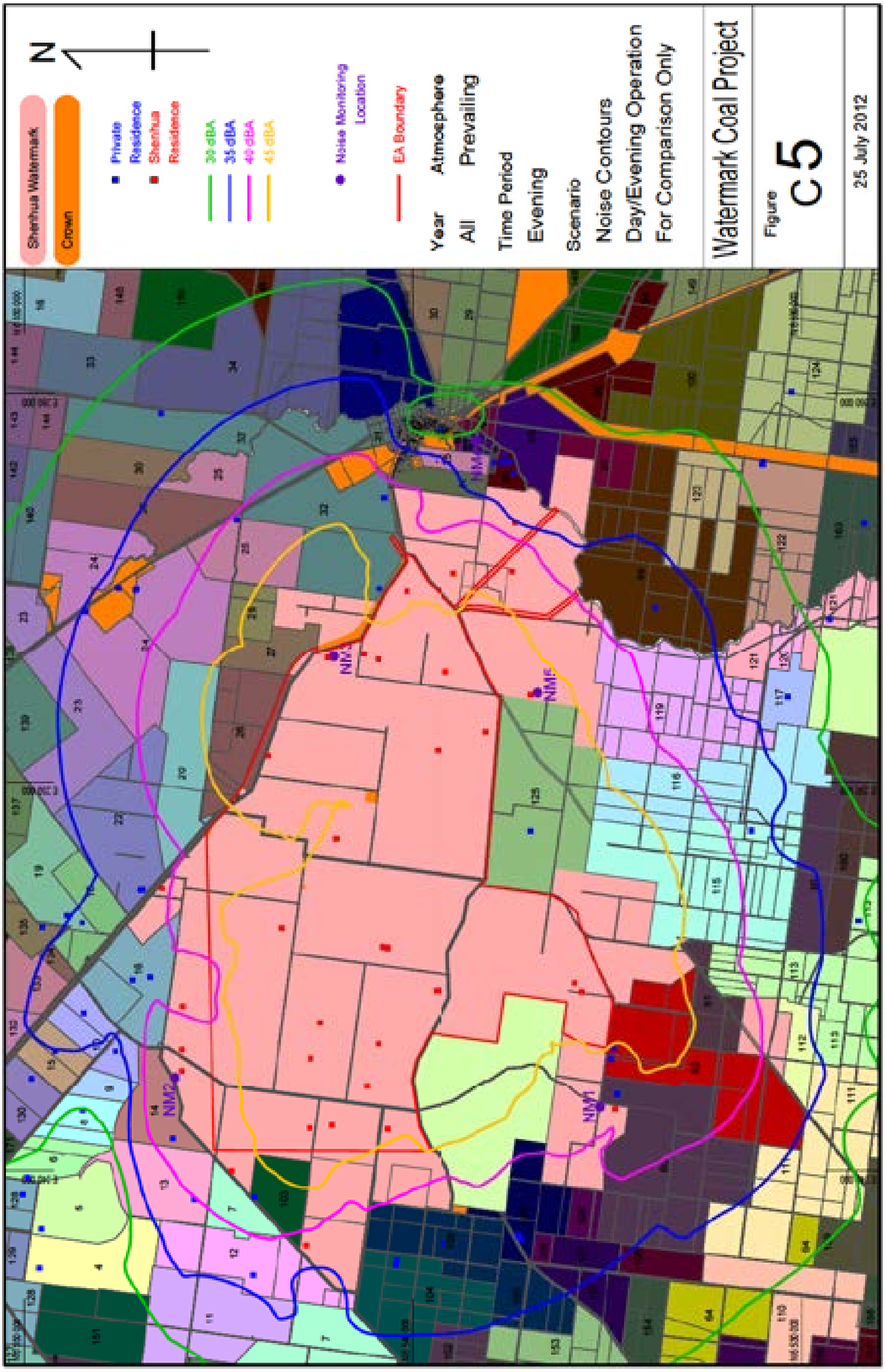
FIGURE	NOISE CONTOURS – NO NOISE MITIGATION		
C1	All years	Day	Neutral weather conditions
C2	All years	Day	Prevailing weather conditions
C3	All years	Evening/night	Prevailing weather conditions
FIGURE	NOISE CONTOURS – DAYTIME OPERATION ONLY		
C4	All years	Day	Prevailing weather conditions
FIGURE	NOISE CONTOURS – DAY AND EVENING OPERATION ONLY		
C5	All years	Evening	Prevailing weather conditions
FIGURE	NOISE CONTOURS – BEST CASE MITIGATION		
C6	All years	Evening/night	Prevailing weather conditions

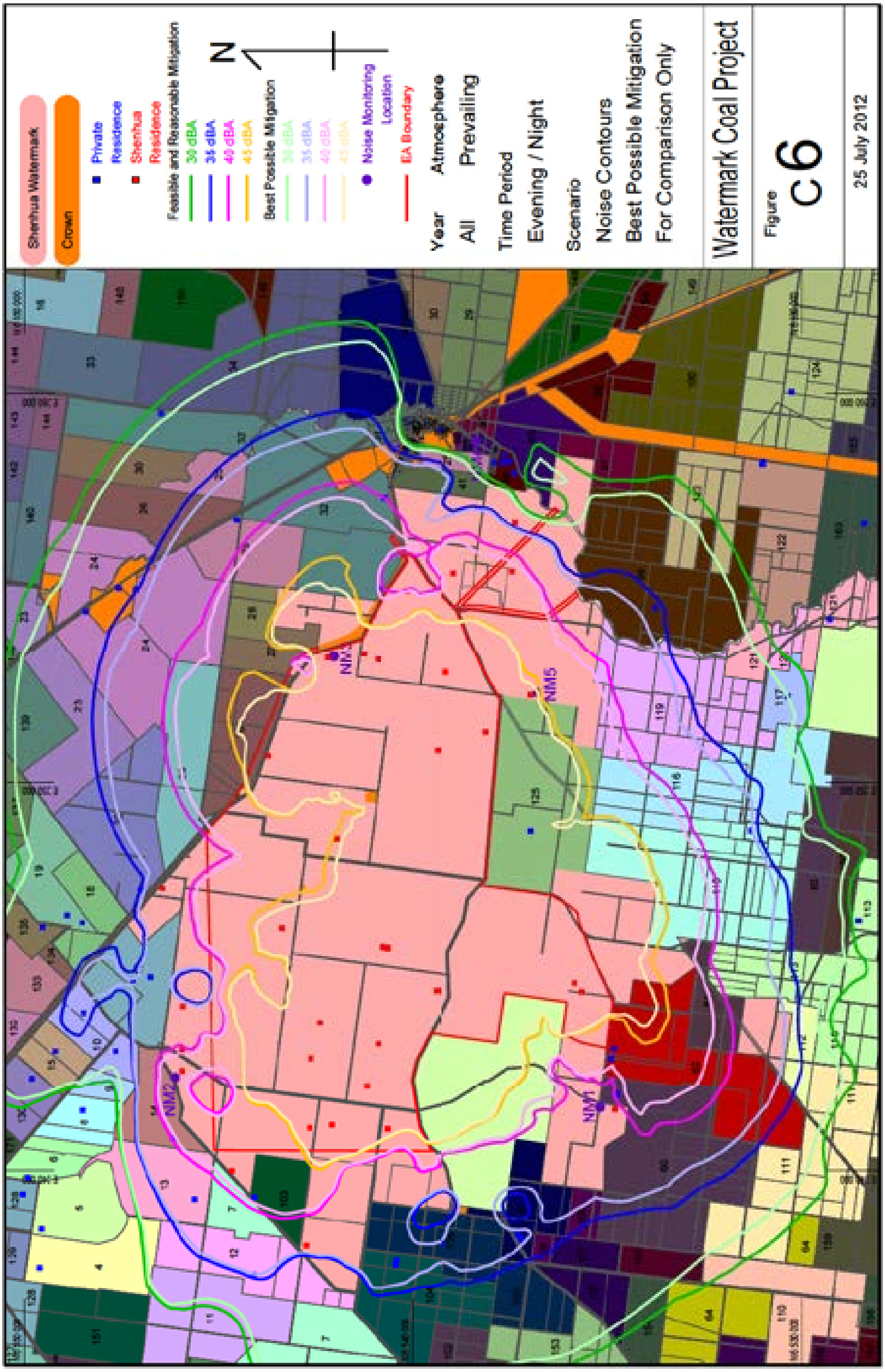

Sherhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Neutral
Time Period
Day
Scenario
Noise Contours
No Noise Mitigation
For Comparison Only
Watermark Coal Project
Figure
C1
25 July 2012


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
No Noise Mitigation
For Comparison Only
Watermark Coal Project
Figure
c2
25 July 2012
NM2
NM3
NM5


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year Atmosphere
All Prevailing
Time Period
Evening / Night
Scenario
Noise Contours
No Noise Mitigation
For Comparison Only
Watermark Coal Project
Figure
C3
25 July 2012
NM1
NM2
NM3
NM5


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Day
Scenario
Noise Contours
Day-Only Operation
For Comparison Only
Watermark Coal Project
Figure
C4
25 July 2012
NM2
NM3
NM5


Shenhua Watermark
Crown
Private Residence
Shenhua Residence
30 dBA
35 dBA
40 dBA
45 dBA
Noise Monitoring Location
EA Boundary
Year
All
Atmosphere
Prevailing
Time Period
Evening
Scenario
Noise Contours
Day/Evening Operation
For Comparison Only
Watermark Coal Project
Figure
C5
25 July 2012
NM1
NM2



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APPENDIX D – PREDICTED NOISE LEVEL TABLES

TABLE	DESCRIPTION
D1	Predicted operational noise levels at residences, day neutral
D2	Predicted operational noise levels at residences, day prevailing
D3	Predicted operational noise levels at residences, evening/night prevailing
D4	Predicted operational noise levels over 25% of property areas, day neutral
D5	Predicted operational noise levels over 25% of property areas, day prevailing
D6	Predicted operational noise levels over 25% of property areas, evening/night prevailing

Construction and sleep disturbance noise levels are not included in the tables. Entries in the tables have been shaded using the following colours:

- Red – a significant noise impact of 5 dBA or more above the intrusive criteria;
- Blue – a moderate noise impact of less than 5 dBA above the intrusive criteria; and
- Green – a mild noise impact of 2 dBA or less above the intrusive criteria.

