6. Emissions and Environmental Effects

This section describes the existing air, noise and water environment of the area within which the proposed mine will be developed and outlines the anticipated effects on them. Safeguards to be implemented to protect the environment are also described.

6.1 Climate

The climate of the Newnes Plateau is typically cool and temperate, characterised by mild summers and cold winters. It is influenced predominantly by the local topography, altitude, aspect and exposure. The rainfall is generally seasonally distributed with higher falls occurring during the summer months, however temperature ranges, frosts, fog and snow incidence increase with increasing altitude. Frosts and snow occur from April through to November, while fogs occur during all months of the year.

Climatic data has been obtained from the Bureau of Meteorology station at the Newnes Forest Centre, located approximately 3 km north of the northern boundary of the proposed site.

6.1.1 Temperature and Humidity

The mean daily maximum and minimum temperature for each month are presented in **Table 6.1** and indicate that temperatures vary seasonally with maximum daily temperatures occurring in the summer months and minimum temperatures occurring during winter.

The annual range for mean daily maximum and minimum temperatures is 16.6^{o}C and 5.0^{o}C respectively. The coldest month is July with a mean daily maximum temperature of 9.5^{o}C and a minimum of -0.9^{o}C. The warmest months are January and February which have mean daily maximum temperatures of 23.4^{o}C and 22.4^{o}C respectively and mean minimum temperatures of 9.9^{o}C and 10.7^{o}C.

The mean relative humidity at 9 am tends to be greatest in June, while the mean relative humidity at 3 pm tends to be greatest in April, and lowest in December. The annual range is 72.8% and 65.9% for 9 am and 3 pm respectively. Due to higher temperatures experienced during summer, the relative humidity is lower than in the winter months (refer to **Table 6.1**).

6.1.2 Rainfall

The mean monthly and yearly rainfall data together with the mean number of rain days for the Lithgow area is presented in **Table 6.2**.

The total mean annual rainfall for Lithgow is 1070.6 mm with maximum falls occurring during January, February and December. The months with the lowest rainfall are July and September. There is a marked seasonality in rainfall with higher rainfalls occurring in the summer months and drier conditions experienced from April to September.

Table 6.1 - Average Monthly Temperature and Humidity Data

Month	Mean Daily Max Temp (°C)	Mean Daily Min Temp (°C)	9 am Mean Relative Humidity (%)	3 pm Mean Relative Humidity (%)
January	23.4	9.9	70	58
February	22.4	10.7	78	75
March	20.4	8.9	74	78
April	16.3	5.6	78	79
May	13.0	2.3	77	70
June	9.9	0.4	81	70
July	9.5	-0.9	74	66
August	10.5	0.0	77	66
September	13.9	1.5	65	58
October	17.1	5.0	71	62
November	19.9	7.0	67	57
December	22.9	9.4	65	51

Source: Australian Bureau of Meteorology, 1999.

The mean monthly number of rainy days is highest during January, February and March with 12.3, 13.0 and 12.2 rain days respectively. Throughout the remainder of the year there is a fairly consistent number of rainy days per month ranging from 9.1 to 11.2 (refer to **Table 6.2**). The total number of rainy days per year is 130.7 days.

Table 6.2 - Mean Rainfall Data

Month	Mean Monthly Rainfall (mm)	Mean No. of Rain Days
January	119.9	12.3
February	115.5	13.0
March	103.2	12.2
April	79.9	9.1
May	82.2	10.5
June	83.5	10.5
July	66.8	10.0
August	82.4	10.8
September	66.9	9.4
October	89.2	11.2
November	89.5	11.1
December	91.7	10.7

Source: Australian Bureau of Meteorology, 1999.

Based on Australian Rainfall and Runoff (1987) data, the rainfall from a 1 in 100 year, 72 hour storm event in the area is 4.27 mm/hr and the 1 in 50 year, 72 hour storm event is 3.88 mm/hr.

6.1.3 Wind

Data on wind speed and direction have been collected at Mount Piper Power Station. On an annual basis, it can be seen that most winds were from the south-west and west-southwest. This pattern is evident in all seasons except summer, where there is a significant contribution of winds from the east-southeast. To determine if the Mount Piper data would be representative of the wind patterns at Newnes Junction, these data have been compared with data collected at Lithgow by the Bureau of Meteorology and also with data generated for the site by The Air Pollution Model (TAPM). This is discussed further in Appendix F.

6.2 Air Quality

An air quality impact assessment for the proposed mine was carried out by Holmes Air Sciences and a full report is provided in Appendix F.

6.2.1 Existing Air Quality

Air quality in the proposed mining area is generally considered good. The current air quality in this area is influenced mainly by the two neighbouring operations - Clarence Colliery Pit Top and Kables Sand Quarry. While the vegetation in these areas remains undisturbed air quality is consistently good.

Air quality at the colliery pit top is also considered to be good. This is influenced predominantly by activities on site including vehicle movements on unsealed roads both within the colliery and at the nearby Kables sand quarry; exhaust emissions from plant and equipment at the pit top, on the access road, and along the Bells Line of Road, emissions from occasional diesel locomotives on the Main Western Railway; and exhausted air from the underground workings.

6.2.2 Summary of goals and standards

Table 6.3 and **Table 6.4** summarise the air quality goals that are relevant to this study. It should be remembered that the air quality goals relate to the total dust burden in the air and not just the dust from the project. In other words, some consideration of background levels needs to be made when using these goals to assess impacts.

Table 6.3 - Air quality standards/goals for particulate matter concentrations

Pollutant	Standard / Goal	Agency
Total suspended particulate matter (TSP)	90 µg/m^3 (annual mean)	NHMRC
Particulate matter < 10 µm (PM_{10})	50 µg/m^3 (24-hour maximum)	NSW EPA
	30 µg/m^3 (annual mean)	NSW EPA long-term reporting goal
	50 µg/m^3 (24-hour average, 5 exceedances permitted per year)	NEPM
Particulate matter <2.5 µm ($PM_{2.5}$)	15 µg/m^3 (annual mean)	US EPA
	65 µg/m^3 (24 hour maximum)	US EPA

Note: bold print indicates goals adopted for this assessment.

Table 6.4 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 6.4 – EPA Criteria for Dust Fallout

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

6.2.3 Air Quality Impacts and Mitigation Measures

Details of estimated dust emissions are presented in the full report contained in **Appendix F**. These estimates assume some control of dust emissions is achievable through the use of watering carts on all unsealed haul roads and by enclosing some of the processing areas. The assessment was done on two different stages of the mine, referred to as Stage 2 and Stage 5.

Stage 2 was modelled to represent the mining operations in its early development. During this stage there would be significant activities taking place in the pit but the total exposed working area of the pit would be small. Stage 5 operations represent the maximum exposed working areas and mining activities. The latter stage is considered to present the worst case in terms of air quality impacts associated with the proposal. Maximum production in any one year was assumed to be 1.4 Mt.

Stage 2

During Stage 2 it is predicted that the maximum 24-hour concentrations will not exceed 50 $\mu g/m^3$ beyond the exploration lease boundary. Concentrations at the nearest residence are predicted to be below 20 $\mu g/m^3$ averaged over 24-hours. This is below to NSW EPA 50 mg/m^3 goal.

The predicted contribution to existing PM_{10} concentrations from the mining activities would be very low beyond the boundary of the exploration lease. The most affected residence is predicted to experience annual average PM_{10} concentrations less than 2 mg/m^3. It would be unlikely that the proposed Stage 2 mining operations would cause exceedances of the annual average PM_{10} goal of 30 mg/m^3 at any sensitive receptor.

Similarly, for TSP the annual average predictions at all sensitive receptors are expected to be low. No exceedances of the 90 mg/m^3 NHMRC goal would be expected. The predicted TSP concentration due to the mining operations in Stage 2 being around 2 to 3 mg/m^3 at the nearest residence (to the south-west of the site).

Dust deposition levels at the nearest residence are predicted to be less than 0.2 g/m^2/month. This level is well below the maximum permissible increase allowed by EPA (2 g/m^2/month) and compliance with this goal in Stage 2 would be anticipated. Also, it is unlikely that the total deposited dust level would exceed 4 g/m^2/month due to Stage 2 mining operations.

Predicted concentrations and deposition levels at the nearest residences due to Stage 2 mining operations are summarised below.

- Predicted maximum 24-hour PM_{10} average concentration less than 20 mg/m^3;
- Predicted annual average PM_{10} concentration less than 2 mg/m^3;
- Predicted annual average TSP concentration less than 3 mg/m^3; and
- Predicted increase in annual average dust deposition less than 0.2 g/m^2/month.

Stage 5

Predicted dust concentrations and deposition levels during Stage 5 operations are of similar magnitude to the Stage 2 predictions. The major difference between Stage 2 and Stage 5 is that maximum concentrations and deposition levels would shift further to the south-east. This would be expected with a shift in the activities to the south-east during Stage 5. Modelling results are shown in **Figure 6.1** to **Figure 6.4**.

Examination of the predicted concentration and deposition levels due to the proposed operations during Stage 5 leads to similar conclusions to those drawn from Stage 2 predictions. That is, the maximum 24-hour PM_{10}, annual average PM_{10} and TSP and annual average dust deposition levels due to the proposed operations during this stage are unlikely to cause exceedences of their respective air quality goals. Predictions at the nearest residence are low and it is unlikely that the proposed operations would be the cause of exceedances of air quality goals.

Predicted concentrations and deposition levels at the nearest residences due to Stage 5 mining operations are summarised below.

- Predicted maximum 24-hour PM_{10} average concentration less than 30 mg/m^3
- Predicted annual average PM_{10} concentration 2 mg/m^3 or less
- Predicted annual average TSP concentration less than 5 mg/m^3
- Predicted increase in annual average dust deposition 0.2 g/m^2/month or less.

6.2.4 Greenhouse Gas Emissions

Mining results in the emission of carbon dioxide (CO_2) during the combustion of diesel fuel (used primarily in diesel-powered equipment) and indirectly in the use of electricity to power mining equipment. These are the only significant sources of greenhouse gases involved in the Project. The electrical and fuel requirements for these sources have been used to estimate CO_2 emission rates for the proposed mining operations. In doing this it has been assumed that each MWh of electrical energy used results in the release of 1.06 t of CO_2 and that the cost of electricity is 13 cents per kWh.

Table 6.5 summarises the estimated CO_2 emissions from the Project for each year of operation. It is estimated that over the life of the mine \$2.6 Million will be spent on electricity to power the conveyors, offices and signaling on site. This would equate to 21,200 t of CO_2, assuming the cost of electricity is 13 cents per kWh.

