would take place in the road or that would affect trafficable areas in accordance with the RTA's Traffic Control at Work Sites Guidelines, 2003.

11.2 Noise Assessment

Atkins Acoustics was commissioned to carry out an acoustic assessment of the W2CP. The report is contained in full in Appendix N and summarised below.

The noise report presents the results, findings and recommendations of site investigations, noise modeling and assessment of the proposal. The main aims of the assessment were to:

- Identify nearby residential dwellings and other sensitive areas potentially exposed to noise impacts from the proposal, including the Bluehaven Residential Estate;
- Measure, review and comment on the pre development ambient background noise levels;
- Establish noise assessment goals in accordance with DECCW guidelines and procedures including the Industrial Noise Policy (INP), Environmental Noise Control Manual (ENCM), the Environmental Criteria for Road Traffic Noise (ECRTN);
- Predict and evaluate noise emissions from the proposal;
- Assess potential noise impacts from the operation and transport; and
- Where assessment goals are exceeded, recommend ameliorative control measures.

The W2CP will produce noise during two different phases – construction and operation. Each of these phases will generate different types and levels of noise, and are assessed and reported separately. The following sections outline the methods used to determine the most appropriate infrastructure option from a noise perspective, noise sources from the development, details of the existing acoustic environment around the surface infrastructure and rail corridor, assessment methodology and results for both construction and operation of the W2CP.

11.2.1 Infrastructure Options

Several infrastructure options were considered during the evaluation and assessment process for the noise study. The options covered various infrastructure arrangements, each of which provided advantages and disadvantages to the overall operation and noise emissions as well as other potential factors such as visual impact and operational suitability. Each option was the subject of detailed acoustic modeling and assessment but also detailed operational assessment. This iterative process has enabled the most optimal infrastructure arrangements to be developed for the project. The various options are described in more detail in the specialist report contained in Appendix N, and summarised below:

1. Base Case – standard noise controls with three active dozers, two working the project stockpile and the third operating the ROM stockpile;

2. One Dozer on ROM and a fully automated reclaim product stockpile;

3. ROM dozer with enclosed product stockpile and two operating dozers;

4a (i) No ROM dozer, fully enclosed product stockpile operating two dozers;

4a (ii) No dozer on ROM and a fully automated product stockpile;

4b. No dozer on ROM and one dozer on product stockpile;

4c. No dozer on ROM and two dozers on product stockpile;

5. Fully enclosed ROM with one dozer and one dozer on the product stockpile;

6a. ROM Bin, two conveyors to two crushers plus one dozer on product stockpile;

6b. ROM bin, two conveyors / two crushers / two dozers with enclosed product stockpile;

6c. ROM bin, two conveyors / two crushers and fully automated product stockpile; and

7. One dozer on ROM stockpile, no dozer on product stockpile.

The preferred option from both an environmental and operational perspective is Option 4b. This option includes an automated ROM stockpile management system utilising one product stockpile dozer. This option has been adopted and represent the development project as described in Chapter 2.

This option also provided a lower noise emission level than in most other cases. The proposal has been designed to minimise noise impacts on the environment, particularly impacts on the local community.

11.2.2 Potential Noise Sources

The main Tooheys Road noise sources would be associated with infrastructure and workshops, including conveyors, crusher, train loader and mobile plant. To ameliorate noise, the following strategies have been incorporated into the development of the site layout and adopted for noise modeling:

- ❒ Double skin cladding of coal handling plant;
- ❒ Low noise rated conveyors and motor drives;
- ❒ Conveyor structures with side and roof screens to provide effective directional noise amelioration;
- ❒ Design of the coal reclaim system to minimise dozer reliance for train loading;
- ❒ Selection of mobile plant fitted with secondary noise control kits;

- ❒ Removal of surface rail crossing and requirement for trains to sound warning horns whilst on site;

- ❒ Replacement of mobile plant reversing alarms with low level alarms;

- ❒ Low noise rated gas flares; and

- ❒ Where practical and feasible motor drives and gearboxes would be specified and selected to achieve a noise level of less than 85 dB(A) measured at one metre from the source.

The main noise sources at the Buttonderry site would be associated with infrastructure and workshops, including the mine winder (man access) and mine ventilation. The site layout was developed to maximise noise shielding from local topography.

Noise control strategies incorporated into the site layout, include:

- ❒ Enclosing the mine winding equipment;
- ❒ Enclosing the mine ventilation fans/motors;
- ❒ Inline attenuators installed on the fan discharges; and
- ❒ Earth bunding along the southern alignment of the car park.

Another potential source of noise generation is from traffic movements associated with the W2CP. The project would generate minimal road traffic movements during the development phase and mining operations. However, potential traffic noise impacts during the construction would arise from heavy and light vehicle traffic. During the operational phase the main traffic would be associated with mine personnel arriving and departing the Tooheys Road and Buttonderry sites at shift changes. Typically, residential dwellings on Bushells Ridge Road and Hue Hue Road that could be exposed to additional road traffic noise are set back more than 30 m from the centre road alignment.

Coal produced and loaded onto trains at Tooheys Road would be transported to the Port of Newcastle or domestic power stations accessed from the rail line. The rail loop will be developed to permit continuous controlled train loading and the parking of two additional trains.

Residential development along the rail corridor vary in density and off-set distances. Table 11.11 presents a summary of typical off-set distances for the main townships along the rail line.

North of Wyee the Main Northern Rail Line services Vales Point Colliery, Eraring Colliery, Newstan Colliery and the Tabalba Colliery. For the purpose of assessing train noise impacts from the W2CP the existing scheduled freight and commuter train movements between Wyee and Wyong were adopted.

A review of the Freight Standard Timetable for the MNRL between Sydney and Newcastle identified that the scheduled average weekday train movements between Wyee and Wyong is 25. It is envisaged that the W2CP train movements per day will be five to seven, and coal trains would normally consist of two or three locomotives and between 37 to 48 wagons (“trucks”).

Table 11.11 Typical Residential Development Off-set Distances

Residential Area	Off-set Distance (m)
Wyee	50-60
Morisset	50-60
Dora Creek	50-60
Awaba	50-60
Fassifern	25-30
Boorgul	15-20
Teralba	15-25
Cockle Creek	15-25
Cardiff	15-258
Kotora	15-25
Adamstown	15-25
Broadmeadow	10-15
Waratah	15-20

11.2.3 Existing Noise Environment

For the purpose of assessing the existing ambient noise, attended and unattended audits were undertaken during November 2006, April 2007 and January 2010. The measurement results have been evaluated in accordance with INP assessment procedures to confirm existing background and ambient noise levels, and establish the project specific noise assessment goals.