Table D1: Operational Noise Levels at Residences, Day Neutral, LAeq,15min

Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Day Neutral, LAeq,15min							
2	12.0	20.1	18.3	15.4	12.9	4.1	11.1	3.7
4	-1.7	-0.9	-0.4	-1.9	-0.2	0.5	5.9	1.3
5	-1.6	-0.5	0.9	-1.2	-0.5	0.4	5.5	1.1
6	0.0	1.7	2.7	0.7	0.0	0.0	5.0	0.7
8	4.8	7.2	6.9	5.2	5.6	3.3	8.2	3.7
10N	8.1	11.1	11.3	8.7	7.6	6.7	12.0	7.6
10S	7.7	10.3	10.1	8.2	7.9	7.2	15.0	9.5
12	6.7	8.3	7.6	4.4	7.4	7.5	21.6	15.2
13	9.2	10.1	9.2	7.1	9.0	9.9	23.7	17.3
14	10.2	11.3	10.6	8.6	10.4	11.5	25.5	19.5
15	6.1	9.1	9.6	6.9	5.4	4.9	10.8	5.1
16N	10.9	14.4	13.4	11.2	10.4	9.7	14.4	10.1
16S	12.8	15.9	15.0	12.6	11.9	11.5	15.0	11.6
19N	9.0	14.4	13.8	11.1	9.9	8.1	11.2	7.2
19S	9.6	14.5	14.0	11.4	10.0	8.4	11.5	7.7
22	12.8	18.3	16.9	14.2	13.1	12.2	16.0	11.4
24N	11.1	19.4	17.7	13.3	12.3	5.0	11.1	4.5
24S	12.5	20.8	18.7	16.4	13.4	4.2	11.3	3.6
25S	16.1	17.8	21.3	20.7	22.1	11.1	12.4	7.1
25W	12.8	16.6	19.0	21.8	18.8	6.8	9.9	2.2
32E	15.9	19.2	21.9	22.3	20.6	10.3	10.3	5.0
32N	9.2	13.3	14.0	15.1	14.6	4.7	7.8	-0.4
32W	18.7	21.3	26.0	29.7	23.0	10.9	11.2	5.0
35	14.2	16.7	19.8	19.0	18.3	9.2	9.3	4.3
36	13.7	16.1	19.3	18.5	17.6	9.0	9.1	4.0
39	16.0	19.0	21.6	21.6	20.8	10.4	10.4	5.2
40	15.1	17.5	20.5	19.8	19.4	9.9	10.1	5.2
41	15.7	18.5	21.2	20.9	20.7	10.3	10.5	5.3
43	15.2	17.5	20.6	19.8	19.6	10.0	10.3	5.4
44	14.9	17.0	20.3	19.4	18.9	9.7	10.0	5.1
45	14.6	16.6	20.1	19.1	18.5	9.6	9.9	4.9

Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Day Neutral, LAeq,15min							
47	14.3	16.3	19.8	18.9	18.2	9.4	9.7	4.7
48	14.2	16.2	19.7	18.8	18.1	9.4	9.7	4.6
51	13.7	15.7	19.1	18.3	17.4	9.1	9.4	4.3
52	13.5	15.5	18.9	18.0	17.2	9.0	9.3	4.1
54	15.2	16.8	20.5	19.5	19.2	10.0	10.6	5.8
59	11.6	13.6	13.3	13.6	16.9	11.0	11.1	4.8
60	8.3	10.6	9.5	7.8	11.3	25.4	21.6	10.1
62E	12.4	14.8	13.4	10.6	14.3	31.5	27.3	10.5
62W	11.0	13.3	12.1	9.6	13.2	29.5	25.2	10.6
88	12.1	13.7	16.5	15.9	15.2	8.5	8.8	3.5
98N	11.5	13.4	13.1	13.5	16.6	10.9	10.9	4.4
98W	12.2	14.1	13.7	14.3	17.2	11.6	11.2	4.5
99	19.4	21.5	20.2	20.0	25.4	17.7	15.2	8.8
103	8.7	10.0	9.0	6.2	8.9	9.9	25.8	19.2
104	7.1	8.3	7.8	5.7	7.4	9.1	18.9	13.8
105	7.0	8.4	8.0	6.0	7.5	9.7	19.0	13.9
106	6.2	7.4	6.7	5.2	7.1	11.4	17.3	12.1
113	13.8	15.5	13.1	10.3	14.8	23.4	19.5	7.1
115	20.1	22.3	17.7	15.8	22.0	29.4	25.4	12.9
117	19.2	20.7	17.5	16.6	22.5	20.8	18.4	10.4
121	14.8	16.4	14.3	12.5	17.1	13.7	11.9	3.9
122	11.7	13.1	13.5	12.6	16.1	10.3	9.1	2.7
124	9.4	10.5	11.6	9.7	13.5	7.4	7.2	0.4
125	35.1	38.8	30.9	29.7	34.5	36.5	37.1	27.3
128	-0.7	0.8	2.0	-0.1	-0.6	-0.1	4.8	0.6
130	4.7	7.3	8.3	5.5	3.9	3.3	9.3	3.2
135	8.2	13.4	12.9	10.2	9.1	7.2	10.3	6.4
163	10.6	11.6	11.4	10.1	11.6	9.5	8.5	1.6

Table D2: Operational Noise Levels at Residences, Day Prevailing, LAeq,15min

Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Day Prevailing, LAeq,15min							
2	26.9	29.0	31.3	31.2	29.8	22.5	25.8	21.7
4	15.2	15.9	15.6	14.7	15.7	15.2	22.8	18.1
5	15.8	16.6	16.2	15.2	15.8	16.2	24.0	20.1
6	16.8	17.5	17.4	16.7	16.5	17.2	25.6	20.9
8	18.8	19.7	20.3	18.8	19.2	19.0	27.3	23.1
10N	22.2	23.7	24.6	21.7	23.8	23.2	33.1	25.9
10S	22.2	23.1	23.8	21.8	23.1	23.9	31.0	24.4
12	20.2	21.8	22.4	20.7	21.7	25.5	31.8	28.2
13	21.8	22.6	22.8	21.3	22.7	27.5	33.8	31.3
14	22.2	23.1	23.3	22.1	23.0	27.8	36.6	33.9
15	22.2	23.1	23.0	20.8	23.4	23.0	30.5	25.0
16N	23.1	24.7	24.8	23.2	24.5	23.9	32.1	27.3
16S	24.7	26.2	25.9	24.2	25.8	24.7	32.9	28.3
19N	25.5	27.6	28.8	25.9	27.6	20.7	30.3	26.3
19S	25.9	27.9	28.9	25.6	27.8	21.2	30.8	26.9
22	29.2	31.0	32.0	28.4	30.4	23.8	31.1	28.0
24N	26.3	28.5	30.7	29.7	29.2	22.1	25.5	21.3
24S	27.4	29.6	31.9	32.1	30.4	22.7	26.2	22.0
25S	25.7	27.7	29.5	32.5	32.6	21.7	22.9	17.5
25W	27.0	29.5	32.4	33.0	31.1	22.4	25.5	20.9
32E	28.6	31.1	33.4	36.3	34.0	22.2	24.7	20.1

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Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Day Prevailing, LAeq,15min							
32N	22.5	24.9	27.1	27.4	26.8	20.4	22.7	18.1
32W	30.1	33.4	38.5	42.4	39.1	24.1	26.4	20.5
35	25.5	27.9	29.9	32.9	30.4	20.6	22.6	18.1
36	24.6	27.1	29.2	31.2	29.8	20.5	22.2	17.5
39	28.1	30.5	32.7	35.3	33.4	21.9	24.4	19.7
40	26.5	28.9	30.6	33.3	31.4	20.9	23.0	18.4
41	27.6	30.0	32.0	34.4	32.8	21.5	24.0	19.2
43	26.4	28.8	30.5	33.2	31.5	21.0	23.0	18.3
44	25.6	28.0	29.9	32.5	30.9	20.8	22.7	17.9
45	25.2	27.6	29.6	32.2	30.6	20.7	22.5	17.7
47	24.9	27.3	29.3	31.6	30.3	20.7	22.4	17.5
48	24.8	27.2	29.2	31.3	30.2	20.7	22.3	17.5
51	24.3	26.6	28.7	30.1	29.8	20.6	22.1	17.2
52	24.2	26.4	28.5	29.7	29.7	20.6	22.0	17.1
54	25.3	27.4	29.3	31.7	31.2	21.1	22.6	17.5
59	24.4	25.1	26.4	24.6	30.7	22.1	22.7	15.8
60	26.0	27.0	26.5	25.4	26.9	37.6	35.0	24.6
62E	26.6	27.7	27.1	25.7	27.2	41.6	37.9	23.8
62W	26.8	27.8	27.2	26.0	27.3	40.1	37.2	24.4
88	23.2	24.6	27.0	26.6	29.1	20.6	21.6	16.4
98N	24.4	25.1	26.3	24.8	30.7	22.1	22.7	15.8
98W	24.6	25.4	26.5	25.3	31.0	22.2	22.8	16.1
99	27.2	29.4	28.0	25.5	33.1	29.5	26.0	20.0
103	22.7	23.9	24.6	22.9	23.9	28.1	36.4	32.5
104	20.0	21.2	21.6	20.3	22.0	27.8	33.4	30.1
105	20.7	21.9	22.1	20.8	22.7	27.8	33.7	29.3
106	21.7	22.8	22.5	21.2	23.2	30.6	32.6	26.7
113	18.6	20.2	19.4	16.1	21.3	24.2	22.6	15.4
115	22.0	24.2	20.3	21.0	26.0	34.2	29.9	21.9
117	23.0	24.4	20.6	18.6	23.7	28.8	26.0	19.6
121	20.3	21.8	19.6	16.5	21.8	22.5	20.9	14.8
122	19.6	22.0	23.5	21.0	25.9	21.6	20.1	14.0
124	17.4	19.7	21.0	19.6	23.5	18.8	18.3	12.0
125	39.8	42.6	36.3	36.0	42.6	45.8	45.7	35.0
128	16.4	17.1	17.1	16.2	16.3	17.1	25.2	20.6
130	20.8	21.7	21.8	19.9	22.4	21.1	29.5	24.0
135	24.5	26.5	27.9	25.1	26.7	20.6	30.0	25.7
163	17.4	19.4	20.1	17.9	20.9	19.8	18.3	11.6

Table D3: Operational Noise Levels at Residences, Evening/Night Prevailing, LAeq,15min

Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Evening/Night Prevailing, LAeq,15min							
2	29.0	31.3	34.1	33.9	31.8	23.7	26.7	22.9
4	16.6	17.8	17.3	16.1	17.0	17.3	22.7	19.0
5	17.3	18.7	17.8	16.5	17.2	17.9	24.6	21.5
6	18.2	19.3	18.7	17.2	17.8	18.5	26.7	22.7
8	20.4	21.9	22.2	20.6	20.9	20.3	27.9	25.1
10N	24.7	25.9	26.6	23.9	25.7	25.1	35.7	29.0
10S	24.2	25.2	25.9	23.6	24.8	25.4	32.2	28.2
12	21.7	23.0	23.4	21.8	22.8	27.4	35.4	31.7
13	23.2	24.2	24.4	22.8	24.2	28.6	37.8	35.2
14	24.1	25.1	25.2	23.8	24.5	29.1	40.1	37.1
15	23.7	24.9	24.8	22.5	25.0	24.1	32.8	28.2