Table 6.5 – Summary of estimated CO_2 Emissions

Year	Diesel Equipment					CO_2 from electricity (t)	Total CO_2 emission (t)	CO_2 emission as % of 2000
	Diesel usage (t/y)	Carbon content (%)	Percent combusted (%)	Carbon left in fuel (%)	CO_2 emissions (t)			
1	99	86	99	1	308	1,010	1,318	0.00025
2	124	86	99	1	387	1,010	1,397	0.00026
3	151	86	99	1	472	1,010	1,482	0.00028
4	178	86	99	1	557	1,010	1,567	0.00029
5	261	86	99	1	815	1,010	1,825	0.00034
6	289	86	99	1	902	1,010	1,912	0.00036
7	318	86	99	1	992	1,010	2,002	0.00037
8	348	86	99	1	1,088	1,010	2,098	0.00039
9	380	86	99	1	1,186	1,010	2,196	0.00041
10	436	86	99	1	1,361	1,010	2,371	0.00044
11*	507	86	99	1	1,582	1,010	2,592	0.00048
12	507	86	99	1	1,582	1,010	2,592	0.00048
13	507	86	99	1	1,582	1,010	2,592	0.00048
14	507	86	99	1	1,582	1,010	2,592	0.00048
15	507	86	99	1	1,582	1,010	2,592	0.00048
16	507	86	99	1	1,582	1,010	2,592	0.00048
17	507	86	99	1	1,582	1,010	2,592	0.00048
18	507	86	99	1	1,582	1,010	2,592	0.00048
19	507	86	99	1	1,582	1,010	2,592	0.00048
20	507	86	99	1	1,582	1,010	2,592	0.00048
21	507	86	99	1	1,582	1,010	2,592	0.00048
Total	8,159	-	-	-	25,471	21,200	46,671	0.00872

** From Year 11 it has been assumed that peak production is maintained through until Year 21 and that the total diesel usage over life of mine is 9.6 million litres.*

These figures can be compared with the CO_2 equivalent emission estimates from Australia's National Greenhouse Gas Inventory (Australian Greenhouse Office, 2002). There are two widely accepted methods for estimating greenhouse gas emissions (1) the United Nations Framework Convention on Climate Change (UNFCCC) and (2) the Kyoto protocol method. The differences between the two methods relate to the way in which forest sinks are treated. The estimated CO_2-equivalent emission for the two methods for all sectors are:

- UNFCCC - 535.3 Mt;
- Kyoto – 503.3 Mt.

For the purposes of this discussion we will only reference the UNFCCC figure. The 1990 emission using the UNFCCC methodology is 503.3 Mt. There are no practical alternative fuels for a mining project of this type. However, alternative mining methods can lead to greater efficiency in the use of fuels and electricity. These include:

- ❐ Minimising haul distances for waste and ore;
- ❐ Minimising double handling of materials; and
- ❐ Using the most practical and efficient machinery.

6.3 Noise

A noise impact assessment for the proposed development was carried out by Atkins Acoustics. A summary of the report is provided below and the full report is provided in **Appendix G**.

The key objectives of the study were to:

- ❐ inspect the site and identify nearby residential dwellings and other sensitive areas potentially exposed to noise emissions from the proposal;
- ❐ measure, review and comment on the existing ambient background noise levels prevailing in the vicinity of the site;
- ❐ recommend noise assessment goals in accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP);
- ❐ recommend noise assessment goals in accordance with the Environment Protection Authority, Environmental Noise Control Manual (EPA, ENCM);
- ❐ identify and quantify the main noise sources associated with the proposal;
- ❐ predict and evaluate the likely range of noise emissions;
- ❐ assess the noise impacts;
- ❐ prepare noise contour plots for the mine operations under varying operational and meteorological conditions; and
- ❐ where assessment goals are exceeded, recommend ameliorative noise control measures.

6.3.1 Existing Ambient Noise Levels

Ambient Noise Measurements

For the purposes of assessing noise from the proposal, the existing ambient background noise levels were measured and recorded from Thursday 16 March 2000 to Tuesday 18 April 2000.

The reference locations selected to acquire ambient noise levels that are representative of those presently experienced by local residences in Newnes Junction included:

- ❐ *Measurement Location 1*: 5 Sandham Road (representing the residences at the north-western portion of the Newnes 'village' on the south-western side of

Sandham Road. The residences are exposed to noise from rail traffic and distant road traffic noise from Bells Line of Road).

- *Measurement Location 2*: Sandham Road, opposite Newnes Junction Railway Station (representing the residences at the south-eastern potion of Newnes 'village' on the north-eastern side of Sandham Road. The residences are shielded from noise from road traffic on Bells Line of Road).

The ambient noise levels were measured and assessed as percentile A-weighted sound levels. The parameters regarded as being the most important amongst these, are the "L_{A90}", the level exceeded for 90% of the sample period and referenced as the "background or average minimum noise level", and the "L_{Aeq}", which is the A-weighed energy equivalent continuous (constant) sound level.

Results

Using procedures recommended in the EPA, "Industrial Noise Policy", the Rating Background Level (RBL) and ambient L_{Aeq} noise levels were established to assess noise emissions from the proposal. The RBL is the median of the tenth percentile background levels for each assessment period over the seven (7) day measurement period. The L_{Aeq} level represents the energy averaged noise level for each assessment period. Measured noise levels at the two sites are summarised in **Table 6.6** and a full data set is provided in **Appendix G**.

Table 6.6 - Measured RBL and (L_{Aeq}) Noise Levels - dB(A) re: 20 x 10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Location 1: 5 Sandham Road						
Thu 16.3.00		32	29		57	51
Fri 17.3.00	32	32	29	56	58	50
Sat 18.3.00	37	31	30	51	49	52
Sun 19.3.00	31	32	31	54	50	51
Mon 20.3.00	38	37	34	57	58	54
Tue 21.3.00	42	39	36	56	59	54
Wed 22.3.00	42	37	33	57	58	55
Thu 23.3.00	34	33	31	56	56	54
Fri 24.3.00	33	32	29	55	51	50
Sat 25.3.00	32	29	28	50	46	45
Sun 26.3.00	30	29	28	48	48	49
Mon 27.3.00	31	31	30	53	52	54
Tue 28.3.00	34	33	38	53	53	54
Wed 29.3.00	31	31	30	52	56	52
Thu 30.3.00	32	29	30	54	56	53
Fri 31.3.00	39	34	34	55	55	54
Sat 1.4.00	34	29	29	49	40	47
Sun 2.4.00	33	30	30	48	45	51
Mon 3.4.00	36	33	31	52	57	53
Tue 4.4.00	32	29	30	53	56	51
Wed 5.4.00	43	39	39	54	58	54
Thu 6.4.00	36	32	30	56	58	52

Table 6.6 - Measured RBL and (L_{Aeq}) Noise Levels - dB(A) re: 20 x 10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Fri 7.4.00	33	31	28	52	54	51
Sat 8.4.00	32	31	29	51	51	50
Sun 9.4.00	30	29	28	49	46	51
Mon 10.4.00	34	33	28	50	53	49
Tue 11.4.00	31	30	28	50	55	51
Wed 12.4.00	31	31	29	53	55	50
Thu 13.4.00	31	30	31	53	56	52
Fri 14.4.00	36	34	30	52	55	50
Sat 15.4.00	36	28	28	51	54	46
Sun 16.4.00	38	29	35	49	48	52
Mon 17.4.00	35	29		50	54	
Thu 16.3.00		28	28		47	36
Fri 17.3.00	32	29	29	49	47	36
Sat 18.3.00	33	28	28	46	49	40
Sun 19.3.00	31	28	29	54	43	41
Mon 20.3.00	42	34	31	53	50	45
Tue 21.3.00	40	38	33	50	50	45
Wed 22.3.00	41	37	31	50	46	42
Thu 23.3.00	34	32	30	51	46	41
Fri 24.3.00	31	31	29	47	44	41
Sat 25.3.00	30	28	28	47	37	37
Sun 26.3.00	29	28	28	48	41	40
Mon 27.3.00	30	29	32	50	56	46
Tue 28.3.00	40	41	33	51	57	45
Wed 29.3.00	34	29	28	53	48	42
Thu 30.3.00	31	29	32	48	46	45
Fri 31.3.00	38	34	30	49	45	45
Sat 1.4.00	31	28	28	47	32	43
Sun 2.4.00	29	29	30	47	35	45
Mon 3.4.00	34	36	31	52	55	44
Tue 4.4.00	30	28	29	48	45	46
Wed 5.4.00	38	36	38	48	50	50
Thu 6.4.00	34	31	30	52	47	43
Fri 7.4.00	30	30	28	47	42	40
Sat 8.4.00	30	30	28	49	36	38
Sun 9.4.00	29	27	27	44	32	41
Mon 10.4.00	40	40	27	49	45	44
Tue 11.4.00	30	29	27	48	45	42
Wed 12.4.00	29	30	28	45	44	37
Thu 13.4.00	31	29	32	49	45	43
Fri 14.4.00	34	33	29	46	44	42
Sat 15.4.00	36	27	27	67	43	40
Sun 16.4.00	32	27	32	47	42	45
Mon 17.4.00	30	28	28	47	45	44
RBL	**32**	**29**	**29**			
Ambient L_{Aeq}				**54**	**48**	**43**

NOTE: Daytime : (7.00am to 6.00pm)
Evening : (6.00pm to 10.00pm)
Night-time : (10.00pm to 7.00am)

Appendix G also presents a summary of the meteorological conditions recorded during the survey period (Thursday 16 March 2000 to Tuesday 18 April 2000).

Additional meteorological information, supplied by Holmes Air Sciences, identified dominant wind directions (see **Table 6.6**). The data also showed that E and F Stability Class conditions at wind speeds of less than 3m/s occur for less than 30% of the time within the study area. Accordingly the EPA, INP recommends that adverse meteorological conditions need only be assessed when wind speeds of 3m/s or below occur for 30% or more of the time in any assessment period or season.

Table 6.7 - Predominant Wind Direction and Percentage Occurrence

Meteorological Station	Time Period	Wind Direction	Percentage Occurrence (%)
Mount Piper	Winter 1997	SW WSW Calm	16 15 10.3
	Autumn 1997	SW WSW Calm	13 10 8.8
	Spring 1997	SW WSW Calm	13 15 6.5
	Summer 1997	ESE Calm	11 4.6
	Annual 1997	SW WSW Calm	13 13 7.9
Lithgow	Winter 1997	W SW Calm	31 17 17.4
	Autumn 1997	W SW SE Calm	20 11 18 17.8
	Spring 1997	W SW NW Calm	30 13 19 10.5
	Summer 1997	W SE E NW Calm	15 18 15 15 15.2
	Annual 1997	W SW SE NW Calm	24 12 15 15 15.3

Audit Noise Measurements

Site attended audit measurements of noise generated by existing rail traffic were conducted to assist in assessing the potential noise impact associated with increased rail movements as a result of the proposal. Measurements were conducted at the rear of the residence identified as 5 Sandham Road on the 7 March 2000 and 18 March 2000. A summary of the L_{Amax} noise level and sound exposure level (SEL) recorded are presented in **Table 6.8**. The location was approximately sixty (60) metres from the main western rail line, and is partially shielded by existing cuttings.

Table 6.8 - Audit Train Measurements at 5 Sandham Road (rear-60m from rail line) (dB(A) re: 20 x 10^{-6} Pa)

Date	Train Type	Speed	Duration	Direction	Sound Exposure Level dB(A)	Sound Pressure Level L_{Amax} dB(A)
7.4.00	Silver commuter	fast	15s	W	79.7	70
	Silver commuter	fast	15s	E	82.1	71
	Goods train	med	38s	W	87.6	72
18.4.00	Silver commuter	fast	13s	W	79.9	70
	Silver commuter	med	15s	E	82.6	72
	Silver commuter	slow	20s	W	78.7	68
	Silver commuter	fast	22s	E	81.4	70

6.3.2 Noise Assessment Goals

In accordance with the Environment Protection Authority, Industrial Noise Policy (EPA, INP) and Environmental Noise Control Manual (EPA, ENCM) the following goals have been considered for assessing noise associated with the proposed mine operations.