Initially nine reference measurement locations were selected for noise monitoring. Two of the locations (M8 and M9) were located on the Buttonderry site adjacent to the referenced property boundaries. Following a review of preliminary noise modeling an additional three sites were selected for additional noise monitoring undertaken during April 2007. Noise monitoring locations are described in Table 11.12.

Site attended audits confirmed that the local acoustic environments were influenced by road traffic, natural sources and localised domestic activities. No industrial noise was identified at the monitoring locations during the audits. Traffic noise exposure for each site is dependent on the location and proximity to either the F3 Freeway (Sydney to Newcastle), Hue Hue Road or Bushells Ridge Road. Two locations that are not directly influenced by nearby road traffic noise include Bruce Crescent (M1) and Sandra Street (M9). Albeit, distant road traffic noise was audible at both of these locations during source (road) to receiver wind conditions.

From INP assessment procedures, the Rating Background Level (RBL) and ambient $L_{Aeq\ (Period)}$ levels were established. The RBL is the median of the tenth percentile background levels for each assessment period. The $L_{Aeq\ (Period)}$ level represents the measured energy averaged noise level for each assessment period. Table 11.14 presents a summary of the existing ambient $L_{Aeq,\ (Period)}$ levels for the daytime, evening and night-time assessment periods, and the calculated *RBL*'s.

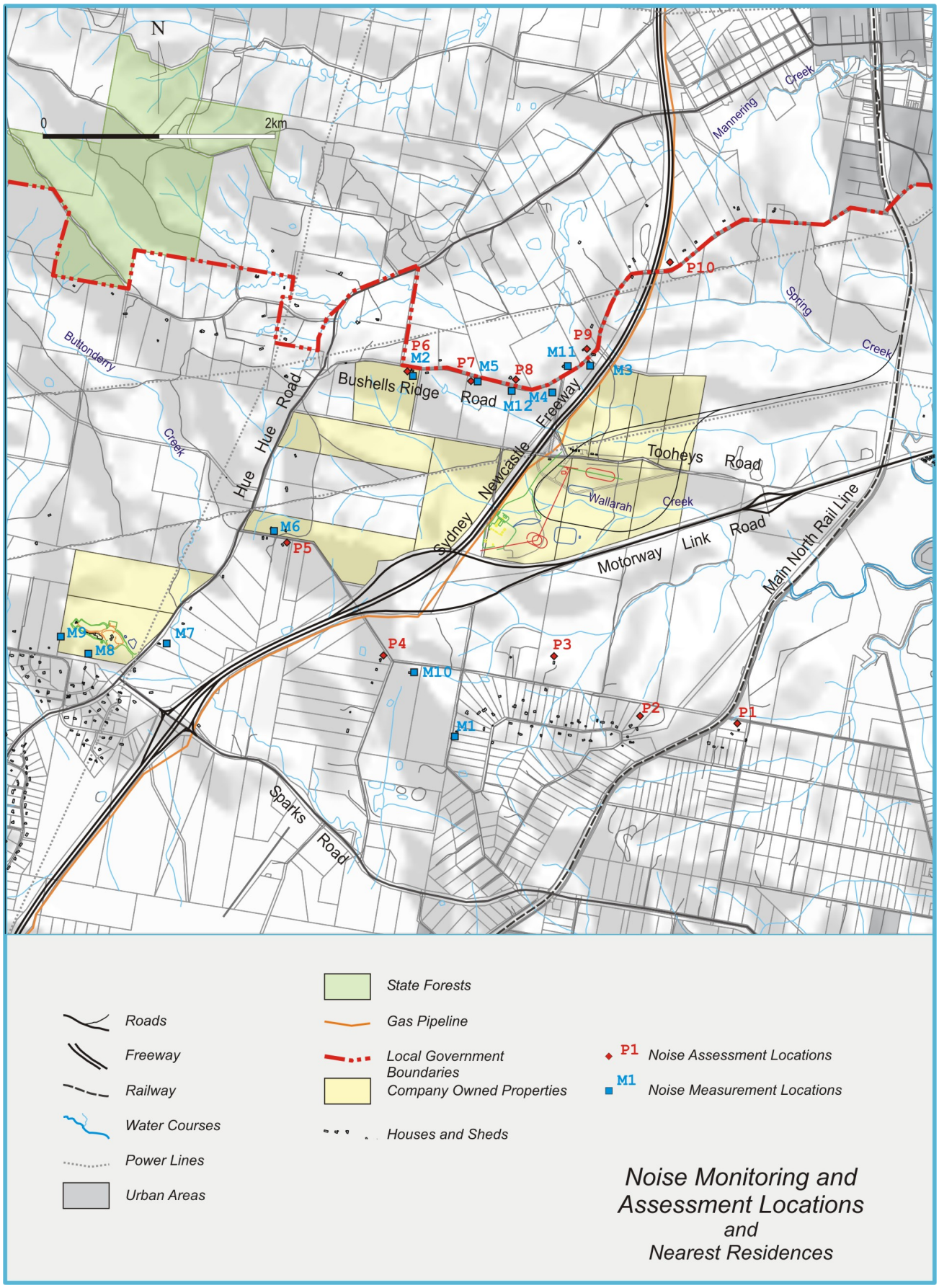

Figure 11.11 Noise Monitoring and Assessment Locations

Table 11.12 Reference Measurement and Assessment Locations

Reference Location	Reference Property	Measurement Location	Description Ambient Noise Sources
M1	250 Bruce Crescent. Wallarah	Rear of house	Local rural amenity and distant traffic
M2	118 Bushells Ridge Road. Kiar	Vacant lot west of house	Local rural amenity, passing road traffic, distance freeway traffic
M3	235 Bushells Ridge Road. Kiar	Rear of house	Freeway road traffic
M4	209 Bushells Ridge Road. Kiar	Rear of house	Freeway road traffic
M5	97 Bushells Ridge Road. Kiar	Rear of house	Local rural amenity, passing road traffic, distance freeway traffic
M6	4 Kiar Ridge Road. Jilliby	Front of house	Hue Hue Road traffic and distant freeway traffic
M7	Hue Hue Road. Jilliby	Front of house	Hue Hue Road traffic and distant freeway traffic
M8	3 Amberwood Close. Jilliby	W2CP vacant land site boundary	Hue Hue Road traffic and distant freeway traffic
M9	Lot 2 Sandra Street. Jilliby	Vacant land site boundary	Local rural amenity and distant traffic
M10	113A Mountain Road. Wallarah	Front of house	Local rural amenity and distant traffic
M11	20 Bushells Ridge Road. Kiar	Front of house	Local rural amenity, freeway traffic, passing road traffic
M12	Bushells Ridge Road. Kiar	Vacant land opposite house	Local rural amenity, passing road traffic, distance freeway traffic

Meteorological Conditions

Meteorological conditions recorded during the noise monitoring were typified by generally low wind speeds (<3 m/s). Air temperatures ranged from 12°C at night to 34°C during the day. The meteorological conditions logged during the measurement periods were considered to be acceptable for outdoor noise measurement.