Year	1	2	5	10	15	21	25	30
Residence	Predicted Residence Noise Level, Evening/Night Prevailing, LAeq,15min							
16N	26.4	27.5	27.9	26.2	27.6	26.7	35.5	30.2
16S	28.0	28.9	29.2	27.4	28.9	27.7	36.0	31.9
19N	27.6	29.3	30.6	27.4	29.2	23.6	32.8	28.4
19S	28.2	29.7	30.6	27.3	29.5	24.4	33.6	29.3
22	31.7	33.6	34.6	30.5	32.7	27.1	35.2	31.5
24N	28.1	30.4	33.2	32.4	31.0	23.4	26.6	22.6
24S	29.8	32.1	34.9	34.9	32.6	24.0	27.1	23.3
25S	26.5	28.1	29.8	35.0	33.0	22.1	22.6	18.3
25W	29.5	32.0	36.6	38.4	35.0	24.1	26.0	22.0
32E	30.3	32.3	35.5	40.0	35.8	24.1	25.1	21.2
32N	23.9	26.3	29.4	30.5	28.6	21.1	22.8	18.6
32W	32.0	33.9	38.8	40.9	40.3	26.3	27.7	22.9
35	26.6	28.8	31.3	35.7	31.5	22.0	22.5	18.9
36	25.5	27.8	29.9	33.3	30.5	21.7	22.0	18.3
39	29.6	31.6	34.7	38.6	35.0	23.7	24.7	20.6
40	27.8	29.8	32.2	36.2	32.5	22.4	23.0	19.3
41	29.0	31.0	33.9	37.3	34.2	23.2	24.2	20.2
43	27.7	29.7	32.0	35.9	32.5	22.4	23.0	19.2
44	26.8	28.8	31.0	35.2	31.8	22.1	22.6	18.7
45	26.3	28.4	30.4	34.5	31.4	21.9	22.3	18.5
47	25.9	28.0	29.9	33.7	31.0	21.8	22.2	18.3
48	25.7	27.8	29.7	33.3	30.9	21.8	22.1	18.3
51	25.1	27.1	28.8	31.7	30.3	21.6	21.8	18.0
52	24.8	26.8	28.4	31.1	30.0	21.6	21.7	17.9
54	26.3	28.0	29.7	33.9	31.9	22.0	22.3	18.4
59	24.1	24.5	21.1	21.2	29.1	21.2	21.9	16.4
60	28.6	29.7	29.3	27.8	28.9	40.3	39.1	29.4
62E	30.3	31.2	30.8	29.7	30.4	42.4	42.1	30.2
62W	30.1	31.1	30.6	29.4	30.2	40.9	41.5	30.1
88	23.2	24.6	24.8	26.2	28.8	21.3	21.1	17.1
98N	24.1	24.5	21.2	21.5	29.0	21.2	21.8	16.3
98W	24.4	25.0	21.8	22.4	29.5	21.4	22.0	16.6
99	28.2	30.0	31.4	32.2	35.4	30.3	26.8	21.2
103	24.7	25.7	26.1	24.5	25.7	29.7	40.8	37.6
104	22.6	23.6	23.9	22.8	23.4	30.2	36.2	33.6
105	23.6	24.6	24.8	23.6	24.2	30.9	35.6	32.0
106	24.2	25.2	24.9	23.6	24.5	33.1	35.6	30.5
113	20.9	21.8	23.3	19.5	24.0	28.9	26.9	21.8
115	27.0	28.5	28.3	26.4	31.8	35.9	31.7	23.9
117	24.8	26.6	27.0	27.1	30.9	28.4	25.8	20.3
121	21.3	23.0	23.7	24.3	26.3	21.0	20.1	15.6
122	19.6	22.2	24.4	23.5	26.9	21.6	20.2	14.4
124	17.2	19.6	21.4	21.5	24.0	18.6	18.0	12.0
125	44.5	46.0	42.3	39.8	45.9	48.2	46.5	38.0
128	17.9	19.0	18.5	16.9	17.7	18.5	26.3	22.2
130	22.4	23.5	23.4	21.4	23.8	22.1	31.3	26.7
135	26.3	28.1	29.6	26.4	28.2	23.1	32.1	27.5
163	17.3	19.9	22.5	22.5	23.1	19.1	17.7	11.8

Table D4: Operational Noise Levels over Property Areas, Day Neutral, LAeq,15min

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Neutral, LAeq,15min							
2	12.2	20.6	18.9	15.3	13.1	5.1	11.7	4.8

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Neutral, LAeq,15min							
4	7.5	8.0	7.5	6.2	7.9	7.9	19.3	14.3
5	2.9	3.6	4.2	3.0	4.7	4.5	11.5	7.7
6	2.1	4.0	4.4	2.7	3.0	1.3	7.0	3.2
007E	8.9	10.1	9.0	6.6	8.9	9.9	25.0	18.5
007W	5.6	7.0	6.1	3.9	6.1	6.8	17.6	11.7
8	5.7	8.0	7.4	5.9	7.2	5.0	11.4	7.5
9	7.5	10.0	8.9	7.4	8.4	7.7	15.6	10.6
10	8.1	10.9	11.1	8.6	8.1	7.2	14.7	9.3
11	6.3	8.1	7.0	4.0	6.8	6.9	19.3	13.2
12	7.9	9.2	8.2	5.4	8.0	8.5	22.2	16.0
13	9.7	10.7	10.0	8.1	9.9	10.9	24.8	18.8
14	9.9	11.5	10.3	8.8	10.5	11.6	25.7	20.3
15	6.4	9.4	9.8	7.2	5.9	5.2	11.0	5.5
016E	5.9	10.2	10.4	9.8	11.0	2.7	5.5	-2.6
016W	12.7	16.2	15.4	12.8	11.9	11.6	16.0	12.1
18	10.3	16.7	15.2	12.2	11.3	9.4	12.8	8.5
19	8.9	17.4	14.7	11.2	11.2	8.1	11.7	7.2
20	15.2	27.3	24.1	17.8	17.5	12.1	17.2	11.3
21	9.4	13.6	13.2	10.5	9.1	8.1	11.4	7.7
22	12.3	22.8	18.7	14.8	14.3	10.8	15.5	9.8
23	10.6	20.9	18.5	13.6	13.8	8.4	13.0	7.1
24	13.8	23.1	21.2	18.1	15.5	6.3	13.0	5.9
025E	12.5	15.8	17.4	19.5	17.6	6.5	9.3	1.7
025S	15.5	17.1	20.2	20.0	21.3	11.5	12.2	6.8
025W	15.1	19.0	21.5	25.5	21.0	8.0	10.8	3.5
026E	11.2	17.8	17.3	18.3	16.1	5.2	9.8	1.6
026W	18.9	32.8	28.4	19.8	19.7	11.5	17.7	11.1
27	18.2	28.4	26.0	27.9	19.0	7.3	13.4	4.7
28	16.1	25.0	23.2	25.8	19.4	7.0	12.4	4.0
29	8.0	9.0	9.7	9.3	11.7	6.2	6.7	0.5
030N	9.5	15.5	15.1	15.9	15.0	4.7	8.7	0.4
030S	8.0	10.0	12.2	11.4	11.3	5.5	5.8	-0.4
31	12.8	15.7	18.6	18.1	17.2	8.3	8.1	2.8
32	16.5	19.3	22.8	25.4	21.1	9.8	10.2	5.0
33	7.6	12.4	12.2	12.5	12.8	3.6	6.8	-1.3
034N	10.6	13.3	15.6	15.7	15.1	6.1	7.4	1.3
034S	7.8	9.9	11.1	12.1	12.1	6.5	6.3	-0.1
35	14.2	16.7	19.8	19.0	18.3	9.3	9.4	4.4
36	13.7	16.2	19.3	18.6	17.7	9.0	9.0	3.9
37	12.8	15.2	18.3	17.6	16.6	8.6	8.7	3.4
038E	11.9	15.0	17.7	17.1	16.1	8.0	7.9	2.4
038W	12.6	15.0	18.1	17.4	16.4	8.5	8.6	3.3
39	16.0	19.0	21.6	21.6	20.8	10.4	10.5	5.2
40	15.1	17.4	20.5	19.7	19.4	9.9	10.1	5.2
41	17.3	20.1	22.2	21.9	23.3	13.2	13.0	7.0
42	15.8	18.5	21.3	20.7	21.0	10.4	10.8	5.6
43	15.3	17.7	20.7	19.9	19.8	10.1	10.4	5.5
44	15.0	17.1	20.4	19.5	19.1	9.9	10.2	5.3
45	14.7	16.7	20.2	19.2	18.7	9.7	10.0	5.1
46	10.1	13.3	15.7	15.8	14.7	7.2	7.0	1.1
47	14.6	16.5	20.0	19.0	18.4	9.5	9.9	4.9
48	14.3	16.3	19.8	18.9	18.2	9.4	9.8	4.8
49	11.3	14.4	17.1	16.7	15.6	7.7	7.6	2.0
50	14.1	16.0	19.5	18.6	17.9	9.3	9.6	4.6

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Neutral, LAeq,15min							
51	13.9	15.8	19.3	18.4	17.6	9.2	9.5	4.5
52	13.6	15.5	19.0	18.1	17.3	9.1	9.4	4.3
53	14.5	16.1	19.6	18.7	18.1	9.6	10.1	5.1
54	15.2	16.8	20.5	19.5	19.2	10.0	10.6	5.8
55	12.5	14.6	17.7	17.0	16.0	8.6	8.8	3.5
56	8.6	10.4	11.7	12.1	12.5	7.1	7.2	1.2
57	8.8	10.1	11.0	11.1	12.3	7.4	7.6	1.7
58	8.8	11.1	12.9	13.3	12.9	7.0	7.0	1.0
59	11.8	13.7	13.5	13.8	17.1	11.1	11.2	4.9
60	11.6	14.3	12.8	10.0	13.6	25.5	22.0	9.6
61	17.5	20.1	16.7	12.4	17.5	34.6	31.5	9.9
62	15.2	18.0	15.8	12.2	16.2	34.4	30.7	10.4
63	9.3	10.5	11.6	11.4	12.6	7.6	8.0	2.2
64	4.0	5.7	4.8	3.7	6.4	14.8	14.0	6.3
065C	12.3	14.2	17.3	16.7	15.7	8.5	8.8	3.5
065N	16.1	29.5	24.2	17.8	17.0	13.7	19.3	13.2
065S	9.4	10.6	11.7	11.5	12.7	7.7	8.1	2.4
66	9.0	10.2	11.1	11.0	12.4	7.5	7.9	2.0
67	8.9	10.1	10.9	10.8	12.4	7.5	7.8	1.9
68	9.3	12.0	14.2	14.4	13.6	7.1	7.1	1.1
69	8.8	9.9	10.7	10.6	12.3	7.4	7.8	1.9
70	8.6	10.3	11.5	11.8	12.4	7.1	7.2	1.2
71	9.1	11.0	12.8	13.0	12.9	7.3	7.3	1.4
72	9.7	12.7	15.1	15.3	14.3	7.1	6.9	0.9
73	9.2	11.6	13.7	13.9	13.3	7.2	7.1	1.2
74	9.4	11.9	14.1	14.3	13.6	7.2	7.2	1.3
75	9.7	12.3	14.6	14.7	13.9	7.3	7.3	1.3
76	9.7	12.4	14.8	14.9	14.0	7.3	7.2	1.3
77	9.5	12.2	14.4	14.6	13.8	7.2	7.1	1.1
78	10.5	12.9	15.5	15.2	14.4	7.7	7.7	2.0
79	10.0	12.3	14.6	14.5	13.8	7.5	7.6	1.8
80	10.2	12.6	15.1	15.0	14.1	7.5	7.5	1.7
81	10.0	12.4	14.8	14.8	14.0	7.5	7.5	1.7
82	9.7	12.7	15.1	15.2	14.3	7.2	7.0	1.0
83	9.9	12.9	15.3	15.4	14.4	7.2	7.0	1.1
84	10.1	13.2	15.7	15.7	14.7	7.3	7.1	1.2
85	10.4	13.5	16.1	16.0	14.9	7.3	7.1	1.3
86	11.8	14.7	17.5	17.0	15.9	8.0	7.9	2.5
87	11.5	14.5	17.2	16.7	15.7	7.9	7.8	2.2
88	11.8	13.3	16.1	15.5	14.8	8.4	8.7	3.3
89	9.4	10.9	12.3	12.2	12.7	7.5	7.8	2.0
90	9.7	11.0	12.3	12.1	12.9	7.8	8.1	2.4
91	9.1	10.5	11.7	11.7	12.5	7.5	7.7	1.9
92	8.6	9.8	10.5	10.6	12.2	7.3	7.6	1.6
93	10.3	13.2	15.7	15.6	14.7	7.4	7.4	1.5
94	10.3	13.2	16.0	15.2	14.7	6.4	6.3	0.7
95	12.7	14.3	14.2	14.1	17.0	10.6	10.6	3.8
96	11.1	12.4	13.3	13.3	15.1	9.1	9.9	4.3
097N	8.9	10.3	10.6	10.9	13.7	7.7	8.3	2.1
097S	14.7	16.5	16.3	15.1	19.6	11.8	11.0	4.5
098C	12.2	13.8	13.9	12.7	16.3	9.2	9.5	2.7
098E	9.9	11.5	12.0	10.6	14.2	6.5	7.4	0.3
098W	13.2	15.3	15.0	15.6	18.2	12.5	12.0	5.4
99	18.9	21.1	19.9	19.7	24.7	17.1	14.9	8.3