Construction

The NSW Environment Protection Authority, Environmental Noise Control Manual (ENCM) (Chapter 171) construction noise guidelines have been adopted for this assessment. These guidelines consider the L_{A10} noise level (the noise level exceeded for 10% of the time) from construction activities and provide assessment goals depending on the construction period. These are:

> **Short Term** – 4 weeks or less. The L_{A10} level of construction noise should not exceed the L_{A90} background noise level by more than 20dB(A).
>
> **Medium Term** – greater than 4 weeks but less than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 10dB(A).
>
> **Long Term** – greater than 26 weeks. The L_{A10} level of construction noise should not exceed the L_{A90} background noise by more than 5dB(A).

In setting these goals the EPA recognises that the levels set will not always be achieved. Accordingly where there is a technical exceedance of the goals, it is generally recommended that the construction activities be restricted to daytime hours.

Considering the duration of the proposed construction activities is less than 26 weeks, the recommended goal for assessing noise emissions from construction activities associated with the proposal is background L_{A90} +10dB(A).

Mining Operations

The EPA, INP assessment procedure for industrial noise sources has two components, namely:

- controlling intrusive noise; and
- maintaining noise level amenity.

The intrusiveness of a noise source is considered to be acceptable if the $L_{Aeq,\ 15\ minute}$ noise level does not exceed the RBL by more than 5dB(A). In order to determine the amenity noise goal, the ambient L_{Aeq} noise levels should not normally exceed the acceptable noise levels (**Table 6.9**). Where existing L_{Aeq} noise levels approach or exceed acceptable noise levels, design goals are set below the existing L_{Aeq} in order to limit any further increase or "creep" in the ambient levels.

Table 6.9 - EPA Noise Policy Amenity Criteria (dB(A) re: 20 x 10^{-6} Pa)

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level - dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Area specifically reserved for passive recreation	All	When in use	50	55

It is noted (EPA, INP [Section 1.4.1]) that the criteria presented above are best regarded as planning tools. They are not mandatory, and an application for a noise producing development is not determined purely on the basis of compliance or otherwise of noise criteria. Numerous other factors need to be taken into account in the determination. These factors include economic consequences, other environmental effects and the social worth of the development.

Located to the west of the proposed mine is the Blue Mountains National Park/World Heritage Area. The EPA, INP provides recommended noise levels for areas specifically reserved for passive recreation such as National Parks. Section 2 [(Table 2.1)] of the EPA, INP recommends a L_{Aeq} noise level of 50dB(A), with a maximum of 55dB(A) for these areas when in use.

Considering the measured ambient noise levels and the EPA guidelines, **Table 6.10** presents the assessment RBL's and the L_{Aeq} noise levels, together with the intrusive and amenity noise goals.

Table 6.10 - Assessment RBL and Ambient L_{Aeq} Noise Levels (dB(A) re: 20 x 10^{-6} Pa)

Period[(1)]	Recommended Noise Level L_{Aeq}	Existing RBL L_{A90}	Existing L_{Aeq}	Intrusive Criterion L_{Aeq}	Amenity Criterion L_{Aeq}
Location 1:	5 Sandham Road				

Table 6.10 - Assessment RBL and Ambient L_{Aeq} Noise Levels (dB(A) re: 20 x 10^{-6} Pa)

Period(1)	Recommended Noise Level L_{Aeq}	Existing RBL L_{A90}	Existing L_{Aeq}	Intrusive Criterion L_{Aeq}	Amenity Criterion L_{Aeq}
Day	50	33	53	38	43
Evening	45	31	55	36	45
Night	40	30	52	35	42
Location 2:	Sandham Road				
Day	50	32	54	37	44
Evening	45	30(2)	48	35	38
Night	40	30(2)	43	35	33
Location 3:	Blue Mountains National Park				
Day	50(3)	-	-	-	50(3)

(1) Daytime: (7.00am to 6.00pm)
Evening: (6.00pm to 10.00pm)
Night-time: (10.00pm to 7.00am)
(2) In accordance with the procedures of the EPA, INP[Section 3.1.2] where the rating background level (RBL) is found to be less than 30dB(A), then it is set to 30dB(A)
(3) Recommended maximum level of 55dB(A)

Site Preparation – Noise Mitigation Works

Site preparation and the construction of bunding for the purposes of noise control will be required prior to the commencement of extraction operations for each mine stage. In order to construct noise control bunds plant and equipment will be required on the surface for removal and placement of topsoil and overburden material. Considering the short duration (less than 4 weeks) of the noise mitigation works, the goal adopted for assessing noise impact is background (L_{90}) +20dB(A).

Train Loading Operations

Train loading activities involving the use of a front end loader, conveyers and surge bin were assessed in terms of the recommended EPA, INP noise goals for mechanical plant outlined in Section 6.3.2.

Train Movements

In accordance with the EPA, ENCM [Chapter 163] the recommended maximum noise goals for residential receivers are specified as a $L_{Aeq,24hour}$ 60dB(A) and a L_{Amax} 85dB(A).

6.3.3 Recommended Goals

Having regard to the measured noise levels and the recommended guidelines, the goals recommended for assessing noise emissions from the proposal are tabulated in the table below.

Table 6.11 - Recommended Noise Goals (dB(A) re: 20 x 10^{-6} Pa)

Noise Goals	Sound Pressure Levels (dB(A)) Day (7.00am–6.00pm)	Sound Pressure Levels (dB(A)) Evening (6.00pm–10.00pm)
5 Sandham Road (R1)		
Construction (L_{A10})	43	41
Stage Preparation (L_{A10})	53	51
Mining Operations (L_{Aeq})	38	36
Train Loading (L_{Aeq})	38	36

Table 6.11 - Recommended Noise Goals (dB(A) re: 20 x 10^{-6} Pa)

Noise Goals	Sound Pressure Levels (dB(A)) Day (7.00am–6.00pm)	Evening (6.00pm–10.00pm)
Train Passby ($L_{Aeq,24hour}$)	60	
Train Passby (L_{Amax})	85	
Sandham Road (R2) – opposite railway station		
Construction (L_{A10})	42	40
Stage Preparation (L_{A10})	52	50
Mining Operations (L_{Aeq})	37	35
Train Loading (L_{Aeq})	37	35
Train Passby ($L_{Aeq,24hour}$)	60	
Train Passby (L_{Amax})	85	
Blue Mountains National Park		
Mining Operations (L_{Aeq})	50-55	

For the purposes of assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most affected point within 30 m of the residence (EPA, INP [Section 2.2.1]). When assessing noise levels at passive and active recreation areas, the noise level is to be assessed at the most affected point within 50 m of the area boundary (EPA, INP [Section 2.2.1 NOTES]).

6.3.4 Site Plant And Equipment

Noise emissions from the proposal have been modelled and assessed in terms of continuous noise from the fixed and mobile plant, haul truck movements, conveyors and train loading operations.

Construction

The main plant of acoustical significance associated with the construction activities would consist of a dozer, excavator, front end loaders, grader, vibratory roller, truck mounted boring machine, haul trucks, water cart, crane, concrete trucks, generator, grader, and compressor. For the assessment of noise emissions from the plant and equipment, sound pressure levels have been established from site attended audit measurements, published data and discussions with the proponent (see **Appendix G**).

Mine Operations

Prior to commencing each mining stage dozers, front-end loader and trucks will be utilized to establish the required bunding for the purpose of noise mitigation. The sound power levels summarised in Table 6.12 were adopted for the purposes of assessing noise during the stage preparation and construction of noise bunds.

The main plant of acoustical significance operated on the mine site would consist of 1-2 dozers, front-end loaders, haul trucks, generator, crusher and conveyors. For the assessment of noise emissions from this plant, the following sound power levels (Table 6.12) have been established from site attended audit measurements.

Table 6.12 - Mine Plant Sound Power Levels (dB(A) re: 10^{-12} Watts*)*

Plant Description	Sound Power Level (dB(A) re: 10^{-12} Watts)								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Dozer (Komatsu D375A)	112	111	113	109	108	107	104	100	93
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81
50tn Haul Truck (CAT 969C)	108	110	105	99	102	103	103	96	92
Generator	106	103	102	96	105	102	99	94	92
Crusher*	106	114	108	104	104	100	99	96	90
Conveyor (1) Drive – 30kW	85	69	74	76	79	82	77	71	58
Conveyor (1) Belt – 70m	96	79	85	87	90	93	88	82	69

* - crusher located below ground in a 'room' excavated within bedrock, with an opening facing nominally north (R. Smith)

Train Loading Operations

It is expected that train-loading operations would have a duration of forty-five minutes to one hour. For the purposes of assessing noise from train loading operations the sound power levels of typical equipment have been established from site attended audit measurements and published data, and are presented in Table 6.13.

Train loading operations involving the use of a front end loader, conveyors, surge bin and Class 81 locomotives were assessed with all mine plant and equipment operating under normal extraction presenting a worst case scenario.

In terms of train movements on the main rail line, the train noise was assessed in terms of a maximum passby noise level, and a $L_{Aeq,24hour}$ taking into account existing train activities and additional train activities as a result of the proposal. Information available at the time of the assessment projected a maximum of two trains being loading within any twenty four hour period, with a maximum of seven trains per week. However it is considered unlikely that more than one train will be loaded on any one day within the first nine years of extraction.

Table 6.13 - Train Loading Sound Power Levels (*dB(A) re: 10^{-12} Watts*)

Item Description	Sound Power Level (dB(A) re: 10^{-12} Watts)								
	dBA	63	125	250	500	1k	2k	4k	8k
Surge Bin	112	98	100	104	102	104	108	105	92
Class 81 Locomotive*	114	106	99	99	105	107	110	106	100
Conveyor (2) Drive – 200kW	93	77	82	84	87	90	85	79	66
Conveyor (2) Belt – 400m	104	89	94	96	98	101	97	93	78
FEL (Volvo L150C)	105	115	109	106	100	96	99	90	81

* at Notch 3 power setting

Information provided by FreightCorp has identified that between two (2) and three (3) Class 81 (3000hp – diesel/electric) locomotives would be used for rail transportation of the ore. It is understood that a train may be loaded with two (2) locomotives operating at a power setting of Notch 2 to 3. The noise modelling predictions for train loading has assumed this operational situation.

Previous studies (James Heddle Acoustical Consultants) of Class 81 Locomotives have been conducted and train noise levels recorded. These measurements were used and adjusted to account for a power setting of Notch 3 for the locomotives and sixty (60) wagons, providing an SEL of Lw111dB(A).

6.3.5 Site Noise Emissions

Noise emissions from the site operations were modelled with the EPA approved Environmental Noise Model (ENM) computer model using the EPA, INP(Section 5.3.1) guidelines for assessment under varying wind conditions.

The meteorological scenarios modelled are:

- Calm: no wind, relative humidity of 70%, and air temperature of 18°C;
- West wind: 3m/sec west wind (270°), relative humidity of 70%, and air temperature of 18°C.