Road Traffic Noise

Residential dwellings on Bushells Ridge Road and Hue Hue Road could be exposed to road traffic noise associated with the proposal. Dwellings on the eastern end of Bushells Ridge Road are exposed to traffic noise from the F3 Freeway. At the eastern end of Bushells Ridge Road (M3) the measured $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ noise levels were 61 dBA and 58 dBA, respectively.

Rail Traffic Noise

The measurement of noise from existing commuter and freight rail traffic on the MNRL was undertaken north of Wyong during December 2009. For assessment purposes three reference off-set distances were selected. Unmanned measurements were conducted at the three locations together with site attended measurements to assess the existing L_{Amax} and $L_{Aeq,\ 24\ hour}$ levels. The results are summarised in Table 11.13.

Table 11.13 Measured Existing Rail Traffic Noise Levels

Off-set Distance (m)	Measured Sound Pressure Levels (dBA)		
	$L_{Aeq, 24\ hr}$	L_{Amax}	$L_{Amax\ (95\%)}$
25	59.2	80-88	86
50	-	75-81	79
100	53.2	64-75	73

Table 11.14 Assessment *RBL*'s and L_{Aeq} Noise Levels

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location M1: 250 Bruce Crescent						
RBL	36.2	41.4	37.2			
Ambient L_{Aeq}				50.3	48.2	47.3
RBL	37.4	41.8	38.2			
Ambient L_{Aeq}				49.2	45.9	46.7
Location M2: 118 Bushells Ridge Road						
RBL	37.8	39.8	33.2			
Ambient L_{Aeq}				51.1	49.7	47.8
Location M3: 235 Bushells Ridge Road						
RBL	52.1	52.1	44.3			
Ambient L_{Aeq}				61.3	60.0	58.4
RBL	52.9	52.1	43.0			
Ambient L_{Aeq}				60.6	61.1	58.2
Location M4: 209 Bushells Ridge Road						
RBL	58.1	56.7	46.6			
Ambient L_{Aeq}				64.4	63.4	63.0
RBL	57.8	55.7	45.6			
Ambient L_{Aeq}				64.3	63.1	62.0
Location M5: 97 Bushells Ridge Road						
RBL	37.4	43.1	36.1			
Ambient L_{Aeq}				48.0	58.8	48.5
RBL	42.6	45.1	41.7			
Ambient L_{Aeq}				64.1	50.2	51.5
Location M6: 4 Kiar Road						
RBL	41.2	39.6	38.6			
Ambient L_{Aeq}				52.4	50.6	49.2
Location M7: Hue Hue Road						
RBL	42.7	46.3	42.9			
Ambient L_{Aeq}				56.8	53.6	54.9
Location M8: Amberwood Close						
RBL	40.8	45.6	41.0			
Ambient L_{Aeq}				50.3	50.9	50.3
Location M9: Sandra Road						
RBL	32.7	35.8	33.5			
Ambient L_{Aeq}				43.8	42.1	42.1
Location M10: 113A Mountain Road						
RBL	39.2	41.6	39.4			
Ambient L_{Aeq}				48.6	48.4	48.9
Location M11: 20 Bushells Ridge Road						
RBL	44.1	48.9	41.9			
Ambient L_{Aeq}				56.0	55.8	55.9
Location M12: Bushells Ridge Road						
RBL	43.7	43.9	41.6			
Ambient L_{Aeq}				63.8	57.0	54.3

11.2.4 Operational Noise Emission Limits and Guidelines

The NSW DECCW has published guidelines and policies for assessing environmental noise impacts from industrial activities and transport infrastructure. The guidelines were prepared to promote uniform procedures for assessing noise impacts are documented in the Industrial Noise Policy (INP), Environmental Noise Control Manual (ENCM), and Environmental Criteria for Road Traffic Noise (ECRTN).

For assessment purposes, residential receptor locations with similar acoustic environments have been grouped together. Table 11.15 presents a summary of the referenced measurement and grouped assessment locations with similar noise environments.

Table 11.15 Summary of Measurement Assessment Locations

Reference Measurement Locations	Reference Assessment Locations	INP Indicative Noise Amenity
M1	P1, P2, P3	Rural
M2	P6	Suburban
M3	P10	Urban
M4	-	Urban
M5	P7	Suburban
M6	P5	Suburban
M7	-	Suburban
M8	-	Suburban
M9	-	Rural
M10	P4	Rural
M11	P9	Suburban
M12	P8	Suburban

Considering intrusive and amenity noise goals (refer to Appendix M for details) for the measurement locations and the referenced residential locations elected for assessing noise from the project, Table 11.16 provides a summary of the project-specific noise goals. Where amenity criterion is less than the intrusive criterion, the lower amenity criterion was adopted and assessed as an $L_{Aeq,\ 15\ min}$ level.