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Neutral, LAeq,15min							
100	11.4	12.9	13.7	12.7	16.4	9.1	8.7	2.2
101	7.7	8.6	9.0	9.3	11.9	6.4	6.7	0.2
102	10.1	11.8	11.7	10.5	14.2	7.6	8.4	1.9
103	9.6	10.7	9.9	7.2	9.7	10.9	27.4	21.2
104	6.4	7.6	7.2	5.0	6.7	8.8	18.1	12.7
105	7.5	8.8	8.3	6.3	7.9	10.3	19.4	14.5
106	7.9	9.0	8.1	6.8	8.7	14.4	18.4	13.3
107	5.5	6.6	5.9	4.5	6.7	13.0	15.2	9.6
108	6.5	7.5	6.8	5.6	7.9	15.4	16.3	10.9
109	5.0	6.4	5.6	4.5	7.2	16.4	15.3	8.3
110	4.3	6.7	6.6	4.4	7.0	16.2	14.6	5.6
111	8.8	11.6	10.5	7.5	10.4	20.8	18.6	6.9
112	13.4	15.3	13.0	9.6	13.4	25.8	23.4	7.4
113	15.1	17.1	14.5	11.1	15.2	28.2	25.5	8.5
114	16.9	18.8	15.9	12.0	16.5	31.3	28.6	9.3
115	23.4	26.2	21.1	18.6	24.3	36.7	33.0	16.4
116	25.6	27.9	22.1	20.0	27.2	29.8	26.3	16.4
117	19.6	21.3	17.8	17.0	22.9	22.1	19.4	10.7
118	21.3	23.5	18.7	16.7	22.9	28.8	24.6	13.7
119	24.3	27.0	22.7	21.9	29.2	25.3	21.7	13.7
120	17.5	19.4	16.3	15.5	19.9	17.3	15.1	7.8
121N	18.8	20.9	17.6	16.7	21.3	18.7	16.3	8.8
121S	14.2	15.8	13.9	12.1	16.5	13.0	11.4	3.5
122	14.4	16.1	14.9	13.6	16.9	13.6	11.9	4.6
123	15.5	17.2	16.9	15.9	20.1	13.9	12.0	5.8
124	9.0	10.0	11.2	9.4	13.2	7.1	7.0	0.1
125	35.3	39.2	30.2	28.8	38.7	36.0	36.2	25.9
127	-1.4	0.6	-0.2	-1.6	0.3	1.6	8.8	4.1
128E	-0.4	1.1	2.3	0.0	-0.6	-0.1	4.7	0.4
128W	-2.2	-1.0	-0.6	-2.1	-0.6	0.6	6.5	1.7
129	-2.0	-0.7	0.3	-1.6	-1.1	0.0	5.0	0.8
130	4.4	6.8	7.8	5.0	3.6	2.9	8.5	2.8
131	4.5	7.3	8.4	5.8	4.3	3.6	8.7	4.3
132	5.8	9.7	9.7	7.1	6.0	4.7	9.4	5.3
133	7.7	11.5	11.7	9.1	7.9	6.6	10.3	6.7
134	8.4	12.7	12.6	9.9	8.5	7.2	10.7	7.0
135	7.7	14.4	12.8	9.7	9.3	6.8	10.0	6.1
136	9.0	14.0	13.5	10.9	9.6	7.9	11.0	7.1
137	8.2	17.4	14.8	10.3	11.2	7.3	10.9	6.2
138	7.9	16.4	14.6	10.2	10.7	5.4	9.5	3.5
139	9.2	19.0	16.9	12.1	12.5	7.1	11.5	5.6
140	8.9	16.0	14.3	11.1	10.7	3.2	8.7	2.2
141	7.8	14.6	13.0	9.2	9.1	2.5	7.7	1.4
142	7.7	14.1	12.5	9.7	10.1	1.6	7.3	0.3
143	6.9	12.4	11.4	9.6	10.4	1.5	6.6	-1.0
144	7.0	12.4	11.5	10.5	11.1	2.1	6.7	-1.3
145	6.6	10.2	11.1	10.7	11.3	3.2	5.5	-2.3
146	8.1	10.6	12.7	11.5	12.4	4.4	5.5	-0.5
147	6.2	13.5	11.7	8.2	8.4	5.4	8.7	5.0
148	8.2	9.9	10.0	8.3	12.2	5.2	6.6	0.1
149	8.3	9.9	11.0	9.5	13.0	5.4	6.3	-0.8
150	8.5	11.3	12.7	12.5	12.8	4.5	6.3	-0.6
151	3.0	5.3	3.4	1.3	4.4	4.2	13.9	8.7
152	4.9	6.3	5.9	3.9	5.7	7.6	16.5	10.7

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Neutral, LAeq,15min							
153	4.3	5.4	4.9	3.3	5.3	9.3	15.0	9.3
154	4.5	5.6	4.9	3.7	6.2	13.1	14.1	7.7
155	3.0	4.6	3.7	2.9	5.4	12.7	12.5	5.2
156	2.4	4.5	4.5	2.8	5.1	12.7	11.7	4.1
157	2.8	4.9	5.6	3.1	5.0	13.4	12.3	3.5
158	3.6	6.0	6.5	4.1	6.0	14.6	13.0	4.0
159	6.0	8.7	8.2	5.7	8.2	17.6	15.6	5.1
160	14.0	15.5	13.1	10.6	14.8	22.8	18.7	8.0
161	12.8	14.1	12.1	9.5	13.6	21.6	18.6	6.6
162	9.8	11.2	9.3	7.9	11.2	16.8	14.5	6.5
163	11.9	13.6	12.6	11.2	13.4	10.9	9.6	2.7
164	10.1	11.4	10.7	9.5	11.1	9.4	8.2	0.8
165	8.3	9.2	10.1	8.5	10.7	7.3	7.0	-0.8
166	1.7	4.0	2.3	0.4	2.9	3.2	11.1	6.3
167	4.9	6.5	5.1	2.3	5.0	5.0	14.5	9.7
168	8.3	10.9	13.1	12.0	12.1	4.8	5.1	-0.5
169	6.0	7.2	9.1	7.3	11.0	3.9	4.9	-2.1
170	4.8	8.4	9.0	7.5	9.6	1.9	4.5	-3.6
171	2.0	4.4	5.6	2.6	1.3	0.7	5.3	0.4

Table D5: Operational Noise Levels over Property Areas, Day Prevailing, LAeq,15min

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Prevailing, LAeq,15min							
2	27.4	29.6	32.1	31.5	30.3	22.8	26.3	22.1
4	17.8	18.9	18.4	17.3	18.5	20.0	27.6	23.8
5	16.4	17.7	16.7	15.5	16.1	16.7	24.6	20.5
6	17.2	18.2	18.0	17.0	16.9	17.6	26.3	21.4
007E	22.4	23.5	24.1	22.6	23.5	28.1	35.5	32.1
007W	19.2	20.3	21.1	19.7	20.3	26.3	29.9	26.5
8	19.1	20.1	20.7	19.2	19.5	19.7	27.5	22.9
9	21.1	21.8	22.2	20.8	21.8	22.9	28.8	23.0
10	22.5	23.8	24.5	21.9	23.8	23.9	32.8	26.2
11	19.4	20.9	21.5	20.2	20.7	25.3	29.4	25.6
12	20.7	22.2	22.8	21.1	22.1	25.9	32.4	29.1
13	21.7	22.6	22.9	21.4	22.6	27.4	34.5	31.9
14	22.8	23.5	23.8	22.4	23.4	27.4	37.1	33.8
15	22.3	23.4	23.5	20.9	23.5	22.9	30.6	25.1
016E	19.0	21.3	22.8	22.5	23.0	17.9	20.1	15.8
016W	25.6	26.9	27.5	24.6	26.9	25.2	33.6	28.7
18	26.9	28.9	30.1	26.9	28.8	21.8	31.2	27.4
19	25.8	27.9	29.3	26.6	28.1	20.9	29.5	25.4
20	34.0	36.7	38.4	34.9	35.1	25.8	32.3	27.4
21	23.9	25.3	27.1	23.2	25.6	22.2	32.3	28.1
22	30.5	32.7	34.1	30.6	31.9	24.3	30.9	26.6
23	27.6	29.9	31.9	29.5	30.2	22.9	28.0	23.4
24	29.7	32.2	34.5	34.0	32.6	23.5	27.9	23.6
025E	25.7	28.1	30.8	31.3	30.0	21.7	24.6	19.9
025S	25.5	27.0	28.8	30.9	32.0	22.1	22.9	17.2
025W	29.1	31.7	35.2	36.1	33.6	23.3	26.6	22.2
026E	25.8	28.1	29.8	31.7	29.9	21.7	25.1	20.6
026W	37.6	41.3	43.0	37.7	37.4	26.9	32.4	27.7
27	32.4	36.3	38.2	41.4	35.1	24.8	28.9	24.4
28	30.2	33.6	35.5	39.6	34.5	24.2	28.1	23.4