Construction

The predicted noise emissions for the construction activities show that recommended noise goals are satisfied at the reference assessment locations during construction works. The results of the modelling are presented in the table below.

Table 6.14 - Predicted Construction Noise Levels - LA10 dB(A) re: 20 x 10-6 Pa

Reference Location	Predicted Noise Level dB(A)	
	Stage 1	Stage 2
5 Sandham Road (R1)	42	40
Sandham Road (R2)	42	41

Mine Operations

The mine development stages considered in the noise modelling included:

Stage 1: Before any substantial worked faces are established, removal of vegetation, erection of infrastructure, pit depth of RL 1020.

Stage 2: Four (4) benches have been formed with elevations of RL 1053, RL 1044, RL 1035 and RL 1020 respectively.

Stage 3: Further bench established, five (5) benches with elevations of RL 1053, RL 1044, RL 1035, RL 1026, and RL 1020.

Stage 4: Pit widened significantly with three (3) large benches of RL 1008, RL 999 and RL 993; and four small benches of RL 1017, RL 1026, RL 1035, RL 1044 and RL 1053 respectively.

Stage 5: Pit is doubled in size with seven (7) benches of RL 993, RL 999, RL 1008, RL 1017, RL 1026, RL 1035 and RL 1044 respectively.

Stage 6: Pit increased in depth and extended further south, one (1) main bench forming base of pit RL 993.

The above scenarios generally cover the situations envisaged throughout the life of the mine. They were selected to present the range of activities, situations and noise levels likely to be emitted from the site.

During initial establishment of the mine stages (Stages 1 to 6) equipment will be located on the existing ground surface for short term periods, before any substantial bunds or working faces are established. This situation will result in the emission of higher noise levels in the short-term. In order to minimise potential noise impacts associated with these activities, it is proposed to stockpile the striped overburden and topsoil, and form a bund approximately 3 to 4 metres high along the southern and western mine boundaries during Stages 1 to 6.

Normal mine extraction was modelled on the assumption that up to two (2) metres of soil and overburden had been removed from the existing ground level within the mine area and a earth bund of a height not less than three (3) metres had been constructed at the perimeter of the stage to the south and west. Additional noise levels have been predicted for extraction at the base of the finished bench level of each stage.

The assessment was based on the assumption that all the fixed and mobile plant was operating simultaneously. Whilst this working situation will not occur all of the time, for the purpose of the noise assessment the worst case scenario has been presented. A review of the production schedule for the mine identified that more than one (1) dozer would be required from Stage 3 to Stage 6 inclusive. Specifically from Year 5 (approximately Stage 3) 1.1 dozers would be required, increasing to 1.7 dozers for Years 11-20 (Stages 5 and 6), equating to 10% use of an additional dozer during Stage 3 increasing to 70% use during Stages 5 and 6. The assessment has considered the continuos operation of two (2) dozers for Stage 3 through to Stage 6.

Table 6.15, 6.16 and **6.17** present a summary of the predicted noise levels at the reference assessment locations for each stage of operations and under various meteorological scenarios during initial stage establishment, normal mine extraction and base of bench level. Predicted noise levels with the operation of an additional dozer are presented in parenthesis. Results have been rounded for presentation purposes, that is 0.1 to 0.4 were rounded down to the nearest dB(A), whilst 0.5 to 0.9 were rounded up to the nearest dB(A).

Table 6.15 - Predicted Noise Levels: Mine Operations –Mine Stage Establishment - (L_{A10} dB(A) re: 20 x 10^{-6} Pa)

Meteorological Scenario	**Predicted Noise Level dB(A)**					
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
5 Sandham Road (R1)						
Calm	33	35	39 (41)	36 (39)	37 (39)	35 (37)
West Wind	26	33	37 (39)	32 (34)	32 (34)	30 (32)
Sandham Road (R2)						
Calm	36	39	41 (44)	41 (44)	**55 (57)**	**53 (55)**
West Wind	34	39	42 (44)	41 (43)	52 **(54)**	50 (52)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

Table 6.16 - Predicted Noise Levels: Mine Operations – Normal Mine Extraction (L_{Aeq} dB(A) re: 20 x 10^{-6} Pa)

Meteorological	Predicted Noise Level dB(A)					
Scenario	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
5 Sandham Road (R1)						
Calm	32	34	34 (36)	35 (37)	36 (38)	35 (37)
West Wind	29	32	33 (34)	33 (35)	31 (33)	31 (32)
Sandham Road (R2)						
Calm	35	36	36 (**38**)	36 (37)	**45 (48)**	**48 (52)**
West Wind	33	36	36 (**38**)	36 (37)	**43 (46)**	**45 (48)**

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

The results of the noise modelling for six (6) stages during calm meteorological conditions and normal extraction activities with two dozers operating are presented as noise contours in **Figure 6.5** to **Figure 6.10**.

Table 6.17 - Predicted Noise Levels: Mine Operations – Base of Bench L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Meteorological	Predicted Noise Level dB(A)					
Scenario	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
5 Sandham Road (R1)						
Calm	27	33	32 (34)	32 (34)	35 (37)	28 (29)
West Wind	24	31	30 (32)	30 (31)	32 (34)	25 (26)
Sandham Road (R2)						
Calm	28	34	34 (35)	32 (33)	**40 (42)**	31 (32)
West Wind	27	34	34 (35)	32 (33)	**38 (40)**	29 (30)

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

The noise predictions presented in **Table 6.15** show that during initial stage establishment the recommended goals are satisfied at 5 Sandham Road (R1). The predictions has shown exceedances of 3-5 dB(A) (Stage 5-calm), 2 dB(A) (Stage 5-west wind) and 1-3 dB(A) (Stage 6-calm) occur at Sandham Road (R2).

The noise predictions presented in **Table 6.16** show that under normal extraction activities and both calm and west wind meteorological conditions the recommended noise goals are satisfied for all Stages at 5 Sandham Road (R1). The results also show that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2) during both calm and west wind meteorological conditions. The results show that during Stage 5 noise exceedances of 8-11 dB(A) (calm) and 6-9 dB(A) (west wind), and during Stage 6 of 11-15 dB(A) (calm) and 8-11 dB(A) (west wind) are predicted.

The noise predictions in **Table 6.17** show that during the conclusion of extraction for all stages, the recommended goals are satisfied at 5 Sandham Road (R1). During Stage 5 noise exceedances of 3-5 dB(A) (calm) and 1-3 dB(A) (west wind) are predicted.

6.3.6 Train Loading Operations

Train loading operations have been considered with all mine plant operating under normal extraction activities. While this situation may not occur all of the time it represents a worst case prediction. A summary of the predicted noise levels during each stage of development and under varying meteorological conditions, are presented in **Table 6.18**.

The predicted noise levels (**Table 6.18**) show that the recommended goal is generally satisfied during all stages at 5 Sandham Road (R1). The Exceedance of 1dB(A) during Stage 5 (calm) with two (2) dozers operating is considered marginal. At Sandham Road (R2) the results have shown a marginal noise exceedance of 1-2dB(A) (Stage 3 – calm and west wind) and 1dB(A) (Stage 4 – calm and west wind) respectively. During Stage 5 an exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind) were predicted; whilst Stage 6 predicted an exceedance of 11-14dB(A) (calm) and 8-11dB(A) (west wind).

Table 6.18 - Predicted Noise Levels: Train Loading and Normal Operation L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Meteorological Scenario	Predicted Noise Level dB(A) Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
5 Sandham Road (R1)						
Calm	33	35	35 (37)	36 (37)	37 (**39**)	36 (38)
West Wind	32	34	34 (35)	34 (36)	33 (34)	33 (34)
Sandham Road (R2)						
Calm	35	37	37 (**38**)	37 (**38**)	**45 (48)**	**48 (51)**
West Wind	35	37	37 (**39**)	37 (**38**)	**43 (46)**	**45 (48)9**

NOTE: Exceedance of recommended goal presented in BOLD
Level in parenthesis represents two dozers operating

6.3.7 Train Movements

The maximum noise levels for a train passby (Class 81 Locomotive) set to Notch 3 power setting at the entrance to the rail loop for the receiver identified as 5 Sandham Road (R1), and the main western rail line for the receiver identified as Sandham Road (R2) were predicted. A summary of the predicted maximum passby noise levels are presented in **Table 6.19**.

Table 6.19 - Predicted Train Passby Noise Levels (Class 81 Locomotive) (L_{Amax} dB(A) re: 20 x 10^{-6} Pa)

Reference Location	Predicted Noise Level dB(A)	
	Facade	Within 30m of Dwelling
5 Sandham Road (R1)	77	81
Sandham Road (R2)	78	80

Taking account of the projected maximum of two (2) trains in a twenty four (24) hour period (Section 5.2), a maximum of seven (7) trains per week, and the measured SEL noise levels of train passbys (**Table 6.8**), **Table 6.20** provides a summary of the existing and projected rail movements, and calculated existing and predicted $L_{Aeq, 24hour}$ noise levels.

Table 6.20 - Predicted Train Noise Levels ($L_{Aeq,24hour}$) (dB(A) re: 20 x 10^{-6} Pa)

Reference Location	Existing Daily Rail Movements	Projected Daily Rail Movements	Existing $L_{Aeq,24hour}$	Predicted $L_{Aeq,24hour}$	Increase dB(A)
5 Sandham Road (R1)	$25^{(c)}$ $20^{(f)}$	$25^{(c)}$ $22^{(f)}$	54.9	55.4	+0.5
Sandham Road (R2)	$25^{(c)}$ $20^{(f)}$	$25^{(c)}$ $22^{(f)}$	55.6	56.0	+0.4

NOTE: (F) Freight Train – indicative provided by RailAccess Corporation
(C) Commuter Train – provided by CityRail

The calculated noise levels for the additional rail movements projected for the proposal satisfy the recommended goal of $L_{Aeq, 24hour}$ 60dB(A).

6.3.8 Assessment

The results of the predictions associated with noise emissions from construction activities has shown that the recommended noise goals are satisfied at the reference assessment locations during both Stage 1 and Stage 2 construction works.

The assessment has shown that during the short term activities associated with initial stage establishment, noise exceedances will occur during Stage 5 and Stage 6 works at the reference location identified as Sandham Road (R2).

Similarly the assessment has shown that noise exceedance during mine extraction and train loading activities will occur during Stage 5 and Stage 6 at Sandham Road (R2) with marginal exceedances of 1-2 dB(A) predicted for worst case scenario during Stage 3 and Stage 4 respectively. It is understood that Stages 1 to 4 represent more than nine (9) years into the development of the mine.

The assessment has also shown that predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60dB(A) when assessed to 5 Sandham Road (R1) and Sandham Road (R2).

With respect to the Blue Mountains National Park and World Heritage Area to the east, the assessment has shown under normal extraction operations, the recommended noise goal of 55dB(A) will be achieved within fifty (50) metres of the common boundary.

6.3.9 Findings and Recommendations

The results of noise predictions associated with the construction and development of the proposed mine has shown that the recommended noise goals are satisfied at the reference assessment locations.

Noise modelling has shown that during stage preparations involving the construction of bunds for noise control, the recommended goals are satisfied at 5 Sandham Road (R1). Noise exceedances of 3-5dB(A) (Stage 5-calm), 2dB(A) (Stage 5-west wind) and 1-3dB(A) (Stage 6-calm) are predicted at Sandham Road (R2).