Table 11.16 Project Specific Noise Goals

Period	Recommended Noise Level $L_{Aeq\ Period}$	Existing RBL	Existing $L_{Aeq\ Period}$	Project Specific Noise Goals	
				Assessment Noise Goal $L_{Aeq,\ 15\ min}$	Sleep Arousal $L_{A1,\ 1\ min}$
Assessment Location P1					
Day	50	36	49	41	-
Evening	45	41	47	45	-
Night	40	37	47	40	52
Assessment Location P2					
Day	50	36	49	41	-
Evening	45	41	47	45	-
Night	40	37	47	40	52
Assessment Location P3					
Day	50	36	49	41	-
Evening	45	41	47	45	-

Table 11.16 Project Specific Noise Goals

Period	Recommended Noise Level $L_{Aeq\ Period}$	Existing RBL	Existing $L_{Aeq\ Period}$	Project Specific Noise Goals	
				Assessment Noise Goal $L_{Aeq,\ 15\ min}$	Sleep Arousal $L_{A1,\ 1\ min}$
Night	40	37	47	40	52
Assessment Location P4					
Day	50	39	49	44	-
Evening	45	41	48	45	-
Night	40	39	49	40	54
Assessment Location P5					
Day	55	41	52	46	-
Evening	45	40	51	45	-
Night	40	39	49	40	54
Assessment Location P6					
Day	55	38	51	43	-
Evening	45	40	50	45	-
Night	40	33	48	38	48
Assessment Location P7					
Day	55	37	48	42	-
Evening	45	43	50	45	-
Night	40	36	48	40	55
Assessment Location P8					
Day	55	44	56	49	-
Evening	45	49	56	46	-
Night	40	42	56	46	57
Assessment Location P9					
Day	55	44	64	49	-
Evening	45	44	57	47	-
Night	40	42	54	44	57
Assessment Location P10					
Day	60	52	61	57	-
Evening	50	52	60	50	-
Night	45	43	58	48	58

11.2.5 Road Traffic Noise Goals

Procedures for assessing road traffic noise from new land use developments are documented in the ECRTN and are summarised in Table 11.17.

Table 11.17 Road Traffic Noise Goals

Land Use Development	Traffic Noise Criteria		Where Criteria is already Exceeded
	Daytime	Nighttime	
Land use developments with potential to create additional traffic on local roads.	$L_{Aeq,\ 1hour}$ 55	$L_{Aeq,\ 1hour}$ 50	In all cases, the development should not increase existing noise levels by more than 2dB(A). Where feasible and reasonable noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.
Land use developments with potential to create additional traffic on collector roads.	$L_{Aeq,\ 1hour}$ 60	$L_{Aeq,\ 1hour}$ 55	

11.2.6 Rail Traffic Noise Goals

Rail traffic noise is regulated by licenses issued by the DECCW. As part of licence conditions the DECCW is progressively incorporating requirements for implementation of Pollution Reduction Programs (PRP). The noise levels recommended by the DECCW for the assessment of rail noise exposure is that the cumulative levels (ie the existing plus proposed) should not exceed $L_{Aeq2\ 24\ hour}$ 60 dBA and $L_{Amax\ (95th\ percentile)}$ 85 dBA assessed at residential building facades.

11.2.7 Noise Modelling

Operational noise modeling for the Tooheys Road and Buttonderry sites considered noise from fixed plant, mobile plant and train loading. A summary of the sound power levels adopted adopted for noise modeling is presented in Table 11.18.

Table 11.18 Plant and Equipment Sound Power Levels

Plant Description	Sound Power Level (dB re: 10^{-12} Watts)									
	dB(A)	32	63	125	250	500	1k	2k	4k	8k
Tooheys Road										
Drift Conveyor	91	88	95	97	93	89	86	80	73	58
Drift Conveyor Drive	97	93	92	91	93	92	95	88	78	67
ROM Stockpile Conveyor	100	97	104	106	102	98	95	89	82	67
ROM Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
ROM Coal Stockpile	103	102	109	106	102	97	96	96	95	86
Stockpile Dozer D11	111	106	108	117	107	108	107	102	96	86
ROM-Crusher Conveyor	96	93	100	102	98	94	91	85	78	63
ROM-Crusher Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Crusher Building	105	107	106	108	110	105	96	87	79	65
Crusher-transfer Building Conveyor	103	100	107	109	105	101	98	92	85	70
Crusher-transfer Building Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Transfer Building	102	101	102	101	103	104	87	77	63	54
Incline Stockpile Conveyor	96	93	100	102	98	94	91	85	78	63
Incline Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Stockpile Conveyor	101	98	105	107	103	99	96	90	83	68
Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Coal Stockpile	103	102	109	106	102	97	96	96	95	86
Rail Bin Transfer Conveyor	96	93	100	102	98	94	91	85	78	63
Rail Bin Transfer Conveyor Drive	87	83	92	81	83	82	85	78	68	57
Coal Train per 30 m	97	99	108	99	90	93	92	89	84	82
Rail Loading	87	93	86	86	84	81	81	80	78	73
Gas Flare Module	86	89	87	85	82	79	78	80	68	59
Buttonderry										
Fan Discharge No 1	85	108	98	91	85	79	76	78	76	77
Fan Discharge No 2	85	108	98	91	85	79	76	78	76	77
Fan House	72	100	91	78	77	68	54	49	37	27
Winder Building	73	84	87	85	82	81	79	73	65	54

In assessing the noise generation from traffic movements related to the W2CP, it is assumed that each employee during the operational phase drives to the site, the peak hour traffic generation at the change of shift would be in the order of 200 car movements between 6.30 and 7.30 am at the Buttonderry site, and 20 car movements at the Tooheys Road site.

To assess the rail transport of coal from the W2CP, passby noise measurements for freight trains show that the level of noise exposure is dependent on the rolling stock, train length, train speed, track design and off-set distance from the tracks. The main noise sources identified include locomotive engine / exhaust, wheel / rail noise and wagon radiated noise.

11.2.8 Modelling Results

Noise modeling from each site was conducted with the DECCW approved ENM computer model. The noise modelling assumed that the fixed and mobile plant (one stockpile dozer) were operating simultaneously together with train loading. A summary of the predicted noise levels to the reference assessment locations for each meteorological scenario is shown in Table 11.19 and Table 11.20.

Table 11.19 Predicted Noise Levels for Day/Evening Site Operating Conditions

Assessment Location	Predicted Noise Level (L_{Aeq} dB(A)) Meteorological Conditions							
	Goals (Day/Evening)	Calm	NE	E	SE	S	SW	W
Location P1	41/41	22	29	18	16	17	20	32
Location P2	41/41	31	35	30	27	26	28	33
Location P3	41/41	34	40	36	29	28	30	34
Location P4	44/44	19	31	27	20	16	15	16
Location P5	46/45	14	27	31	22	14	14	14
Location P6	43/43	32	34	38	39	37	30	30
Location P7	42/42	35	37	41	42	40	36	36
Location P8	49/46	34	34	42	45	43	37	37
Location P9	49/47	31	27	32	39	42	39	39
Location P10	57/50	27	22	25	32	37	36	36

Table 11.20 Predicted Noise Levels for Night Site Operating Conditions

Assessment Location	Predicted Noise Level (L_{Aeq} dB(A)) Meteorological Conditions					
	Goal	Calm	TI	S	SW	W
Location P1	40	22	31	17	20	32
Location P2	40	31	34	26	28	33
Location P3	40	34	38	28	30	34
Location P4	40	19	23	16	15	16
Location P5	40	14	19	14	14	14
Location P6	38	32	36	37	30	30
Location P7	40	35	39	40	36	36
Location P8	46	34	39	43	37	37
Location P9	44	31	35	42	39	39
Location P10	48	27	32	37	36	36

The noise modelling results summarised in Table 11.19 and Table 11.20 show that the project assessment goals (Table 11.16) are marginally satisfied during adverse weather conditions. Operational noise levels at the Bluehaven are predicted to be less than 35 dBA under adverse westerly wind and temperature inversion conditions.