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Prevailing, LAeq,15min							
29	21.7	23.1	24.0	24.3	27.4	20.5	20.9	15.5
030N	23.8	26.1	28.1	28.9	27.9	20.8	23.8	19.3
030S	21.1	22.8	23.9	25.0	26.1	19.9	20.6	15.8
31	24.6	27.0	29.5	32.7	29.7	20.3	22.0	17.9
32	29.9	32.4	35.3	37.1	34.8	23.2	25.6	20.9
33	20.9	23.1	25.0	25.1	25.0	19.1	21.6	17.2
034N	23.1	25.4	27.6	28.8	27.7	20.4	22.1	17.8
034S	21.9	22.9	25.3	25.1	27.9	20.5	20.7	15.4
35	25.4	27.9	29.9	32.8	30.4	20.6	22.5	18.0
36	24.8	27.3	29.4	31.7	29.9	20.5	22.2	17.7
37	23.8	26.1	28.4	29.5	29.2	20.4	21.8	17.0
038E	23.4	25.8	28.3	29.7	28.7	20.2	21.5	17.0
038W	23.7	25.9	28.2	29.2	29.1	20.4	21.7	17.0
39	28.1	30.6	32.7	35.4	33.4	21.9	24.4	19.7
40	26.4	28.8	30.6	33.3	31.3	20.9	23.0	18.3
41	27.5	29.8	31.9	34.6	33.6	22.7	23.9	18.7
42	27.4	29.8	31.7	34.1	32.6	21.4	23.7	18.9
43	26.6	28.9	30.6	33.2	31.6	21.1	23.1	18.3
44	25.8	28.1	30.0	32.5	31.0	20.9	22.7	17.9
45	25.3	27.7	29.6	32.2	30.7	20.8	22.5	17.7
46	22.4	24.3	27.2	28.2	28.1	20.1	20.9	16.3
47	25.1	27.4	29.4	31.8	30.5	20.7	22.4	17.6
48	24.9	27.2	29.2	31.3	30.3	20.7	22.3	17.4
49	23.0	25.2	27.9	29.1	28.4	20.2	21.3	16.7
50	24.6	26.9	29.0	30.8	30.1	20.7	22.2	17.3
51	24.4	26.7	28.7	30.2	30.0	20.6	22.1	17.2
52	24.2	26.4	28.5	29.7	29.8	20.6	22.1	17.1
53	24.7	26.8	28.9	30.7	30.5	20.8	22.3	17.3
54	25.2	27.4	29.4	31.8	31.2	21.0	22.6	17.5
55	23.5	25.4	27.8	28.2	29.2	20.5	21.7	16.7
56	22.1	22.9	25.4	24.5	28.2	20.6	20.9	15.6
57	22.3	22.9	25.2	23.6	28.3	20.9	21.1	15.5
58	22.1	23.0	25.8	25.7	28.0	20.4	20.8	15.7
59	24.5	25.1	26.5	24.7	30.7	22.1	22.7	15.8
60	23.2	24.2	24.7	23.4	24.9	33.9	32.3	24.6
61	24.7	26.8	27.0	25.4	28.0	36.5	33.7	19.8
62	25.7	27.3	27.5	25.9	28.0	39.8	36.5	22.5
63	22.4	23.0	25.3	23.7	28.5	20.9	21.3	15.6
64	19.4	20.0	20.9	19.5	20.7	26.5	27.0	22.5
065C	23.4	25.1	27.5	27.7	29.1	20.5	21.6	16.6
065N	37.2	40.2	39.4	33.2	35.6	25.6	34.2	29.4
065S	22.5	23.1	25.3	23.6	28.6	21.0	21.3	15.7
66	22.4	23.0	25.2	23.5	28.4	21.0	21.2	15.5
67	22.4	22.9	25.1	23.4	28.4	21.0	21.2	15.5
68	22.1	23.4	26.2	26.8	28.0	20.3	20.8	15.9
69	22.4	22.9	25.1	23.3	28.4	21.0	21.2	15.4
70	22.1	22.9	25.3	24.3	28.2	20.6	20.9	15.6
71	22.2	23.0	25.7	25.1	28.2	20.5	21.0	15.7
72	22.3	24.0	26.8	27.7	28.0	20.2	20.8	16.1
73	22.1	23.3	26.0	26.2	28.1	20.3	20.9	15.8
74	22.2	23.4	26.2	26.6	28.1	20.3	20.9	15.9
75	22.2	23.6	26.4	26.8	28.1	20.3	20.9	16.0
76	22.2	23.7	26.5	27.1	28.1	20.2	20.9	16.0
77	22.2	23.5	26.4	26.9	28.1	20.3	20.9	15.9

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Prevailing, LAeq,15min							
78	22.5	24.0	26.7	27.0	28.3	20.3	21.1	16.2
79	22.3	23.6	26.4	26.5	28.3	20.4	21.0	16.0
80	22.4	23.8	26.6	26.9	28.2	20.3	21.0	16.1
81	22.3	23.7	26.5	26.7	28.2	20.3	21.0	16.0
82	22.3	23.9	26.7	27.5	28.0	20.2	20.9	16.1
83	22.3	24.0	26.8	27.7	28.1	20.2	20.9	16.1
84	22.4	24.3	27.1	28.0	28.1	20.1	20.9	16.2
85	22.5	24.5	27.3	28.4	28.2	20.1	21.0	16.3
86	23.3	25.5	28.1	29.2	28.6	20.2	21.5	16.8
87	23.1	25.3	27.9	29.0	28.5	20.2	21.3	16.7
88	23.0	24.3	26.8	26.2	29.0	20.6	21.5	16.3
89	22.4	23.1	25.5	24.2	28.4	20.7	21.2	15.8
90	22.5	23.1	25.5	24.0	28.6	20.9	21.3	15.8
91	22.3	23.0	25.4	23.9	28.4	20.8	21.1	15.7
92	22.3	22.9	25.1	23.4	28.3	20.9	21.1	15.4
93	22.4	24.2	27.0	27.7	28.2	20.2	21.0	16.2
94	22.7	24.9	27.1	29.4	27.9	20.1	21.0	17.0
95	24.0	25.0	26.0	26.0	30.5	21.7	22.3	15.7
96	23.3	23.9	25.8	23.9	29.5	21.5	21.9	15.8
097N	23.0	24.0	25.1	24.7	28.8	21.4	21.4	15.1
097S	23.4	24.9	25.4	25.4	30.0	22.7	21.5	15.3
098C	21.7	23.5	24.1	24.6	27.7	20.5	20.3	14.7
098E	18.9	21.5	22.1	22.8	25.2	18.7	18.6	13.1
098W	25.0	25.9	27.1	25.8	31.5	22.6	23.0	16.5
99	26.7	28.9	28.3	26.3	33.2	29.0	25.5	19.4
100	19.9	22.4	22.8	22.6	26.6	21.2	19.8	13.7
101	22.2	23.3	24.6	23.6	28.2	21.0	20.9	15.0
102	20.9	22.9	23.4	23.9	26.6	19.5	19.9	14.7
103	23.8	24.9	25.3	23.8	24.7	28.6	38.3	34.1
104	19.3	20.7	21.1	19.7	21.4	28.1	32.1	28.7
105	21.3	22.5	22.4	21.1	22.9	29.5	34.1	29.4
106	24.0	25.0	24.2	23.1	24.9	32.8	34.7	27.9
107	21.7	22.7	22.7	21.4	23.1	30.9	31.0	25.8
108	23.4	24.4	23.9	22.8	24.5	32.8	32.8	26.6
109	21.4	22.2	22.6	21.0	22.6	29.6	30.0	24.4
110	17.8	18.6	20.5	19.3	20.1	25.6	26.1	21.6
111	18.9	20.4	21.9	20.6	21.8	28.1	27.3	21.1
112	20.7	22.5	23.8	21.8	23.7	29.6	26.9	16.9
113	20.6	22.9	23.8	21.5	24.0	28.9	26.4	15.7
114	22.5	24.8	25.4	23.6	25.9	32.0	29.5	15.0
115	27.2	30.0	27.5	26.2	31.0	42.3	37.0	24.4
116	27.5	29.6	25.1	26.2	31.2	39.5	34.3	24.8
117	23.1	24.6	20.9	18.9	23.8	29.8	26.5	20.0
118	22.7	24.9	20.8	21.9	26.4	35.0	29.7	21.9
119	29.7	31.7	27.5	25.8	32.1	35.6	30.9	23.7
120	22.4	24.3	21.1	18.3	23.2	26.1	24.5	18.1
121N	23.7	25.7	22.4	19.4	24.7	29.0	25.9	19.1
121S	20.0	21.6	19.8	16.5	21.7	23.2	20.6	14.3
122	21.1	23.3	23.5	21.0	25.7	24.2	21.9	15.4
123	23.3	25.7	26.6	23.9	30.0	25.7	23.0	17.1
124	17.1	19.4	20.6	19.9	23.2	18.5	18.1	11.8
125	39.8	43.4	36.6	35.9	44.5	45.1	44.2	33.8
127	13.9	14.4	14.7	13.1	15.3	14.9	21.4	16.1
128E	16.5	17.3	17.8	16.7	17.2	17.6	25.4	21.0

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Day Prevailing, LAeq,15min							
128W	14.9	15.7	16.2	14.9	16.1	15.7	22.8	18.3
129	15.8	16.4	16.8	15.7	16.8	16.9	24.3	20.3
130	20.4	21.4	21.5	19.5	22.1	20.7	29.0	24.1
131	20.3	21.9	23.3	19.6	22.1	21.7	28.5	23.7
132	21.2	22.9	24.2	20.8	23.1	21.6	29.3	24.3
133	23.1	24.7	26.2	23.4	25.0	21.6	30.9	26.3
134	24.2	26.1	27.4	24.4	26.2	21.9	31.9	27.2
135	23.9	26.0	27.4	24.8	26.4	20.6	29.5	25.1
136	25.3	27.3	28.5	25.5	27.3	21.0	30.5	26.6
137	24.5	26.7	28.4	26.0	27.4	21.5	27.0	23.0
138	23.5	25.7	27.3	25.6	26.7	20.3	24.0	19.7
139	25.6	28.0	29.9	27.7	28.6	22.1	26.4	21.9
140	23.2	25.3	27.0	26.4	26.1	20.2	23.2	19.0
141	22.0	24.1	25.5	24.7	24.8	19.3	22.1	17.9
142	21.5	23.6	25.1	24.8	24.5	19.2	21.9	17.7
143	20.6	22.6	24.1	23.9	23.8	18.5	21.2	17.0
144	20.8	22.8	24.4	24.4	24.3	18.7	21.5	17.2
145	19.0	21.4	23.1	23.1	23.4	18.1	20.0	15.5
146	20.2	22.5	24.2	24.9	24.8	18.5	19.8	15.8
147	22.3	24.3	25.9	23.5	25.2	20.4	27.9	23.7
148	18.4	20.6	21.5	21.9	24.2	17.3	17.9	12.8
149	17.2	20.1	20.9	21.6	23.7	18.2	17.7	12.1
150	20.7	22.9	24.8	25.3	25.1	19.1	20.8	16.3
151	15.2	15.9	16.0	14.5	15.3	15.8	23.5	18.2
152	17.8	19.6	20.2	18.7	20.1	27.7	29.8	26.2
153	19.0	20.2	20.7	19.1	20.8	28.1	29.0	24.9
154	20.4	21.2	21.8	20.2	21.7	28.2	28.8	23.9
155	18.5	19.0	19.9	18.5	19.5	24.5	25.6	21.3
156	17.1	17.7	19.1	17.7	18.5	22.8	24.1	20.2
157	15.0	16.1	18.4	17.1	17.5	22.0	23.3	19.4
158	15.1	16.4	18.9	17.6	18.1	22.8	23.8	19.6
159	16.4	18.0	20.0	18.7	19.6	24.9	25.0	20.0
160	18.0	19.2	15.5	14.7	20.8	26.9	24.8	18.6
161	18.1	19.4	18.4	15.8	20.3	22.2	21.2	14.4
162	12.7	14.1	10.4	10.4	12.7	24.0	22.2	17.5
163	18.5	20.6	21.0	18.9	22.3	21.1	19.2	12.7
164	17.0	19.2	19.3	17.3	20.0	20.3	18.3	11.2
165	16.0	18.3	20.1	17.8	20.9	18.2	17.6	10.7
166	14.6	15.3	15.2	13.6	15.6	16.1	22.4	17.2
167	17.3	18.5	18.5	16.9	18.6	23.9	26.1	21.8
168	20.6	22.6	23.9	25.9	25.0	18.8	19.8	15.8
169	14.5	17.4	18.7	19.6	21.2	15.7	16.2	10.0
170	17.7	19.9	21.3	20.7	21.6	17.0	19.0	14.8
171	18.6	19.5	20.0	17.8	20.4	19.3	27.3	23.3

Table D6: Noise Levels over Property Areas, Evening/Night Prevailing, LAeq,15min

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Evening/Night Prevailing, LAeq,15min							
2	29.6	31.9	34.8	34.3	32.3	24.2	27.4	23.5
4	18.8	20.6	19.4	18.4	19.4	21.2	28.4	25.4
5	17.7	19.8	17.9	16.6	17.4	18.0	24.8	21.6
6	18.5	19.9	19.4	17.6	18.3	18.7	27.5	23.3
007E	24.3	25.2	25.7	24.1	25.2	29.5	39.9	36.9