Noise modelling for normal mining activities during calm and west wind meteorological conditions has shown that the recommended noise goals are satisfied for all stages at 5 Sandham Road (R1). The modelling has also shown that the recommended noise goals are generally satisfied for Stages 1-4 (approximately 9 years of mining activity) at Sandham Road (R2) during both calm and west wind meteorological conditions. Predicted 1dB(A) exceedance during Stage 4 with two dozers operating is considered marginal. During Stage 5 exceedances of 8-11dB(A) (calm) and 6-9dB(A) (west wind), and during Stage 6 of 11-15dB(A) (calm) and 8-11dB(A) (west wind) are predicted.

Noise predictions during the final extraction for all stages, has shown that the recommended goals are satisfied at 5 Sandham Road (R1). During Stage 5 noise exceedances of 3-5dB(A) (calm) and 1-3dB(A) (west wind) are predicted at Sandham Road (R2).

The assessment has shown that Stages 1 to 4, that is the first nine years of an estimated twenty-one year lifespan of the mine generally comply with the recommended noise goals. The technical exceedances of 1-2dB(A) are considered marginal. The proponent (Newnes Kaolin Pty Ltd) has consulted with the local community comprising six residential premises on Sandham Road, and discussed potential mitigation strategies including purchase. These strategies will be executed if:

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

The assessment has indicated that although noise exceedances are anticipated in the later stages of the mine development, the affected residences will be given the opportunity to negotiate the sale of their property if the two conditions presented above are confirmed. Additionally the proponent has indicated the potential of a ‘peppercorn’ lease back arrangement, whereby the occupant may remain within the dwelling for a nominal rent for the duration of the mining activities. With the implementation of the proposed negotiated agreements for affected properties, the operation of the mine will be technically compliant with the recommended assessment goals throughout the twenty-one year life of the mine.

With respect to the Blue Mountains National Park, the assessment has shown under normal mining operations, the recommended noise goal of 55dB(A) is satisfied within fifty metres of the park boundary.

With respect to the cumulative noise during train loading operations the assessment has shown that the recommended noise goal is satisfied during all stages at 5 Sandham Road (R1). At Sandham Road (R2) the results have shown a marginal noise exceedance of 0.2 dB(A) (Stage 3) and 0.4 dB(A) (Stage 4) respectively. During

Stage 5 an exceedance of 8.3 dB(A) was predicted, whilst Stage 6 predicted an exceedance of 11.6 dB(A) (calm) and 7.9 dB(A) (west wind). The noise increase resulting from train loading activities (generally 1-2 dB(A)) would normally be considered marginal.

The assessment has shown that predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85 dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60 dB(A).

Noise Control Recommendations

To minimise noise emissions from the operations the following recommendations are made:

- to minimise the degree of noise generated during the construction activities, it is recommended that as part of the contractors undertaking that an "Construction Noise Management Plant" (CNMP), be prepared to address the issue of construction noise;
- all construction activities shall only take place between the hours of 7.00am – 6.00pm Monday to Friday, and 7.00am-1.00pm Saturday;
- the tree mulcher shall be located as far as practicable within the valley located adjacent the northern boundary of the lease area;
- all construction site plant and equipment shall satisfy the acoustic performance specified in Appendix G;
- all loading and building conveyor systems shall be belt type conveyors;
- all permanent site plant and equipment shall satisfy the acoustic performance specified in Appendix G;
- where practical all permanent site mobile plant shall be fitted with secondary/ residential grade noise controls and acoustic treated engine enclosures;
- where practical audible alarms shall be replaced with flashing lights or a similar warning system;

6.3.10 Conclusion

The results of ambient noise monitoring and environmental noise audits conducted in the area have confirmed that the existing ambient noise is typically rural and influenced by road traffic on the Bells Line of Road, rail traffic, local domestic, existing colliery and Rocla quarry operations and natural elements such as wind, birds, animals, etc.

The finding of the prediction of noise emissions associated with construction activities has shown with appropriate selection of plant and equipment, restriction of construction hours, and preparation of a CNMP the recommended assessment goals can be achieved.

The findings of the noise modelling for the proposal have shown that with appropriate selection of equipment, effective noise controls and management procedures, noise from the mine under normal extraction operations and train loading operations can be controlled to generally satisfy the daytime assessment goals under calm and west wind meteorological conditions for Stages 1 to 4. That is for the first nine years of an estimated twenty-one year lifespan of the mine when assessed to 5 Sandham Road (R1) and Sandham Road (R2). It is anticipated that an approval for the mine will include conditions relating to any predicted noise exceedances. The proponent is confident that any exceedances identified during the latter stages of the mine development will be able to be negotiated.

With respect to the Blue Mountains National Park to the east, the assessment has shown under normal extraction operations, the recommended noise goal of 55 dB(A) is achieved within fifty metres of the common boundary.

The assessment also found the predicted noise levels associated with rail movements on the main rail line satisfy the recommended L_{Amax} noise level of 85 dB(A) and the recommended $L_{Aeq\ 24hour}$ noise level of 60 dB(A)

Based on the findings of the assessment and as part of the Noise Management Plan for the proposal it is recommended that noise monitoring be conducted during initial stages of mine development to confirm the above findings and establish the practicability of additional noise controls where required.

6.4 Hydrology and Water Quality

Water management and pollution control systems for the proposed mine have been investigated in detail. In essence, the proposed system provides for the containment of storm runoff within inpit ponds and sumps designed to contain all runoff from a 1 in 50 year, 72 hour storm event. Stored water would be used for dust suppression purposes with any excess water treated within a purpose built treatment plant prior to discharge. The discharge quality will need to meet stringent guidelines to ensure that downstream water quality impacts are avoided.

The following sections detail existing surface and groundwater quality (Section 6.4.1), surrounding hydrological systems (Section 6.4.2), proposed pollution control systems (Sections 6.4.3 to 6.4.5) and details of the treatment plant required (Section 6.4.6). Proposed internal drainage systems and water management structures are also shown on **Figures 3.2** to **3.8**. These figures show how the water management system changes as the quarry develops.

An important component of the water management system is the control of sediment within the quarry area. These matters are described in Section 6.4.7. Groundwater issues also form part of the water management system and these are discussed in detail in Section 6.4.8 while the full consultants report is provided as Appendix H.

6.4.1 Water Quality

Water quality within the upper reaches of the Wollangambe River into which the site waters flow is primarily controlled by runoff from:

- vacant Crown Land;
- industrial areas within the catchment, including Clarence Colliery and Rocla Quarry. These sites have controlled discharges into the Wollangambe system and water management systems in place to minimise their impact;
- the Main Western Railway at the top of the ridge;
- the township of Newnes Junction including dirt roads, septic systems and cleared areas.

Existing water quality in the Wollangambe River is generally good, naturally low in pH (4.5 – 5.5), iron, manganese and suspended solids, as shown in **Table 6.21**, while expected groundwater inflows into the pit are shown on **Table 6.22**.

Water quality guidelines relevant to this project include:

- Australian and New Zealand for Fresh and Marine Water Quality (ANZECC, 2000); and
- Schedule 2 of the Clean Waters Act 1970 (now incorporated into Part 3 of Schedule 5 of the Protection of the Environment Operations Act 1997).

Table 6.21 – Background Water Quality

Parameter	Upstream of Newnes Kaolin	Downstream of Newnes Kaolin
Acidity		
to pH 3.7 (as CaCO3) mg/L	<1	<1
to pH 8.3 (as CaCO3) mg/L	4	4
Alkalinity		
CO3 (as CaCO3) mg/L	<1	<1
HCO3 (as CaCO3) mg/L	2	2
OH (as CaCO3) mg/L	<1	<1
Calcium mg/L	1.3	0.8
Chloride mg/L	9.0	6.0
Specific Conductance uS/cm	31	27
Iron (total) mg/L	0.06	0.39
Iron (filterable) mg/L	<0.05	<0.05
Potassium mg/L	0.9	1.4
Langelier Saturation	-6.7	-6.9
Magnesium mg/L	0.7	0.4
Manganese (total) mg/L	<0.05	<0.05
Manganese (filterable) mg/L	<0.05	<0.05
Sodium mg/L	4.8	2.9
PH	4.5	4.5
Total Sulfur as SO4 mg/L	3.7	2.3
Total Dissolved Solids mg/L	20	15
Total Hardness (as CaCO3) mg/L	6.1	3.6

Total Suspended Solids mg/L	<1	3

Table 6-22 – Expected Groundwater Quality

Parameter	Ponded Groundwater Sample 1	Ponded Groundwater Sample 2	Fresh Groundwate
ACIDITY			
to pH 3.7 (as CaCO3) mg/l	<1	<1	<1
to pH 8.3 (as CaCO3) mg/l	<1	4	20
ALKALINITY			
CO3 (as CaCO3) mg/l	4	<1	<1
HCO3 (as CaCO3) mg/l	17	6	6
OH (as CaCO3) mg/l	<1	<1	<1
Calcium mg/l	5.0	1.9	1.9
Chloride mg/l	11.0	11.0	10.0
Specific Conductance uS/cm	60	30	35
Iron (filterable) mg/l	<0.05	<0.05	<0.05
Potassium mg/l	1.5	1.4	0.9
Langelier Saturation	-0.4	-5.3	-6.0
Magnesium mg/l	0.7	0.4	1.1
Manganese mg/l	0.11	0.09	0.06
Sodium mg/l	9.0	3.7	5.4
pH	9.2	5.3	4.6
Total Sulfur as SO4 mg/l	3.6	1.8	8.7
Total Dissolved Solids mg/l	40	20	20
Total Hardness (as CaCO3) mg/l	15.5	6.6	9.2
Total Suspended Solids mg/l	10	27	1350

6.4.2 Surface Water Hydrology

The key objective of the water quality and erosion and sediment control system is to prevent sediment loss and protect the water quality of the local area. Water management and erosion control on site is a key issue given that the site is located within the Wollangambe River catchment that flows into the Blue Mountains National Park and World Heritage Area.

There are no major permanent watercourses through the site, however two minor ephemeral creeks occur on the site, as shown on **Figure 6.11**. Both of these creeks form part of the upper tributaries of the Wollangambe River, which flows into the Colo River.

The Wollangambe River and the Colo River have both been recognised as "wild and scenic" rivers under section 61 of the *National Parks and Wildlife Act, 1974*. These rivers are important in that they are of significant conservation value, and are popular recreational areas.

The waters into which the proposed mine site discharges are classified as Class P Protected Waters. The water quality of controlled mine discharges would need to meet a suspended solids standard of 15 mg/L – ie. sensitive water standards according to current ANZECC guidelines. There would also need to be a dilution factor of 19:1 – ie. such discharge cannot raise background suspended solids levels by more than 1.5 mg/L.

In order to protect the local water and soil resources in the area a comprehensive Soil and Water Management Plan will be prepared for the project following approval, as required by the DLWC. This plan will address in further detail all aspects of soil disturbance, storage and movement, retention of any mobilised sediments and water management on and off the site.

To protect the surface waters of the surrounding areas, and in particular those of the adjacent National Park and World Heritage Area, numerous water quality and erosion and sedimentation control measures will be incorporated into the mine design as outlined below.