For descriptive purposes, noise contours produced from the ENM modelling are presented in Figure 11.12 to Figure 11.20. The noise plots are presented for descriptive and visual purposes, and compliance with the recommended noise INP goals should be confirmed against the predicted levels presented above.

The levels predicted for the Buttonderry site show that the project assessment goals are satisfied.

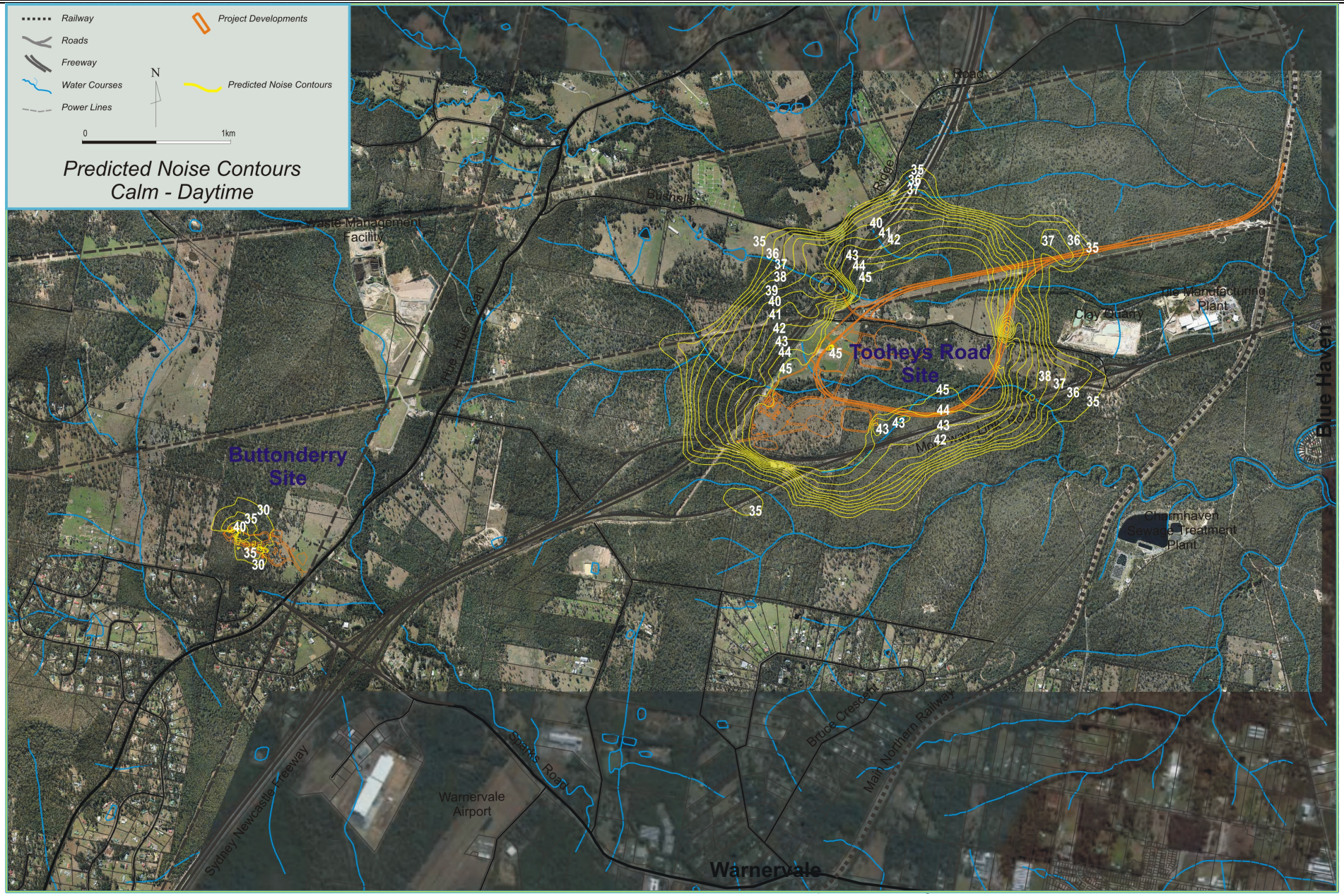

Figure 11.12 Predicted Noise Contours, Calm - Daytime

Figure 11.13 Predicted Noise Contours, NE Wind - Daytime

Figure 11.14 Predicted Noise Contours, South Wind

Figure 11.15 Predicted Noise Contours, SE Wind - Daytime

Figure 11.16 Predicted Noise Contours, Temperature Inversion

Figure 11.17 Predicted noise Contours, South West Wind

Figure 11.18 Predicted Noise Contours, East Wind

11.2.9 Road Traffic Noise Assessment

Table 11.21 presents a summary of the predicted peak hour traffic noise levels assuming a 50% split in traffic from the Buttonderry site and an average pass-by traffic speed of 60 kph.

Table 11.21 Predicted Operational Traffic Noise Levels

Shift	Times	Vehicle Trips			
		10 m	30 m	50 m	100 m
Buttonderry Site (Hue Hue Road)					
Day	6.30 – 7.30 am	59.1	55.1	53.1	50.2
Afternoon	2.30 – 3.30 pm	59.1	55.1	53.1	50.2
Night	10.30 – 11.00 pm	58.1	54.1	52.1	49.2
Tooheys Road Site (Bushells Ridge Road)					
Day	6.30 – 7.30 am	51.6	47.7	45.6	42.8
Afternoon	2.30 – 3.30 pm	52.1	48.1	46.1	43.2
Night	10.30 – 11.00 pm	48.1	44.1	42.1	39.2

The predicted $L_{Aeq\ 1\ hour}$ traffic noise levels for Hue Hue Road at 30 m satisfy the daytime 60 dBA and nighttime 55 dBA target noise assessment goals for collector roads. Passby L_{Amax} noise levels from cars at 30 m are predicted to be in the order of 64 – 65 dBA. For Bushells Ridge Road the predicted traffic noise levels satisfy the target noise assessment goals at 10 m from the road.