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Evening/Night Prevailing, LAeq,15min							
007W	20.2	21.3	22.2	20.6	20.9	27.1	32.3	29.0
8	20.7	22.2	22.5	21.0	21.3	20.9	28.6	24.9
9	22.8	24.0	24.4	22.7	23.5	24.2	30.7	25.6
10	24.8	25.9	26.5	24.0	25.6	25.5	35.3	29.3
11	20.4	21.9	22.2	20.9	21.1	26.6	31.7	28.2
12	22.3	23.5	23.8	22.3	23.2	27.5	36.0	32.7
13	23.2	24.3	24.5	22.8	24.1	28.5	38.1	35.3
14	24.9	25.8	26.1	24.4	25.3	28.8	40.5	36.9
15	23.8	25.1	25.1	22.7	25.0	24.1	33.0	28.3
016E	19.8	22.2	24.3	24.5	24.0	18.4	20.1	16.1
016W	28.7	29.6	30.4	27.8	29.6	27.7	37.0	32.5
18	29.2	31.0	32.2	28.7	30.6	25.1	34.3	30.1
19	27.7	29.7	31.3	28.3	29.6	23.2	31.8	27.3
20	36.9	39.7	42.2	38.4	38.1	28.9	35.0	30.1
21	26.7	27.6	29.2	25.7	27.7	25.4	35.1	30.5
22	33.0	35.3	36.9	33.1	34.2	26.9	34.0	29.4
23	29.7	32.1	34.4	31.9	32.1	24.7	29.9	25.2
24	32.5	35.1	38.3	37.2	35.2	25.8	29.3	25.4
025E	27.7	30.1	34.1	35.9	32.8	23.1	24.9	20.8
025S	25.9	27.2	28.5	32.8	32.1	21.9	22.4	17.9
025W	32.0	34.9	39.9	42.5	38.0	25.4	27.5	23.7
026E	28.1	30.6	34.0	35.2	32.7	23.2	25.6	21.6
026W	41.2	45.0	46.0	41.5	40.9	30.5	34.8	30.9
27	37.2	40.8	43.3	45.7	38.9	28.0	30.7	27.2
28	34.5	37.9	41.8	44.2	39.0	26.9	29.5	25.8
29	21.3	22.8	23.2	24.0	27.2	20.5	20.0	15.7
030N	25.5	27.9	31.1	32.1	30.2	21.8	24.1	20.0
030S	20.9	23.0	24.4	25.9	26.3	20.0	19.8	15.9
31	25.7	28.2	31.0	35.5	31.1	21.6	21.8	18.5
32	32.0	34.0	37.9	41.8	37.4	25.2	26.2	22.4
33	21.9	24.3	26.9	27.5	26.4	19.7	21.7	17.7
034N	24.4	26.6	29.6	31.6	29.2	21.1	22.1	18.1
034S	20.9	22.2	22.3	23.2	27.2	20.7	19.8	15.9
35	26.6	28.8	31.2	35.6	31.4	21.9	22.5	18.8
36	25.7	28.0	30.4	34.1	30.7	21.7	22.1	18.5
37	24.3	26.6	28.4	30.7	29.5	21.4	21.5	17.8
038E	23.8	26.4	28.8	31.3	29.1	21.2	21.2	17.6
038W	24.1	26.3	28.1	30.2	29.3	21.4	21.4	17.7
39	29.6	31.6	34.7	38.7	35.0	23.7	24.7	20.7
40	27.7	29.7	32.1	36.1	32.5	22.3	23.0	19.2
41	28.8	30.6	33.4	37.2	34.7	23.1	24.0	19.6
42	28.8	30.7	33.5	36.7	33.9	23.0	23.9	19.9
43	27.9	29.8	32.1	35.9	32.7	22.4	23.0	19.2
44	26.9	28.9	31.1	35.2	32.0	22.1	22.6	18.8
45	26.4	28.4	30.4	34.5	31.5	22.0	22.4	18.5
46	22.2	24.6	27.0	28.9	28.0	20.9	20.4	16.8
47	26.0	28.1	30.0	34.0	31.2	21.9	22.2	18.4
48	25.8	27.8	29.6	33.3	31.0	21.8	22.1	18.3
49	23.1	25.8	28.2	30.4	28.6	21.1	20.9	17.3
50	25.5	27.5	29.2	32.6	30.7	21.7	22.0	18.1
51	25.2	27.2	28.8	31.8	30.4	21.7	21.9	18.0
52	24.9	26.8	28.3	31.0	30.1	21.6	21.8	17.9
53	25.5	27.4	29.0	32.4	31.0	21.8	22.0	18.1
54	26.3	28.1	29.9	33.9	31.9	22.0	22.3	18.4

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Evening/Night Prevailing, LAeq,15min							
55	23.8	25.7	26.8	28.7	29.1	21.4	21.3	17.5
56	21.2	22.1	21.5	22.1	27.2	20.9	20.2	16.2
57	21.4	21.9	20.6	20.2	27.4	21.0	20.3	16.1
58	21.3	22.5	23.0	24.4	27.3	20.8	20.1	16.3
59	24.2	24.5	21.2	21.6	29.1	21.3	21.9	16.4
60	25.0	26.2	26.6	24.9	27.0	38.7	35.7	29.0
61	28.1	29.5	29.6	27.9	31.2	41.8	38.3	28.2
62	29.1	30.3	30.4	28.8	30.9	43.9	40.9	29.2
63	21.7	22.1	20.7	20.3	27.6	21.0	20.4	16.2
64	20.1	21.0	21.5	19.8	21.5	28.8	28.6	24.3
065C	23.5	25.3	26.2	28.0	29.0	21.3	21.2	17.3
065N	40.4	43.7	43.6	36.2	39.5	29.4	36.7	31.9
065S	21.8	22.1	20.7	20.2	27.6	21.1	20.5	16.2
66	21.6	22.0	20.5	19.9	27.5	21.0	20.4	16.1
67	21.5	21.9	20.4	19.7	27.5	21.0	20.3	16.0
68	21.6	23.2	24.4	26.5	27.5	20.8	20.2	16.4
69	21.5	21.9	20.3	19.6	27.4	21.0	20.3	16.0
70	21.3	22.0	21.3	21.7	27.2	20.9	20.2	16.1
71	21.4	22.4	22.3	23.3	27.3	20.9	20.3	16.3
72	21.9	24.1	26.2	28.1	27.8	20.8	20.3	16.6
73	21.5	22.9	23.6	25.4	27.4	20.8	20.2	16.4
74	21.6	23.1	24.1	26.1	27.5	20.9	20.3	16.5
75	21.8	23.4	24.6	26.6	27.6	20.9	20.3	16.5
76	21.8	23.6	24.9	27.0	27.6	20.9	20.3	16.6
77	21.7	23.4	24.7	26.8	27.6	20.8	20.3	16.5
78	22.2	24.0	25.0	26.8	27.9	21.0	20.6	16.8
79	21.9	23.4	24.1	25.9	27.7	21.0	20.5	16.6
80	22.0	23.7	24.8	26.7	27.7	21.0	20.5	16.7
81	21.9	23.5	24.5	26.4	27.7	20.9	20.4	16.6
82	21.9	24.0	25.8	27.8	27.7	20.8	20.3	16.6
83	22.0	24.2	26.2	28.1	27.8	20.8	20.3	16.7
84	22.2	24.5	26.7	28.6	28.0	20.9	20.4	16.8
85	22.4	24.8	27.2	29.2	28.1	20.9	20.5	16.9
86	23.6	26.0	28.2	30.4	28.9	21.2	21.1	17.5
87	23.3	25.8	28.0	30.1	28.7	21.1	21.0	17.4
88	22.9	24.2	24.4	25.5	28.6	21.3	21.0	17.0
89	21.6	22.3	21.3	21.5	27.5	21.0	20.4	16.3
90	21.8	22.3	21.1	20.9	27.7	21.1	20.5	16.3
91	21.5	22.1	20.9	20.9	27.4	21.0	20.4	16.2
92	21.4	21.8	20.4	19.8	27.3	20.9	20.2	16.0
93	22.2	24.4	26.2	28.1	27.9	20.9	20.5	16.8
94	23.5	25.9	28.5	31.6	28.8	20.6	20.6	17.2
95	24.0	24.7	23.7	24.6	29.8	21.4	21.4	16.2
96	22.8	23.0	21.3	21.3	28.8	21.2	21.1	16.4
097N	22.6	23.3	21.6	22.7	28.3	21.0	20.4	15.5
097S	23.7	24.8	24.5	24.3	29.7	22.8	21.0	16.1
098C	21.8	23.0	23.4	24.3	27.3	20.8	19.5	15.0
098E	19.0	21.3	22.2	23.1	24.9	18.9	18.0	13.0
098W	24.9	25.5	22.4	22.9	29.8	21.8	22.2	17.1
99	27.6	29.3	30.5	31.0	34.5	29.6	26.3	20.6
100	20.3	22.3	23.0	22.6	26.8	21.6	19.6	13.9
101	21.4	22.3	20.6	20.2	27.5	20.7	19.9	15.4
102	20.8	22.6	23.1	24.1	26.3	19.8	19.1	14.7
103	26.2	27.1	27.4	26.0	26.8	30.3	43.1	39.1

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Evening/Night Prevailing, LAeq,15min							
104	21.5	22.7	23.1	21.8	22.6	30.1	34.9	31.8
105	24.1	25.1	25.1	24.0	24.5	31.5	36.1	32.1
106	26.4	27.4	26.7	25.7	26.3	35.9	36.4	30.2
107	23.1	24.1	24.2	22.5	24.1	32.9	34.0	29.2
108	25.1	26.1	25.8	24.2	25.7	35.9	35.6	29.7
109	22.5	23.4	23.6	21.8	23.6	31.6	32.3	27.8
110	18.5	19.7	21.1	19.6	21.0	28.0	27.6	23.4
111	20.2	21.6	22.7	21.3	23.0	31.7	29.7	24.8
112	22.8	24.2	25.3	23.0	25.7	35.5	31.4	24.9
113	23.8	25.4	26.3	24.0	27.4	35.0	31.2	24.8
114	25.9	27.5	28.0	26.2	29.5	37.5	34.2	26.3
115	31.5	33.6	33.0	31.3	36.6	43.9	38.9	28.6
116	32.1	34.1	33.5	31.5	38.8	40.8	34.8	27.3
117	25.2	27.0	27.5	27.5	31.3	29.9	26.5	20.8
118	27.4	29.4	29.4	27.6	33.3	36.8	31.1	24.0
119	32.0	33.8	33.6	33.1	38.7	36.8	31.9	25.4
120	23.5	25.7	26.8	27.1	30.0	25.4	24.2	18.8
121N	25.3	27.4	28.4	28.6	31.9	29.2	26.1	20.1
121S	21.0	22.7	23.5	24.3	26.0	21.4	19.7	15.2
122	21.6	23.9	26.0	26.2	28.3	23.9	22.1	16.2
123	23.8	26.1	28.0	27.2	31.0	26.1	23.5	17.8
124	16.9	19.3	20.9	21.3	23.7	18.3	17.8	11.7
125	44.2	45.5	41.8	40.2	49.5	47.3	44.4	37.6
127	14.7	15.6	15.3	14.0	15.4	16.6	20.9	16.9
128E	17.8	18.9	18.9	17.1	18.4	18.9	26.6	22.8
128W	16.1	17.0	17.5	16.0	17.0	17.7	23.4	19.4
129	17.1	18.1	18.1	16.6	17.9	18.1	25.3	21.9
130	21.9	23.0	23.1	20.8	23.4	21.6	30.7	26.5
131	21.5	23.1	24.2	20.7	23.1	22.4	30.2	25.6
132	22.6	24.1	25.4	21.9	24.1	22.6	31.3	26.3
133	24.9	26.3	27.8	24.6	26.4	23.7	32.9	28.3
134	26.3	27.8	29.1	25.9	27.7	24.6	34.3	29.5
135	25.6	27.4	29.0	26.1	27.7	22.7	31.4	26.7
136	27.4	29.1	30.2	27.0	29.0	23.9	33.2	28.7
137	26.0	28.3	30.2	27.7	28.7	22.8	28.9	24.5
138	24.8	27.0	29.2	27.7	27.9	21.3	25.1	20.8
139	27.4	29.7	32.0	29.8	30.2	23.4	28.0	23.4
140	24.5	26.6	28.8	28.4	27.5	21.0	23.8	19.9
141	23.1	25.1	27.1	26.4	26.1	20.1	22.7	18.7
142	22.7	24.9	26.8	26.5	25.8	19.8	22.3	18.4
143	21.6	23.9	25.9	25.7	25.2	19.2	21.5	17.6
144	21.8	24.1	26.4	26.4	25.7	19.4	21.7	17.7
145	19.8	22.2	24.5	25.0	24.2	18.6	19.9	15.7
146	20.9	23.2	25.6	26.9	25.7	19.0	19.5	15.7
147	23.5	25.5	27.3	24.6	26.2	21.5	29.4	25.0
148	18.3	20.4	21.4	22.3	23.8	17.3	17.1	12.5
149	17.3	20.1	21.2	21.9	23.5	18.5	17.3	11.8
150	21.5	23.8	26.4	27.5	26.1	19.6	20.7	16.5
151	16.3	17.5	17.2	16.0	16.4	17.3	22.6	19.0
152	19.2	20.9	21.5	19.8	20.6	28.8	32.1	28.7
153	20.1	21.3	21.6	20.0	21.4	29.5	31.2	27.2
154	21.3	22.2	22.5	20.6	22.6	30.5	30.7	26.4
155	19.1	20.0	20.4	18.7	20.2	26.2	26.9	22.7
156	17.6	18.7	19.4	17.9	19.1	24.3	25.1	21.2