6.4.3 Surface Water Management

A primary objective of the water management plan is the separation of clean and dirty water systems. Clean water will be diverted around the disturbed areas and allowed to flow into the natural drainage system. Dirty water will be contained on site and treated before controlled discharge off site.

There are two key disturbed areas to be controlled. The first contains the mine and internal access roads from the in-pit crusher to the various mine benches. The second consists of the stockpile and infrastructure areas.

The water management system has been designed to contain runoff from a 1 in 50 year, 72 hour storm event. This will ensure the maximum level of safety for the Wollangambe River by providing zero discharge of untreated water during such events. Water will be treated prior to discharge to the natural waterways.

6.4.4 Hydrologic Basis for Management of Surface Waters

The intensity of various duration and Average Recurrence Interval (ARI) storms at the Newnes Junction site would be similar to those that can be estimated from standard intensity-frequency-duration (IFD) methods as outlined in Australian Rainfall and Runoff. From the IFD data, the estimated rainfall intensities (in mm/hour) and total rainfall (in mm) for the Newnes Kaolin site are presented for various years and storm durations in **Table 6.23**. A conservative runoff coefficient of 0.8 has been used.

Table 6.23 – Estimated Rainfall Intensities and Volumes

Mine Stage	Average Return Interval (years)	Duration (hours)	Rainfall Intensity (mm/hr)	Total Rainfall (mm)	Area disturbed (ha)	Total volume of water to be stored[1] (ML)
Stage 1	10	2	24.72	49.44	0.75	0.3
Stage 1	50	72	3.88	279.36	0.75	1.7
Stage 2	10	2	24.72	49.44	4.25	1.7
Stage 2	50	72	3.88	279.36	4.25	9.5
Stage 3	10	2	24.72	49.44	5.5	2.2
Stage 3	50	72	3.88	279.36	5.5	12.3
Stage 4	10	2	24.72	49.44	10.75	4.3
Stage 4	50	72	3.88	279.36	10.75	24.0
Stage 5	10	2	24.72	49.44	21.5	8.5
Stage 5	50	72	3.88	279.36	21.5	48.1
Stage 6	10	2	24.72	49.44	25.5	10.1
Stage 6	20	72	3.36	241.92	25.5	49.4
Stage 6	50	72	3.88	279.36	25.5	57.0

1 – Runoff coefficient of 0.8 has been used

6.4.5 Sediment and Surface Water Control

It is recognised that it is generally higher intensity, shorter duration storms that provide the major part of any exported suspended sediment load from a dirty or erodible area. However, it is also acknowledged that sediment loads carried by longer duration, lower intensity storms must be treated as well.

Site runoff management facilities have been designed to fully contain and treat all the 50 year ARI, 72 hour storm event. This storm event represents a considerable volume of water, as shown in the table above.

The surface water control plan has been based on:

- completely capturing site runoff in a 1 in 50 year, 72 hour storm event;
- detaining the runoff in sediment dams within the open cut void; and
- treating the runoff before discharging water of a suitable quality into an ephemeral creekline on site that will direct water into the Wollangambe River.

To control stormwater within the quarry area, the catchment area flowing into the quarry will be minimised to limit the water make in the area. Clean water diversion channels will be constructed up slope of disturbed areas to divert clean water away from disturbed areas. These channels will be established at the commencement of construction activities.

Dirty water from the stockpile and infrastructure area will be limited as far as possible. The stockpile area will be covered and water from the roof of the stockpile will be clean. This water will either be stored for potable supply or discharged into the dirty water systems. Any areas, such as around the office, which will generate clean runoff will be directed to the natural water system. Dirty water that is generated in these areas will be directed into the open cut pit and water treatment plant for treatment.

The volume of the sediment control structures required will vary as the mine progressively disturbs a greater area. Proposed internal drainage systems and water management structures are shown on **Figures 3.2** to **3.8**. These figures show how the water management system changes as the quarry develops. During the first 3 stages of the mine's development, stormwater flows will be contained in:

- The void created by the initial Stage 1 development will include a large sedimentation pond that will readily contain the 1 in 50 year, 72 hour storm event for Stages 1-3 of the project. This void will be capable of containing well in excess of the volumes required.
- Smaller sumps that will be constructed on each working bench to treat the sediment laden water prior to discharge into the larger sedimentation pond.

As the mine develops further, additional sedimentation sumps will be constructed on each working bench. These sedimentation sumps will be used to treat stormwater flows generated on working benches during Stages 4, 5 and 6. These will ensure that short-duration storms are contained and solids loading reduced prior to passing into the main pollution control ponds for treatment prior to discharge.

For large storm events, water will be stored in the base of the pit. During Stages 1 to 3, the storage area will be the void constructed during Stage 1, which will hold a volume well in excess of the 1 in 50 year storm event. During Stages 4, 5 and 6, water volumes greater than the 1 in 50 year storm event will be contained within the floor of the lowest bench of the mine. This area will contain a number of sediment dams (or equivalent) that will contain the majority of smaller storm events. During large storms, such as the 1 in 50 year 72 hour storm event, water will be stored in the base of the mine.

Once a rainfall event has stopped, water in the sediment control structures will be treated to ensure the water is within EPA limits. Once water quality is suitable, treated waters will be discharged to the ephemeral creek line that drains to the Wollangambe River. The discharge will consist of a pipe fitted with a valve that will be locked at all times excepting when treated water is discharging.

6.4.6 Water Treatment

There will be two main forms of treatment, mechanical and chemical. The primary mechanical method will be use of sediment control ponds, particularly those located within the advancing pit. These will both slow the water as well as settle the larger sand particles. The slowest settling, most mobile particles in the runoff from the mine area will be those that consist of the finest kaolin clays, and therefore the most valuable material on site. Given that the quality of treated water to be discharged to the National Park must be very high, and that the kaolin product is a valuable part of the Newnes resource, chemical treatment of sediment laden water will be carried out before any discharge to the National Park.

A treatment plant will be installed which will include several separate processes. The processes will include flocculation to remove the finer clays with additional chemical treatment to remove slightly elevated manganese levels. This later process will include pH adjustment, addition of an oxidising agent such as potassium permanganate followed by filtration to remove the collected material. The processing plant will be fully automated for both start up and operation. The location of the treatment plant is shown on **Figures 3.2** to **3.7**. The plant will be relocated in the early stages as the mine develops, however, the plant capacity (in the order of 1 ML per day) will remain constant.

There are two processes used to chemically remove suspended solids from waste water, namely coagulation or flocculation. In general, turbid raw waters contain suspended matter – both settleable solids, particles large enough to settle on standing, and dispersed solids, particles that will not readily settle. A significant proportion of these non-settleable particles are colloidal. Each particle is stabilised by negative electrical charges on its surface, causing it to repel neighbouring particles. Since this prevents these charged particles from colliding to form larger settleable masses, they do not settle. Coagulants are positively charged, and they destabilise these colloids by neutralising the forces that keep them apart.

There are several types of coagulants available, however the primary selection criteria is the ability to bind completely with solids within the waste stream. When this occurs, all the coagulant is essentially used in the process and no material is lost by way of the discharge.

The material collected from the plant will be a non hazardous sludge of neutralised coagulant and clays. This will be disposed of in pit along with overburden and waste rock and ultimately form part of the rehabilitation program.

There is a range of coagulants available and flocculation trials will be undertaken to determine the most appropriate coagulant for the kaolin fines. A coagulant will be chosen to avoid ecological effect.

6.4.7 Erosion Control

Temporary Systems

The primary objective of the proposed erosion and sedimentary control systems is to safeguard against soil loss and consequently, control the risk of water quality impacts in the National Park downstream. The types of systems to be used are described below.

Prior to any construction work on site, including clearing of vegetation, soil stripping or access road construction, temporary erosion and sedimentation control structures will be put in place. Any exposed areas where erosion hazards exist will be controlled to avoid sedimentation impacts on downstream waterways.

Sedimentation Control Pond

A sedimentation control pond will be constructed to collect and contain sediment-laden runoff from disturbed areas prior to the major construction works. This pond will be constructed in the location of the in-pit sump that will be used for mining Stages 1-3.

Silt Fences

A series of parallel silt fences will be erected downstream of critical drainage locations where ground disturbance has occurred in order to contain sediment generated during construction and prior to the stabilisation of surfaces by revegetation works.

The filter fabric used in the silt fences will have a permeability coefficient of 0.02 m/s, allowing sufficient flow during minor storm events without water build up. Each fence will have a silt retention efficiency of at least 75%, however having the two fences in parallel will increase the overall retention efficiency.

Exposed Batters

Any batters required will be constructed to minimise exposed areas and consequent soil erosion. In addition, any disturbed loose batters will be topsoiled and revegetated as quickly as possible following disturbance. The batters will be stabilised with grasses to hold the topsoil on site.

If necessary, hydromulching will be used to protect underlying fill material from wind and water erosion, thereby minimising sediment loss. The hydromulching applications typically consist of straw, bitumen or polymer binder, seed and fertiliser. The value of the mulch application is that it provides instant protection of the surface soil from erosion and well as protecting seeds, improving water holding capacity and germination. Materials used in hydromulching are also biodegradable, decomposing to form an organic humus.

Disturbed batters that may require treatment include those on access roads and other construction areas. Since some of these surfaces may be relatively steep, the potential for erosion will be high. It will therefore be necessary to undertake revegetation works quickly in order to provide the necessary vegetation for surface stabilisation.

Drainage Culverts

Additional erosion and sedimentation control systems will be used during construction of drainage line crossings or other activities near drainage depressions. Silt traps will be constructed downstream of each crossing and will remain in place during the life of the mine or until subsumed into the mine pit.

Drainage beneath each crossing will be provided by a series of pre-cast concrete pipes if required. The combined cross-sectional area of the pipes will be sufficient to cater for all flows up to a 1 in 50 year, critical duration storm event.

Permanent Systems

In order to protect the soil and water resources of both the site and the adjacent areas, a number of key features will be built into the mine design. These will include diverting run-on water around the site, containing and treating dirty water on the site and rapidly rehabilitating the site as soon as areas become available.

Details regarding each of these are provided below.

Clean Water Diversion

The surface of the Newnes Plateau and the Newnes Kaolin Mine Site generally consists of permeable sandy soils with friable sandstone outcrops. While a certain proportion of the rainfall is absorbed into the sandy soil terrain, surface runoff does occur during heavy rainfall events so particular attention needs to be paid to site drainage and erosion control.

Clean water diversion channels will be constructed around the mine to prevent ingress of clean water into the pit area. This will minimise the amount of water needing to be contained, handled and treated on site.

Run-on water from upslope of the mine will be directed around the site and back into the same natural drainage channels lines which flow eastward into the Blue Mountains National Park. This will be achieved by installing diversion drains and banks upslope of the area to be disturbed by mining activities, as shown in **Figure 3.7**.

Containment and Treatment of Dirty Water

The silt fences and straw bales installed during construction works to reduce the sediment content of runoff from disturbed areas will be maintained as required during the mining operation. It is anticipated that these structures will be installed around access roads and infrastructure areas where necessary. These structures will be maintained to ensure that their capacity to contain sediment is not significantly reduced.