11.2.10 Rail Traffic Noise Assessment

Modelling for the existing and projected rail traffic noise has been undertaken using off-set distances referenced to 15, 25, 50 and 100 m with a building façade correction of 2.5 dBA. The modelling was based on the assumptions that there was a direct line of sight between the trains and receptor, a train speed of 75 – 80 kph and no acoustic shielding.

Table 11.22 Predicted Existing and Future Rail Traffic Noise Levels

Weekdays				Weekends			
Existing		Projected		Existing		Projected	
$L_{Aeq,24hr}$	$L_{A,max}$	$L_{Aeq,24hr}$	$L_{A,max}$	$L_{Aeq,24hr}$	$L_{A,max}$	$L_{Aeq,24hr}$	$L_{A,max}$
Off-set 15 m							
68.7	93.5	69.5	93.5	67.4	93.5	68.4	96.5
Off-set 25 m							
65.0	91.3	65.8	91.3	63.6	91.3	64.7	91.3
Off-set 50 m							
60.4	88.3	61.3	88.3	58.9	88.3	60.1	88.3
Off-set 100 m							
56.3	85.3	57.3	85.3	54.6	85.3	56.0	85.3

The predicted levels summarised in Table 11.22 show that the additional coal trains would not increase the existing L_{Amax} levels along the MNRL and the existing $L_{Aeq,\ 24\ hr}$ levels would increase by 1.4 dBA and the DECCW $L_{aeq\ 24\ hour}$ 60 dBA goal is satisfied at approximately 60 m from the rail line. The L_{Amax} 85 dBA level is predicted to be satisfied at a distance of approximately 100 m.

11.2.11 Mitigation

A review of the noise source contributions and rankings has identified that there is minimal further opportunity to reduce noise from the Tooheys Road site. Where noise exceedances are predicted at residential receptors, W2CP will continue to liaise with affected property owners to discuss in detail the proposed activities, potential noise levels and noise mitigation strategies.

Potential noise mitigation strategies will be discussed with the property owners if:

- the owner believes he or she is adversely affected by intrusive noise from the proposal; and
- noise level measurements confirm the recommended goals are exceeded.

Where a predicted exceedence is of a minor and intermittent nature, it is unlikely that outright purchase of property would be necessary. However this would be offered if noise monitoring during operation confirms that the recommended goals cannot be complied with and other acoustic treatments at these locations are not successful.

11.3 Construction Noise Assessment

Detailed construction staging plans and work methods would be determined by the selected contractor(s) prior to the commencement of site works. The actual construction method and staging may vary from the description below, as a result of detailed design changes, community consultations and submissions.

For the purpose of noise modelling and assessment, indicative construction schedules and work method statements are outlined below for the envisaged surface infrastructure works.

11.3.1 Decline Construction Plant and Equipment

The major plant and equipment that is likely to be used during this phase includes excavators with hydraulic hammers, dozers, road headers, concrete trucks and pumps, trucks and cranes.

11.3.2 Civil Infrastructure – Tooheys Road

The plant and equipment likely to be used during the civil infrastructure works would include excavators, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor and water carts.

11.3.3 Rail Loop and Spur

The plant and equipment likely to be used during the construction of the rail loop and spur would include excavators, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor and water carts.

11.3.4 Buttonderry Site

Construction activities at the Buttonderry site would be associated with the site establishment, civil works including internal roads, drainage, erection of support buildings and equipment, and the construction/boring of the shaft.

The main plant and equipment that is likely to be used during these works would include an excavator, shaft boring machine, rock breaker, a dozer, tippers, trucks, grader and water carts.

11.3.5 Western Shaft Site

The plant and equipment likely to be used during these works would include excavators, shaft boring machine, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor and water carts.

11.4 Construction Noise and Vibration Goals

For major construction projects undertaken in NSW the DECCW recommend procedures for assessing noise and vibration impacts. This noise and vibration assessment has been undertaken in accordance with the DECCW recommended guidelines.

Table 11.23 sets out noise management levels at residences. Restrictions to construction hours may apply to activities that generate noise at residences above the "highly noise affected" noise management level.

Table 11.23 Noise at Residences (Quantitative Assessment)

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Recommended Standard hours: Mon-Fri, 7am-6pm, Sat 8am-1pm. No work on Sun or Public Hol.	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise.
	Highly noise affected 75	The highly noise affected level represents the point above which there may be strong community reaction to noise.
Outside recommended standard hours	Noise affect RBL+5	A strong justification would typically be required for works outside the recommended standard hours.

For other noise sensitive land uses, such as schools, hospitals etc, Table 11.24 presents management levels based on the principle that the characteristic activity for each of these land uses should not be unduly disturbed.

Where construction works are planned to extend over more than two consecutive nights, and a quantitative assessment method is used, it is recommended that the analysis include the assessment of maximum noise levels, and the extent and number of times that the maximum noise level are likely to exceed the RBL.

Table 11.24 Noise at Other Sensitive Receptors

Land Use	Management Level $L_{Aeq\ (15\ min)}$	
	Internal	External
Classrooms at schools and other educational institutes	45	55
Hospital wards and operating theatres	45	66
Places of worship	45	66
Active recreation areas	-	65
Passive recreation areas	-	60
Industrial premises	-	75
Office, retail outlets		70
Community centres	Refer to AS2107	

In light of this, the Construction noise target goals for the W2CP are shown in Table 11.25.

Table 11.25 Construction noise target goals (dBA)

Period	Existing RBL	Existing L_{Aeq}	Project Noise Assessment Goals L_{Aeq}
Location M1:250 Bruce Crescent			
Day	36	49	41
Location M2: 118 Bushells Ridge Road			
Day	38	51	43
Location M3: 235 Bushells Ridge Road			
Day	52	61	57
Location M4: 209 Bushells Ridge Road			
Day	58	64	63
Location M5: 97 Bushells Ridge Road			
Day	37	48	42
Location M6: 4 Kira Road			
Day	41	52	46
Location M7: Hue Hue Road			
Day	43	57	48
Location M8: Amberwood Close			
Day	41	50	46
Location M9: Sandra Road			
Day	33	44	38
Location M10: 113A Mountain Road			
Day	39	49	44
Location M11: 20 Bushells Ridge Road			
Day	44	64	49
Location M12: Bushells Ridge Road			
Day	44	56	49

11.4.1 Vibration Assessment Goals

Vibration impacts from construction activities are normally assessed in terms disturbance and building damage.