Year	1	2	5	10	15	21	25	30
Property	Predicted 25 % Property Area Noise Level, Evening/Night Prevailing, LAeq,15min							
157	15.4	16.8	18.7	17.2	18.2	23.4	24.1	20.2
158	15.7	17.1	19.3	17.7	18.8	24.5	24.8	20.9
159	17.5	18.9	20.6	19.1	20.6	27.3	26.6	22.4
160	22.6	23.7	22.6	20.0	24.7	29.9	26.5	20.6
161	20.0	20.8	22.3	19.5	23.0	26.6	25.7	21.0
162	21.3	22.4	19.6	19.0	23.4	24.8	22.6	19.1
163	18.6	21.2	23.5	23.8	24.8	20.1	18.8	13.1
164	17.1	19.6	21.7	22.1	22.4	19.4	17.4	11.3
165	15.7	18.5	20.8	20.8	21.8	17.7	17.3	10.8
166	15.4	16.4	16.2	14.7	15.6	16.9	21.2	18.2
167	17.9	19.3	19.0	17.5	18.6	24.4	27.6	23.9
168	21.0	23.3	25.1	27.6	25.7	19.2	19.2	15.6
169	14.4	17.2	19.2	20.1	21.1	15.7	15.6	9.7
170	18.4	20.6	22.6	22.6	22.4	17.5	19.0	15.0
171	19.6	20.7	21.1	18.4	21.4	20.4	28.8	24.8

APPENDIX E – BACKGROUND NOISE SURVEY RESULTS

Environmental noise level tables on the following pages show daily Assessment Background Levels (ABLs) and seasonal Rating Background Levels (RBLs) measured by GHD in August to December 2010 at five representative monitoring locations. Missing data indicated by a dash (-) are due to one or more of the following circumstances:

- The noise monitor was not installed during that time period;
- The noise monitor failed to obtain data, or was installed for only part of the period; or
- Data collected during the period were discarded due to winds over 5 m/s or rain, as required by the INP.

The following noise level tables are included in this Appendix.

TABLE	LOCATION
E1	NM1 Clift
E2	NM2 Kirby
E3	NM3 Rowarth
E4	NM4 Breeza Station
E5	NM5 Smythe

Table E1: Measured Background Noise Levels, Location NM1 Clift.

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Thursday-22-Jul-10	-	25.0	24.5
Friday-23-Jul-10	32.0	25.0	25.0
Saturday-24-Jul-10	28.5	25.5	25.0
Sunday-25-Jul-10	28.5	26.5	25.0
Monday-26-Jul-10	34.0	27.5	25.5
Tuesday-27-Jul-10	31.0	27.5	26.5
Wednesday-28-Jul-10	-	25.0	25.0
Thursday-29-Jul-10	37.0	27.0	29.0
Friday-30-Jul-10	32.5	-	32.5
Saturday-31-Jul-10	34.0	35.0	30.0
Sunday-1-Aug-10	33.0	33.5	30.0
Monday-2-Aug-10	37.5	33.5	30.0
Tuesday-3-Aug-10	32.5	26.5	25.5
Thursday-19-Aug-10	-	23.0	22.4
Friday-20-Aug-10	32.6	22.4	16.7
Saturday-21-Aug-10	30.3	28.8	28.7
Sunday-22-Aug-10	28.0	29.1	29.4
Monday-23-Aug-10	-	-	-
Tuesday-24-Aug-10	-	29.3	27.6
Wednesday-25-Aug-10	28.7	28.4	29.9
Thursday-26-Aug-10	-	-	-
Friday-27-Aug-10	-	25.8	26.7
Saturday-28-Aug-10	25.9	25.8	26.7
Sunday-29-Aug-10	27.1	26.0	-
Monday-30-Aug-10	-	-	-

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Winter Background Levels	32.0	26.5	26.7
Tuesday-21-Sep-10	-	31.2	24.4
Wednesday-22-Sep-10	28.0	30.4	26.3
Thursday-23-Sep-10	28.1	26.5	21.8
Friday-24-Sep-10	28.4	20.7	18.4
Saturday-25-Sep-10	28.7	18.9	17.8
Sunday-26-Sep-10	26.9	18.4	17.5
Monday-27-Sep-10	30.4	20.1	17.6
Tuesday-28-Sep-10	-	-	-
Thursday-7-Oct-10	-	24.0	18.9
Friday-8-Oct-10	28.6	24.9	20.5
Saturday-9-Oct-10	28.1	25.3	21.5
Sunday-10-Oct-10	37.9	33.8	31.0
Monday-11-Oct-10	35.4	26.2	18.6
Tuesday-12-Oct-10	28.6	30.1	29.4
Wednesday-13-Oct-10	27.9	28.3	19.3
Thursday-14-Oct-10	-	-	-
Wednesday-3-Nov-10	27.6	27.0	24.3
Thursday-4-Nov-10	32.2	38.2	25.5
Friday-5-Nov-10	46.4	37.3	26.2
Saturday-6-Nov-10	32.9	30.2	26.3
Sunday-7-Nov-10	29.1	32.4	27.4
Monday-8-Nov-10	32.6	31.7	35.7
Tuesday-9-Nov-10	-	-	33.6
Wednesday-10-Nov-10	32.1	-	-
Saturday-20-Nov-10	32.3	40.5	31.0
Sunday-21-Nov-10	28.4	29.0	31.4
Monday-22-Nov-10	30.4	33.1	30.9
Tuesday-23-Nov-10	31.9	31.8	30.5
Wednesday-24-Nov-10	30.4	29.9	31.6
Thursday-25-Nov-10	29.3	29.1	29.4
Friday-26-Nov-10	28.8	30.9	31.2
Saturday-27-Nov-10	32.8	32.7	34.3
Sunday-28-Nov-10	32.3	32.8	29.3
Monday-29-Nov-10	32.3	-	-
Spring Background Levels	30.4	30.1	26.3
Thursday-16-Dec-10	40.9	43.7	40.8
Friday-17-Dec-10	39.5	41.5	41.2
Saturday-18-Dec-10	40.7	40.6	40.6
Sunday-19-Dec-10	40.4	40.9	42.4
Monday-20-Dec-10	42.9	40.6	39.9
Tuesday-21-Dec-10	38.4	39.3	40.0
Wednesday-22-Dec-10	38.3	38.4	40.2
Thursday-23-Dec-10	39.5	-	-
Summer Background Levels	39.9	40.6	40.6

Table E2: Measured Background Noise Levels, Location NM2 Kirby.

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Friday-23-Jul-10	-	29.0	28.0
Saturday-24-Jul-10	30.5	28.5	29.0
Sunday-25-Jul-10	30.5	30.5	31.0
Monday-26-Jul-10	32.0	31.0	29.0
Tuesday-27-Jul-10	31.0	29.0	29.0
Wednesday-28-Jul-10	-	29.5	33.0
Thursday-29-Jul-10	36.5	41.0	35.0
Friday-30-Jul-10	30.0	-	36.0
Saturday-31-Jul-10	32.0	36.5	29.5
Sunday-1-Aug-10	30.5	33.0	30.0
Monday-2-Aug-10	35.0	33.0	35.5
Tuesday-3-Aug-10	30.5	29.5	29.5
Friday-20-Aug-10	-	21.1	17.5
Saturday-21-Aug-10	25.9	17.1	16.8
Sunday-22-Aug-10	20.0	17.7	17.8
Monday-23-Aug-10	23.8	25.9	19.6
Tuesday-24-Aug-10	26.0	28.9	26.9
Wednesday-25-Aug-10	30.2	26.4	31.3
Thursday-26-Aug-10	31.3	29.3	30.4
Friday-27-Aug-10	-	-	-
Winter Background Levels	30.5	29.2	29.5
Thursday-2-Sep-10	-	32.5	26.9
Friday-3-Sep-10	27.4	26.9	32.0
Saturday-4-Sep-10	29.4	37.5	28.9
Sunday-5-Sep-10	-	-	-
Wednesday-22-Sep-10	-	28.7	26.2
Thursday-23-Sep-10	26.2	28.0	26.6
Friday-24-Sep-10	25.9	24.5	21.4
Saturday-25-Sep-10	26.4	25.7	21.4
Sunday-26-Sep-10	23.1	24.1	19.6
Monday-27-Sep-10	26.9	26.7	26.2
Tuesday-28-Sep-10	-	-	-
Monday-18-Oct-10	-	27.0	21.9
Tuesday-19-Oct-10	28.6	30.6	24.3
Wednesday-20-Oct-10	27.8	28.5	23.5
Thursday-21-Oct-10	28.5	27.5	24.9
Friday-22-Oct-10	28.9	28.5	24.9
Saturday-23-Oct-10	28.6	29.3	27.5
Sunday-24-Oct-10	29.6	29.1	27.4
Monday-25-Oct-10	31.7	-	-
Wednesday-3-Nov-10	29.0	33.3	23.8
Thursday-4-Nov-10	30.8	34.7	26.4
Friday-5-Nov-10	46.5	31.7	27.2
Saturday-6-Nov-10	32.8	35.0	23.9
Sunday-7-Nov-10	29.9	35.8	31.7
Monday-8-Nov-10	31.2	32.2	30.2
Tuesday-9-Nov-10	30.0	31.9	32.5
Wednesday-10-Nov-10	31.4	-	-

BRIDGES Acoustics

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Tuesday-30-Nov-10	-	46.3	44.0
Spring Background Levels	28.9	29.2	26.3
Wednesday-1-Dec-10	42.3	45.1	43.3
Thursday-2-Dec-10	39.5	49.1	44.2
Friday-3-Dec-10	40.0	42.1	44.1
Saturday-4-Dec-10	38.2	45.2	41.5
Sunday-5-Dec-10	36.8	41.5	44.9
Monday-6-Dec-10	36.5	41.2	43.5
Tuesday-7-Dec-10	36.5	-	-
Thursday-16-Dec-10	35.2	43.2	48.1
Friday-17-Dec-10	36.6	45.6	43.4
Saturday-18-Dec-10	32.8	46.8	42.3
Sunday-19-Dec-10	31.9	44.4	39.4
Monday-20-Dec-10	42.7	44.6	29.6
Tuesday-21-Dec-10	30.6	45.7	35.7
Wednesday-22-Dec-10	30.5	44.3	42.4
Thursday-23-Dec-10	29.7	-	-
Summer Background Levels	36.5	44.6	43.3

Table E3: Measured Background Noise Levels, Location NM3 Rowarth.