The sedimentation pond constructed in the early stages of the construction works will be enlarged to form a large in-pit sump as the mining progress to collect sediment-laden runoff from the mine site. This sump will be the key containment dam for the project.

The sump will be designed to allow the site to operate as a nil-discharge site for storm events of 1 in 50 years (72 hours) and less. It is proposed to apply for a discharge licence from the EPA to enable discharges of treated water to be made in-between storm events as needed. This will permit the storage capacity of the in-pit sump to be maintained at a reasonable level.

The stormwater collected will contain suspended clays that will contain a significant amount of high value kaolin product. It will be treated to remove the suspended material since this contains a significant amount of high value kaolin product both to protect the waters of the Blue Mountains National Park and to maximise clay recovery.

Discharges from the site would occur in a controlled manner once the water quality has been verified as meeting discharge requirements. Water treatment will be carried out to ensure that the water quality is suitable for discharge.

Treatment of the Opencut High-Walls

The opencut highwalls will be terraced (see **Figure 3.12** and **Figure 3.13**), retarding surface water flows within the pit and assisting with infiltration rates. In addition, the berms will be revegetated as rapidly as possible to further encourage water retention. Water collection on these berms will be directed to specific sections of the berm for discharge to the next bench. This will allow the safe discharge of the water down the batters, minimising the risk of long term erosion of the mine high wall.

As the benches are developed, water will flow from one bench to the next lower bench during rainfall events. To prevent the benches from accumulating water, concentrating it into low points and discharging in an uncontrolled fashion, the benches will be constructed to direct water into the wall, and the water will be directed to specific overflow points and discharged in a controlled fashion to the next bench (see **Figure 3.14**). This will prevent gully erosion occurring on the rehabilitated areas and the removal of topsoil resources and rehabilitating vegetation.

The batters between the berms will be constructed so they are vertical or near vertical to minimise the erosion risk on them. The nature of the sandstone in this area results in greater erosion of sloped sandstone batters versus vertical batters. This is related to the clay content in the sandstone causing rilling where water concentrates. The steeper the sandstone batters, the less erosion occurs over longer time periods, as evidenced on sites nearby which have exposed sandstone batters in similar material.

The berms will also be rehabilitated as soon as possible after mining. This early and progressive stabilisation and revegetation of the mine benches will minimise the disturbed areas exposed at any one time, limiting sediment movement generated on the site and increasing infiltration.

6.4.8 Groundwaters

An assessment of the hydrogeology of the Newnes Kaolin site and the potential hydraulic and water quality impacts of the proposed pit on the surrounding groundwater system was prepared by Dr F Kalf, of Kalf and Associates Pty Ltd. The main findings of the assessment are summarised in the following sections, and the full report is contained in **Appendix H**.

Groundwater through the proposed site occurs in both primary and secondary structures in the Triassic sandstone and is supplied entirely by infiltration and recharge to a shallow groundwater system in the upper sandstone. This aquifer system is distinct from additional much deeper aquifer zones beyond 100 m and 200 m or more within the coal measure strata.

Depth to the potentiometric surface over the site area could be expected to be at a depth from ground surface in the range less than 2 m to 25 m. These depths, however, are consistent with the emergence of seepages in the lower lying sections of the drainage gullies that cross the western boundary of the site.

In summary, the predominate groundwater flow occurs in an easterly to north-easterly direction with some groundwater flow being re-directed towards the Rocla Sand Quarry. Beyond the main western railway line groundwater would flow in a general south-westerly direction towards Dargans Creek.

Groundwater Quality

The groundwater quality from the shallow groundwater system in the area generally has low to moderate salinity. The groundwater currently being extracted from nearby bores would be similar to that which could be expected from groundwater inflow in the new pit, since all sites lie at a depth that is within the sandstone shallow groundwater flow system in the area.

Expected groundwater quality is shown on **Table 6.21**. This table shows that although ground water quality varies, it is predominantly very good with generally low salinity, low metals and soft. The pH varies but this is typical of soft water with low dissolved solids. Indeed, the material being mined at Newnes represents the edge of the shallow aquifer used for domestic water supply to Clarence Village as well as a commercial bottled drinking water company. Water quality, although excellent, has slightly elevated manganese, which will require removal to meet discharge quality criteria, as discussed in Section 6.4.6.

Impact Assessment

During the excavation of the proposed kaolin pit, the local watertable within the sandstone will be intersected, and as the pit is deepened, groundwater will flow towards the mined out voids. Based on existing data the total drawdown in the pit from the initial watertable level is likely to be in the range of 15 m to 25 m.

As groundwater flows into the pit the watertable will be lowered progressively around the periphery of the pit. The drawdown will migrate outwards from the pit until it reaches equilibrium. This will occur when rainfall recharge into the sandstone strata, within the created cone of drawdown depression, balances the inflow to the pit. Once equilibrium conditions are established further migration of the watertable drawdown will not occur once the final pit depth has been achieved.

The creation of a drawdown zone of influence will cause groundwater flow directions to be directed towards the pit. Outside of this zone of influence the groundwater flow directions will remain unaffected and unchanged from the pre-mining flow directions.

It is anticipated that the proposed pit will not have any hydraulic effect on the groundwater system within the Clarence Village.

Any significant drawdown influence will be restricted to within about 500 m or so from the pit under maximum development. Ultimate steady state conditions will be reached within a year or so once the 21-year pit floor depth has been achieved. Note however, that these are predicted maximum levels, and they will develop slowly to such levels over time as the mining progresses.

Drawdowns around the periphery of the pit will not affect vegetation since these species rely largely on soil moisture conditions. This is verified by the sound condition of tree species evident in the areas surrounding the existing Rocla Quarry where drawdown conditions occur.

The drawdown influence on the tributary streamflow will also be small. Some baseflow and surface water seepage will be lost to the easterly drainage gullies, but the volume would not be measurable in the lower reaches of the main draining tributaries. Any change would be well within the normal fluctuations created by climatic variations.

Final pit inflow is expected to average around 0.2 Ml/day, but the major proportion of this will be lost in evaporation from the high walls of the pit and storages within the floor of the pit. No groundwater would exit from the pit during active mining operations since the watertable gradient will be directed toward the pit.

Once mining ceases the mined out pits will fill with groundwater, rainfall and rainfall runoff. Filling will occur until a new equilibrium is established between the ponded water depth, evaporation and natural groundwater seepage. It would be expected that a new lake system would be finally established as regrowth occurs and natural seepage of good quality water re-enters the catchment area.

Groundwater Monitoring

At least three monitoring boreholes will be sunk in a westerly direction at increasing distances form the western boundary of the proposed pit. These holes will be established prior to commencement of mining to enable background water quality to be determined. The holes will be sunk to a minimum depth of 50 m and fitted with 50 mm slotted PVC and gravel filter and be completed as permanent observation holes with a surface concrete block and cap fitted in the usual manner. Water samples taken will be analysed for the major ionic constituents to establish baseline conditions for the active and post mining period.

Water level measurements will also be conducted initially on a monthly basis in each hole over time to establish seasonal trends and then at 3 monthly intervals to verify the impacts predicted.

6.5 Transportation Impacts

6.5.1 Existing Transportation Network

Road Network

The proposed mine site is located north of the Bells Line of Road, a major east-west transportation route linking the north west of Sydney with Lithgow and central NSW.

The other major road in the vicinity is the Great Western Highway, which provides access to sites north and south of the Bells Line of Road.

Annual traffic volumes travelling along the Bells Line of Road are shown in **Table 6.24**. The annual average daily traffic volumes along the Bells Line of Road are relatively stable during the years recorded.

Table 6.24 - Traffic Volumes in the Region

Monitoring Site	1996 AADT	1997 AADT	1998 AADT	1999 AADT	2000 AADT
[99.037] Bells Line of Road (Bell)*	N/A	3175	3200	3227	3181
[99.927] Bells Line of Road (Clarence)**	3301	N/A	N/A	3166	N/A

Source: RTA AADT figures, 2001
AADT = Average annual daily traffic, measured as axle pairs
* Traffic Count Station located on the Bells Line of Road, immediately west of the intersection with the road (unnamed) joining Bell and Mount Wilson. This is a permanent station, established in 1996 (1996 count not applicable).
** Traffic Count Station Located on the Bells Line of Road at Clarence, west of the Clarence Colliery access road. This is a temporary station.

6.5.2 Existing Access Arrangements

The site is joined to major route Bells Line of Road by a 2 km two lane, sealed road, used for access to Clarence Colliery and Kable Sands.

The section of Bells Line of Road immediately to the east and west of the site access road is a high standard highway, with sealed shoulders and regular stopping provisions, with 4 lanes in some sections. Heavy vehicles regularly use the road.

6.5.3 Expected Traffic Generation

During the construction phase of the project, a variety of road registered vehicles will be used to transport personnel, materials and equipment to and from the proposed mine site. Vehicles likely to be used during construction include:

- light personnel transportation vehicles;
- small concrete trucks;
- mobile crane;
- earthmoving equipment.

These vehicles will either be already located within the region, being owned by local contractors used during construction, or will enter the region via the Bells Line of Road before following the smaller access road to the construction site. A worst case scenario of 20 vehicles per day is anticipated at any one location along the transmission line.

6.5.4 Assessment Criteria

The Ausroad Traffic Assessment Criteria for Rural Roads is provided in **Table 6.25**. This data provides the basis for establishing the expected level of service for various road formation and design. The bulk of the roads to be affected by this proposal include the "Unsealed", "Sealed Undivided" and "Sealed Divided" roads.

Table 6.25- Austroad Traffic Service Assessment Criteria for Rural Roads

Road Stereotype	Quality of Traffic Service		
	Poor (vpd)	Fair (vpd)	Good (vpd)
Unsealed			
Natural Surface	over 100	61 to 100	up to 60
Formed	over 100	61 to 100	up to 60
Gravel one lane (up to 4.5 m)	over 100	61 to 100	up to 60
Gravel two lane (up to 4.5 m)	over 150	61 to 150	up to 60
Sealed Undivided			
One lane (up to 4.5 m)	over 300	151 to 300	up to 150
Narrow two lane (4.6 to 6.4 m)	over 4 000	1 001 to 4 000	up to 1 000
Wide two lane (6.5 to 9.1 m)	over 6 000	4 001 to 6 000	up to 4 000
Three lane (9.2 to 11.6 m)	over 10 000	6 001 to 10 000	up to 6 000
Four lane (over 11.6 m)	over 15 000	10 001 to 15 000	up to 10 000
Divided			
Four lane (up to 9.1 m x 2)	over 30 000	15 001 to 30 000	up to 15 000

vpd = vehicles per day

6.5.5 Transportation Impacts

Construction Road Impacts

At any one time, construction traffic is expected to be in the order of 10 vehicles per day and a worst case scenario is anticipated to be 20 vehicles in any one day. These will include large vehicles transporting heavy machinery, equipment and construction materials.

Construction vehicles will not have any major impacts along the majority of the transportation route. There will be no major impacts on local Newnes Junction residents since the construction traffic will access the mine site to the north of the village and will not be required to pass the local residences.

Construction traffic will only be a minor portion of the total traffic using the Bells Line of Road for the duration of the period of construction and no inconvenience to other road users is anticipated. The worst case scenario of 20 vehicle movements generated during any one day represents approximately 0.6% (based on traffic counts in 2000) of the traffic flow on the Bells Line of Road and will therefore have no significant impact on the regional road network. Any impacts will be minor in nature and short term in duration.