Human Comfort and Annoyance

Goals for assessing vibration in buildings are recommended in the DECCW *Assessing Vibration: a technical guideline.* The vibration levels recommended in the DECC guideline are summarised in Table 11.26.

Table 11.26 Vibration Levels for Assessment of Human Comfort

Frequency (Hz)	Vibration Level (mm/s)			
	Continuous Vibration		Intermittent Vibration	
	Day (2)	Night (1.4)	Day (60)	Night (90)
1	3.2	2.2	95	31
1.25	2.3	1.6	68	22
1.6	1.6	1.1	47	15
2	1.1	0.8	33	11
2.5	0.8	0.6	24	8.0
3.15	0.6	0.4	17	5.8
4	0.4	0.3	19	4.0
5	0.3	0.2	9.5	3.2
6.3	0.3	0.2	7.6	2.5
8	0.2	0.1	6.0	2.0
10	0.2	0.1	6.0	2.0
12.5	0.2	0.1	6.0	2.0
16	0.2	0.1	6.0	2.0
20	0.2	0.1	6.0	2.0
25	0.2	0.1	6.0	2.0
31.5	0.2	0.1	5.4	1.8
40	0.2	0.1	5.0	2.0
50	0.2	0.1	6.0	2.0
63	0.2	0.1	6.0	2.0
80	0.2	0.1	6.0	2.0

Building Structures

German Standard DIN4150-Part3 (1986) provides guidelines for evaluating the effects of vibration on structures. The values are the maximum vibration levels measured in any direction at the building foundation are summarised in Table 11.27.

Table 11.27 Safety Limits for Structural Damage

Type of Structure	Vibration Level (mm/s)		
	<10Hz	10Hz – 50Hz	50Hz – 100Hz
Commercial / industrial buildings or buildings with similar design	20	20 - 40	40 - 50
Dwellings and buildings of similar design and/or use	5	5 - 15	15 - 20
Structures of great intrinsic value	3	3 - 8	8 - 10

11.4.2 Noise Emissions from Construction Plant and Equipment

For modelling and assessment purposes the plant and equipment and sound power levels summarised in Table 11.28 were considered. The sound power levels were established from Australian Standard 2436 1981 "Guide to Noise Control on Construction Maintenance and Demolition Sites", site attended measurements and manufacturers' data.

Table 11.28 Construction Plant Sound Power Levels

Plant Description	Sound Power Level dB(A)	
	Range	Average Level
Dozers	104-111	108
Hydraulic Boring Machine	100-110	105
Water Cart	104-106	105
Front End Loaders	105-112	107
Haul Trucks	102-113	110
Scrapers	110-115	113
Track Excavators	105-115	110
Graders	105-110	107
Excavator with Hydraulic Breaker	112-122	120
Rollers	100-113	106
Backhoe	100-108	104
Concrete Truck	108-110	109
Concrete Pump	100-110	105
Power Generators/Compressors	95-108	102
Truck Mounted Crane	100-106	102

11.4.3 Vibration from Construction Plant and Equipment

Table 11.29 provides a summary of typical ground vibration levels generated by construction plant and equipment.

Table 11.29 Vibration Levels from Construction Equipment

Plant Description	Vibration Level (mm/s)		
	@ 5 m	@ 20 m	@ 40 m
Rock-breaker (large)	5	0.5	0.3
Rock-breaker (light)	1	0.3	0.1
Dozer	2	0.2	0.02
Truck	1	0.5	0.02

11.4.4 Construction Noise Modelling and Assessment

Noise from construction activities was modelled with the ENM and an inhouse computer model. Figure 11.19 presents a typical noise contour plot for Tooheys Road and Buttonderry sites with an envisaged worst case scenario, with all earth works operating simultaneously. Construction activities at the Western Shaft are provided in Figure 11.20.

The modelling shows that noise from the construction activities has the potential to exceed the noise target assessment objectives. Considering the transient nature of the envisaged construction works, any short-term impacts would normally be considered to be acceptable.

The noise emissions from construction related traffic are expected to satisfy the daytime 60 dBA target noise assessment goals for collector roads.

11.4.5 Vibration Modelling and Assessment

The main source of ground vibration that has been identified and assessed is associated with rock hammers. Ground vibration level predicted from rock hammers could range up to 0.5 mm/sec at a distance of 20 m, and are below 0.3 mm/sec at 40 m. Vibration levels at these distances satisfy the structural damage assessment goals and are expected to be acceptable from a human disturbance point of view.