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Friday-23-Jul-10	-	31.0	29.5
Saturday-24-Jul-10	29.0	29.0	28.5
Sunday-25-Jul-10	29.0	28.0	28.5
Monday-26-Jul-10	34.0	29.0	28.5
Tuesday-27-Jul-10	31.5	29.0	29.0
Wednesday-28-Jul-10	-	27.5	27.5
Thursday-29-Jul-10	32.0	28.0	28.5
Friday-30-Jul-10	30.5	-	30.5
Saturday-31-Jul-10	31.0	32.0	28.5
Sunday-1-Aug-10	31.0	30.0	28.5
Monday-2-Aug-10	32.0	29.0	30.0
Tuesday-3-Aug-10	31.5	28.0	28.0
Wednesday-4-Aug-10	31.0	28.0	28.0
Thursday-5-Aug-10	30.5	-	-
Winter Background Levels	31.0	29.0	28.5
Thursday-2-Sep-10	-	29.9	30.9
Friday-3-Sep-10	31.7	33.4	31.1
Saturday-4-Sep-10	31.6	33.5	29.9
Sunday-5-Sep-10	29.0	26.6	25.7
Monday-6-Sep-10	26.2	24.7	25.1
Tuesday-7-Sep-10	27.4	23.8	25.0
Wednesday-8-Sep-10	26.2	22.8	23.6
Thursday-9-Sep-10	-	-	-
Wednesday-29-Sep-10	-	24.9	25.2
Thursday-30-Sep-10	25.0	23.6	20.9
Friday-1-Oct-10	27.5	25.5	21.9

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Saturday-2-Oct-10	27.6	25.1	24.6
Sunday-3-Oct-10	30.0		30.2
Monday-4-Oct-10			27.9
Tuesday-5-Oct-10	31.6	31.8	28.5
Wednesday-6-Oct-10	-	-	-
Monday-18-Oct-10	-	28.4	20.4
Tuesday-19-Oct-10	32.7	36.1	27.1
Wednesday-20-Oct-10	29.2	35.8	19.9
Thursday-21-Oct-10	29.4	33.6	20.4
Friday-22-Oct-10	29.6	32.0	20.3
Saturday-23-Oct-10	28.4	40.4	29.6
Sunday-24-Oct-10	33.0	32.5	25.7
Monday-25-Oct-10	35.6	-	-
Saturday-20-Nov-10	36.7	38.8	28.4
Sunday-21-Nov-10	31.5	36.8	29.1
Monday-22-Nov-10	37.3	39.1	28.6
Tuesday-23-Nov-10	36.8	38.5	27.9
Wednesday-24-Nov-10	36.6	37.7	30.1
Thursday-25-Nov-10	36.8	36.9	27.3
Friday-26-Nov-10	32.4	37.5	30.6
Saturday-27-Nov-10	37.1	35.3	34.0
Sunday-28-Nov-10	37.1	35.8	-
Tuesday-30-Nov-10	33.4	45.4	44.4
Spring Background Levels	31.6	33.5	27.6
Wednesday-1-Dec-10	33.7	43.2	42.0
Thursday-2-Dec-10	35.8	46.7	41.2
Friday-3-Dec-10	34.3	40.9	42.6
Saturday-4-Dec-10	35.9	43.8	44.5
Sunday-5-Dec-10	38.6	47.3	45.9
Monday-6-Dec-10	38.6	43.2	43.4
Tuesday-7-Dec-10	41.2	-	-
Summer Background Levels	35.9	43.5	43.0

Table E4: Measured Background Noise Levels, Location NM4 Breeza Station.

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Thursday-22-Jul-10	-	27.5	26.5
Friday-23-Jul-10	29.5	27.0	26.5
Saturday-24-Jul-10	26.5	26.0	26.0
Sunday-25-Jul-10	27.0	27.0	26.5
Monday-26-Jul-10	31.0	26.5	26.5
Tuesday-27-Jul-10	30.0	27.0	26.0
Wednesday-28-Jul-10	-	27.0	27.0
Thursday-29-Jul-10	30.5	28.0	28.0
Friday-30-Jul-10	29.0	-	30.0
Saturday-31-Jul-10	29.0	28.0	28.5
Sunday-1-Aug-10	30.0	28.0	27.0
Monday-2-Aug-10	30.0	28.5	27.5

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Tuesday-3-Aug-10	30.5	26.5	-
Thursday-19-Aug-10	-	28.5	24.1
Friday-20-Aug-10	27.2	28.8	21.7
Saturday-21-Aug-10	24.5	22.8	20.3
Sunday-22-Aug-10	22.4	23.6	22.5
Monday-23-Aug-10	27.2	20.9	19.9
Tuesday-24-Aug-10	25.9	22.9	23.7
Wednesday-25-Aug-10	31.6	23.1	21.1
Thursday-26-Aug-10	-	-	-
Winter Background Levels	29.0	27.0	26.5
Friday-10-Sep-10	-	24.1	21.3
Saturday-11-Sep-10	24.9	24.8	19.9
Sunday-12-Sep-10	25.1	21.9	21.5
Monday-13-Sep-10	29.1	25.7	22.0
Tuesday-14-Sep-10	28.9	28.9	23.5
Wednesday-15-Sep-10	-	-	-
Thursday-7-Oct-10	-	25.1	24.8
Friday-8-Oct-10	27.9	26.6	26.2
Saturday-9-Oct-10	28.4	25.9	25.5
Sunday-10-Oct-10	31.1	27.1	25.1
Monday-11-Oct-10	34.6	26.0	24.0
Tuesday-12-Oct-10	30.1	29.8	24.6
Wednesday-13-Oct-10	27.4	25.9	25.2
Thursday-14-Oct-10	-	-	-
Tuesday-26-Oct-10	29.4	34.2	22.8
Wednesday-27-Oct-10	29.7	33.5	25.7
Thursday-28-Oct-10	32.5	33.9	24.0
Friday-29-Oct-10	29.3	32.9	28.1
Saturday-30-Oct-10	31.3	30.6	30.3
Sunday-31-Oct-10	31.4	32.2	29.7
Monday-1-Nov-10	30.5	28.9	23.5
Tuesday-2-Nov-10	29.0	-	-
Thursday-11-Nov-10	33.6	36.6	33.0
Friday-12-Nov-10	32.2	39.1	38.3
Saturday-13-Nov-10	32.3	37.8	36.0
Sunday-14-Nov-10	30.1	34.2	36.6
Monday-15-Nov-10	35.9	35.9	35.8
Tuesday-16-Nov-10	30.3	42.4	37.9
Wednesday-17-Nov-10	33.8	40.4	37.7
Thursday-18-Nov-10	30.0	40.9	36.3
Friday-19-Nov-10	-	-	-
Spring Background Levels	30.1	30.6	25.5
Wednesday-8-Dec-10	37.7	40.4	43.2
Thursday-9-Dec-10	38.0	39.3	46.1
Friday-10-Dec-10	39.9	44.7	48.3
Saturday-11-Dec-10	38.8	43.7	42.5
Sunday-12-Dec-10	38.5	40.6	43.0
Monday-13-Dec-10	37.3	41.0	42.8
Tuesday-14-Dec-10	37.2	41.1	42.1

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Wednesday-15-Dec-10	37.5	-	-
Summer Background Levels	37.9	41.0	43.0

Table E5: Measured Background Noise Levels, Location NM5 Smythe.

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Thursday-22-Jul-10	-	26.5	25.5
Friday-23-Jul-10	26.5	29.0	26.5
Saturday-24-Jul-10	25.5	28.5	27.0
Sunday-25-Jul-10	25.5	32.0	28.5
Monday-26-Jul-10	29.5	40.0	28.0
Tuesday-27-Jul-10	27.0	38.5	35.5
Thursday-19-Aug-10	-	32.7	32.5
Friday-20-Aug-10	28.3	32.8	26.8
Saturday-21-Aug-10	24.7	25.3	23.2
Sunday-22-Aug-10	19.7	25.3	30.0
Monday-23-Aug-10	23.4	31.6	26.8
Tuesday-24-Aug-10	-	-	-
Friday-27-Aug-10	-	26.4	23.6
Saturday-28-Aug-10	20.8	26.9	24.3
Sunday-29-Aug-10	22.0	29.9	28.8
Monday-30-Aug-10	24.5	31.5	29.6
Tuesday-31-Aug-10	24.3	30.8	30.8
Winter Background Levels	24.7	30.4	27.5
Wednesday-1-Sep-10	-	-	-
Friday-10-Sep-10	-	-	27.1
Saturday-11-Sep-10	24.2	24.3	27.3
Sunday-12-Sep-10	24.2	24.9	26.3
Monday-13-Sep-10	27.7	29.0	27.6
Tuesday-14-Sep-10	-	-	30.2
Wednesday-15-Sep-10	28.5	28.4	27.0
Thursday-16-Sep-10	28.0	25.7	25.8
Friday-17-Sep-10	23.6	24.1	25.9
Saturday-18-Sep-10	24.7	25.0	-
Sunday-19-Sep-10	-	-	-
Wednesday-29-Sep-10	-	20.6	18.3
Thursday-30-Sep-10	21.7	19.2	17.8
Friday-1-Oct-10	22.5	22.9	18.4
Saturday-2-Oct-10	22.4	23.3	22.8
Sunday-3-Oct-10	29.0		32.4
Monday-4-Oct-10			22.9
Tuesday-5-Oct-10	27.2	31.3	23.4
Wednesday-6-Oct-10	-	-	-
Tuesday-26-Oct-10	29.3	30.9	28.5
Wednesday-27-Oct-10	28.5	32.6	30.9
Thursday-28-Oct-10	36.1	38.2	30.8
Friday-29-Oct-10	33.5	32.7	29.2
Saturday-30-Oct-10	38.1	29.7	29.7

Date	Assessment and Rating Background Levels, LA90		
	Day	Evening	Night
Sunday-31-Oct-10	35.2	30.6	28.2
Monday-1-Nov-10	29.1	29.5	27.9
Tuesday-2-Nov-10	28.8	-	-
Friday-12-Nov-10	31.6	33.7	40.0
Saturday-13-Nov-10	30.9	33.7	33.6
Sunday-14-Nov-10	31.3	32.7	34.6
Monday-15-Nov-10	34.7	34.8	46.3
Tuesday-16-Nov-10	31.6	36.4	46.9
Wednesday-17-Nov-10	33.9	34.5	36.4
Thursday-18-Nov-10	29.2	33.3	30.8
Friday-19-Nov-10	29.3	-	-
Spring Background Levels	29.1	30.2	28.2
Wednesday-8-Dec-10	33.7	36.1	41.5
Thursday-9-Dec-10	38.7	35.1	39.6
Friday-10-Dec-10	41.1	40.0	46.0
Saturday-11-Dec-10	37.2	37.9	40.2
Sunday-12-Dec-10	34.2	36.4	37.1
Monday-13-Dec-10	30.2	32.7	36.6
Tuesday-14-Dec-10	30.3	36.7	35.2
Wednesday-15-Dec-10	31.2	-	-
Summer Background Levels	34.0	36.4	39.6