Figure 11.19 Predicted Noise Contours, Construction Phase

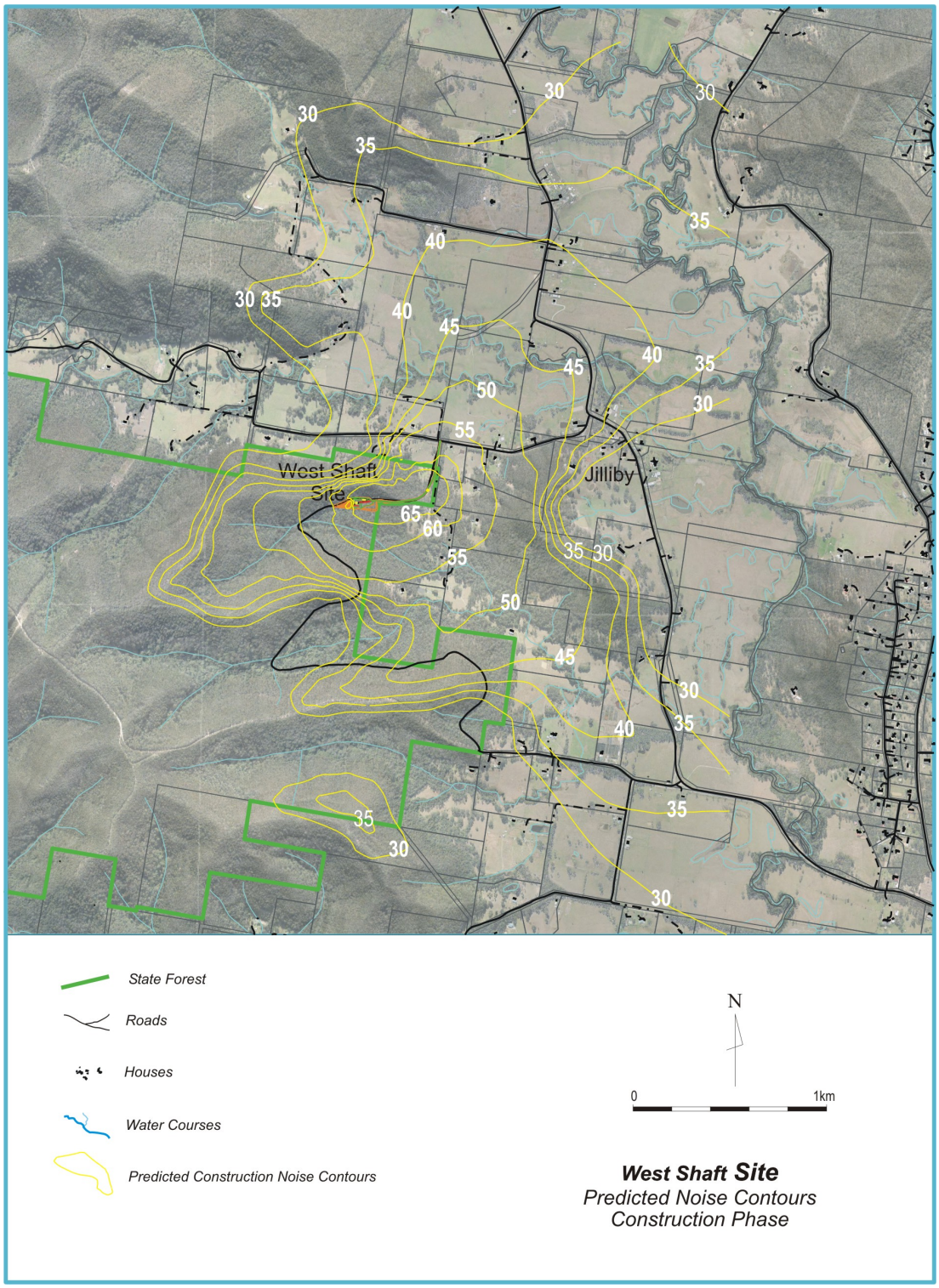

Figure 11.20 Predicted Noise Contours, Construction Phase of the West Shaft Site

11.5 Recommendations

Considering the predicted noise exceedances for the construction phase, as part of the contractor's contractual requirements for the project, noise control and management practices would form part of the contract to minimise potential impacts. In accordance with recognised practices, the following items would form part of any pending construction contract:

- an undertaking to control and minimise noise impacts during the construction phase of the project;
- the adoption of Best Management Practice and Best Available Technology Economical Achievable practices;
- all plant to be selected after consideration of its potential to contribute to or manage impacts from noise and vibration;
- the development of a site induction program for all contractors. The program to include noise reduction techniques and ongoing maintenance of noise controls throughout the duration of the construction works;
- information to be provided to potentially affected property owners prior to commencing works. The information provided to include hours of works and the duration of the works; and
- contact details for affected property owners to contact site environmental staff for complaints about noise and which will be recorded and followed up.

As part of the post approvals for the W2CP, a series of Environmental Management Plans will be prepared including a Noise and Vibration Management Plan (NVMP). The construction contractor, prior to commencing site works would need to demonstrate that the requirements of the NVMP can be met. The plan would include a monitoring program, to identify and address noise and vibration impacts for potentially affected properties, mitigation measures and management practices.

11.6 Off-Site Transport Noise

Off-site transport noise sources would include road traffic associated with mine operations (site deliveries, employees and staff, and coal trains) and construction activities.

11.7 Conclusion

Site attended audits confirmed that the existing local acoustic environments at residential properties in the vicinity of the development sites are controlled by road traffic noise, natural elements and localised domestic activities. Traffic noise exposure for each site is dependent on location and exposure to the F3 Freeway (Sydney to Newcastle), Hue Hue Road and/or Bushells Ridge Road. Two locations not directly influenced by nearby road traffic noise are Bruce Crescent (M1) and Sandra Street (M9). However, distant road traffic noise was audible at both locations during source (road) to receiver breeze conditions.

The main operational noise sources at the Tooheys Road site would be associated with infrastructure and workshops, including conveyors, crusher, train loading and mobile plant. Operational plant at the Buttonderry site would include ventilation fans and the mine winder building.

The results of noise modelling show that the project specific assessment noise goals are satisfied at the Buttonderry and Tooheys Road sites.

A review of the operational noise source rankings identified that there is minimal potential to further reduce noise from the Tooheys Road site. However, should operational noise exceedances be identified during operations, the WACJV will approach the affected property owners to discuss in detail the proposed activities and potential noise levels at their properties. Potential noise mitigation strategies will be discussed with the property owners including purchased if required if the owner believes he or she is adversely affected by noise from the proposal and noise level measurements confirm the recommended goals cannot be met.

The predicted $L_{Aeq\ 1\ hour}$ road traffic noise levels for the Tooheys Road (Bushells Ridge Road) and Buttonderry sites (Hue Hue Road) during the operational phase satisfy the daytime 60 dBA and nighttime 55 dBA target noise assessment goals at off-set distances of 10 m and 30 m respectively. Passby L_{Amax} noise levels from cars at 30 m are predicted to be in the order 64-65 dBA.

Noise modelling for peak annual production output of 5,000,000 tpa show that the additional rail traffic would marginally increase (1-2 dBA) the existing $L_{Aeq,24hr}$ rail traffic noise levels on the Main Northern Rail Line.

The project is not expected to increase the existing L_{Amax} noise levels.

The predicted results show that construction noise impacts have the potential to exceed the noise assessment objectives. Considering the transient nature of the construction works the short-term impacts would normally be considered to be acceptable.

The main source of ground vibration that has been identified and assessed is associated with rock hammers. Ground vibration level predicted from rock hammers could range up to 0.5 mm/sec at a distance of 20 m, and are below 0.3 mm/sec at 40 m. Vibration levels at these distances satisfy the structural damage assessment goals and expected to be acceptable from a human disturbance point of view.

If blasting is required the assessment has shown that the ground vibration goal and air blast over pressure can be satisfied with the employment of controlled MIC's.

A Noise and Vibration Management Plan will be prepared for the mine which will cover both construction and operational phases. The Plan will identify and address noise impacts for potentially affected properties and include a monitoring program, noise mitigation measures and noise management practices. Input from the selected construction contractor and specific additional management controls for the construction program will be included when available.