The local access road leading from the Bells Line of Road to the mine site is currently used by light vehicles accessing Newnes Junction, industrial sites and the State Forests in the vicinity, and heavy vehicles accessing the various industrial sites in the area. The roads have more than sufficient capacity to take an additional 20 traffic movements a day and no significant negative impacts are anticipated.

Wide or long loads being transported during the construction activities may require lead and/or chase vehicles to warn local traffic as appropriate. The roads in the area are not particularly steep or winding and therefore the long loads are not regarded as a particular transportation issue.

Construction Rail Impacts

No rail transportation will occur during the construction phase of the project and there will therefore be no impacts on the rail network during construction.

Operational Road Impacts

Since the vast majority of the product will leave the site via the rail system, road usage during the site operations will be limited to light vehicles used to transport workers to the site, deliveries of fuel and occasional heavy vehicles that may transport spot loads from the site to specific markets nearby.

There will be an estimated 10 light vehicles a day entering and exiting the site. While it is not possible to accurately determine the number of heavy vehicles that will transport material from the site the number of such vehicles will be very small. Road transportation of kaolin ore will be limited to very occasional loads to meet spot market demands. It is not anticipated that such transportation will occur on a frequent basis. Any such loads will be covered prior to leaving the site to control dust generation.

The existing road network is able to absorb the additional vehicle movements without upgrade and no significant impacts of the road network will occur during the operation of the proposed facility.

Operational Rail Impacts

During the operation of the site, the rail loop currently owned and operated by Clarence Colliery will be used for the transportation of the kaolin ore to the Sydney based processing area. For the purposes of this assessment it has been assumed that the kaolin ore will be transported over 50 weeks of the year and that the maximum tonnage of 1.4 million tonnes will be transported.

The transportation of 1.4 million tonnes of material per year on a 50 week basis will require 9 unit trains (each carrying 3,000 t) per week.

Rail loading arrangements will be ultimately determined by the rail authority that wins the contract to transport the material and consequently details of the arrangements are not yet available. However, a number of restrictions exist on the use of the existing rail facilities.

Clarence Colliery is committed to 3 unit trains per week and has priority over the use of the loop. Clarence Colliery loading generally occurs early in the morning (for example 5:00 am) on three mornings of the week. Clarence Colliery may, on occasion, load all three unit trains in one day. This would require only 3 hours of time and would still allow sufficient time for the loading of the kaolin ore.

The rail loop is connected to the Main Western Railway Line that is used to transport regular freight to the eastern seaboard.

6.6 Waste Disposal

The proposed mine will incorporate current best practice with respect to waste management and minimisation. Recycling will occur as much as practicable within the local area but will include as an anticipated minimum, glass, empty drums, pallets and paper if collection services are available.

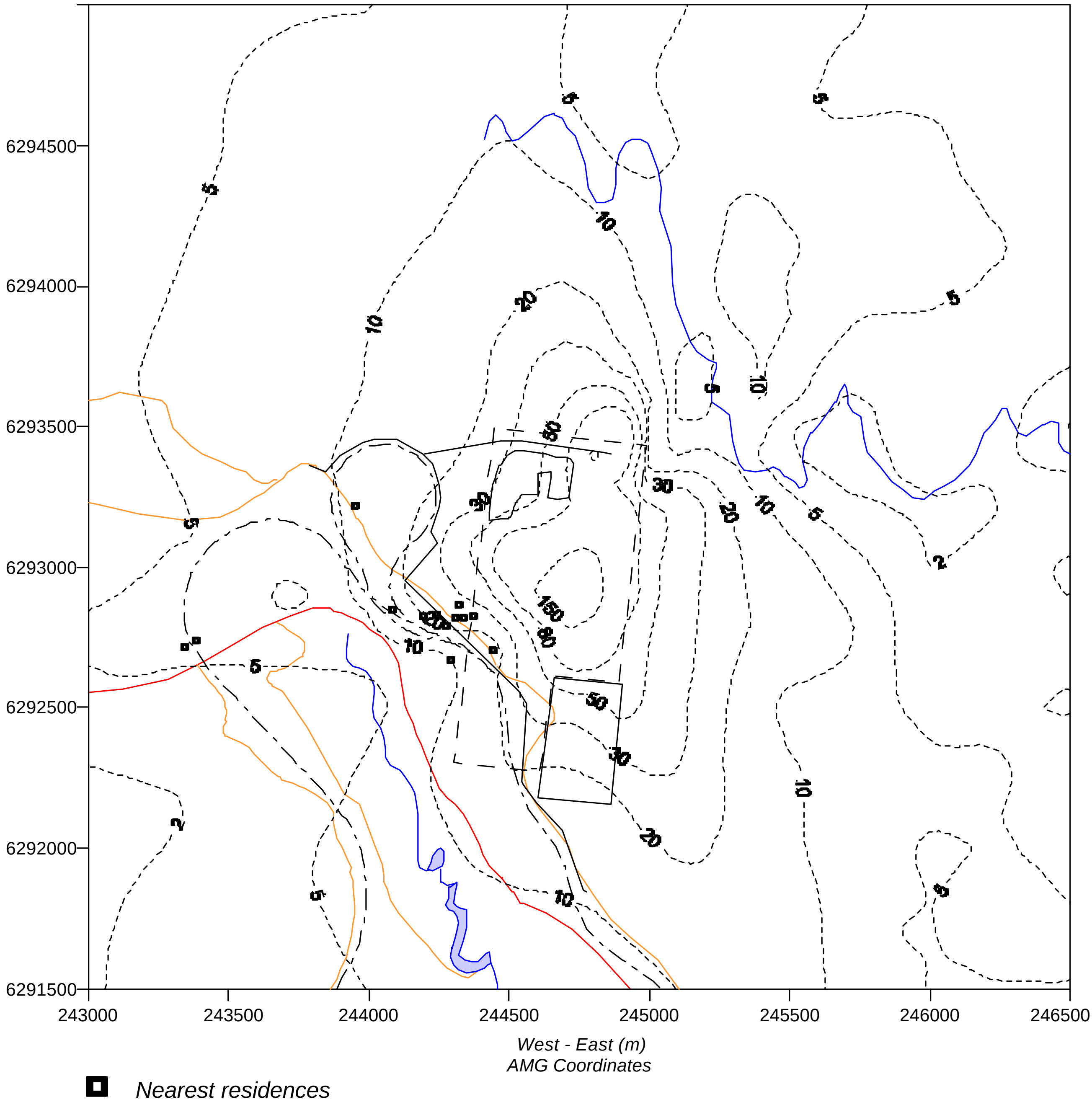
The operation does not require the use of chemicals and licensed contractors will transport all waste oils off site.

All servicing of vehicles will occur at designated locations within the pit. No oils will be deposited on the site and all waste material will be removed from site and disposed of appropriately.

Other wastes will be appropriately disposed of at licensed local landfill sites.

Domestic wastes will be disposed of via normal collection services. Bulk wastes such as tyres and non-recyclable equipment will be disposed of by contractors in approved facilities in the area.

Vegetation cleared during the construction program will be managed by mulching or chipping for use in the rehabilitation program.

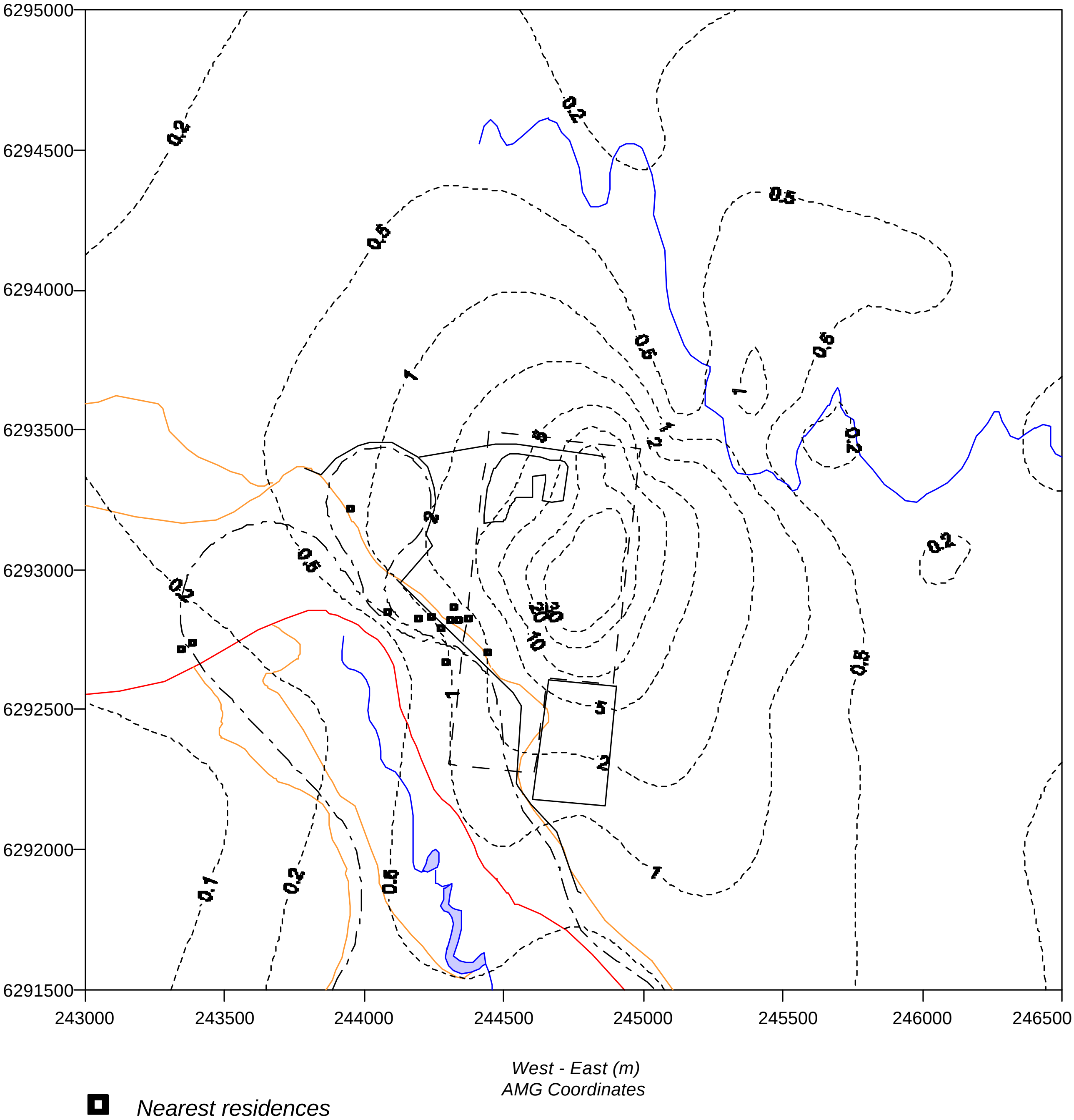


Source : Holmes Air Sciences

0 1000 metres

FIGURE 6.1

Predicted maximum 24-hour average PM_{10} concentration at ground-level (Stage 5 Operations) - µg/m³

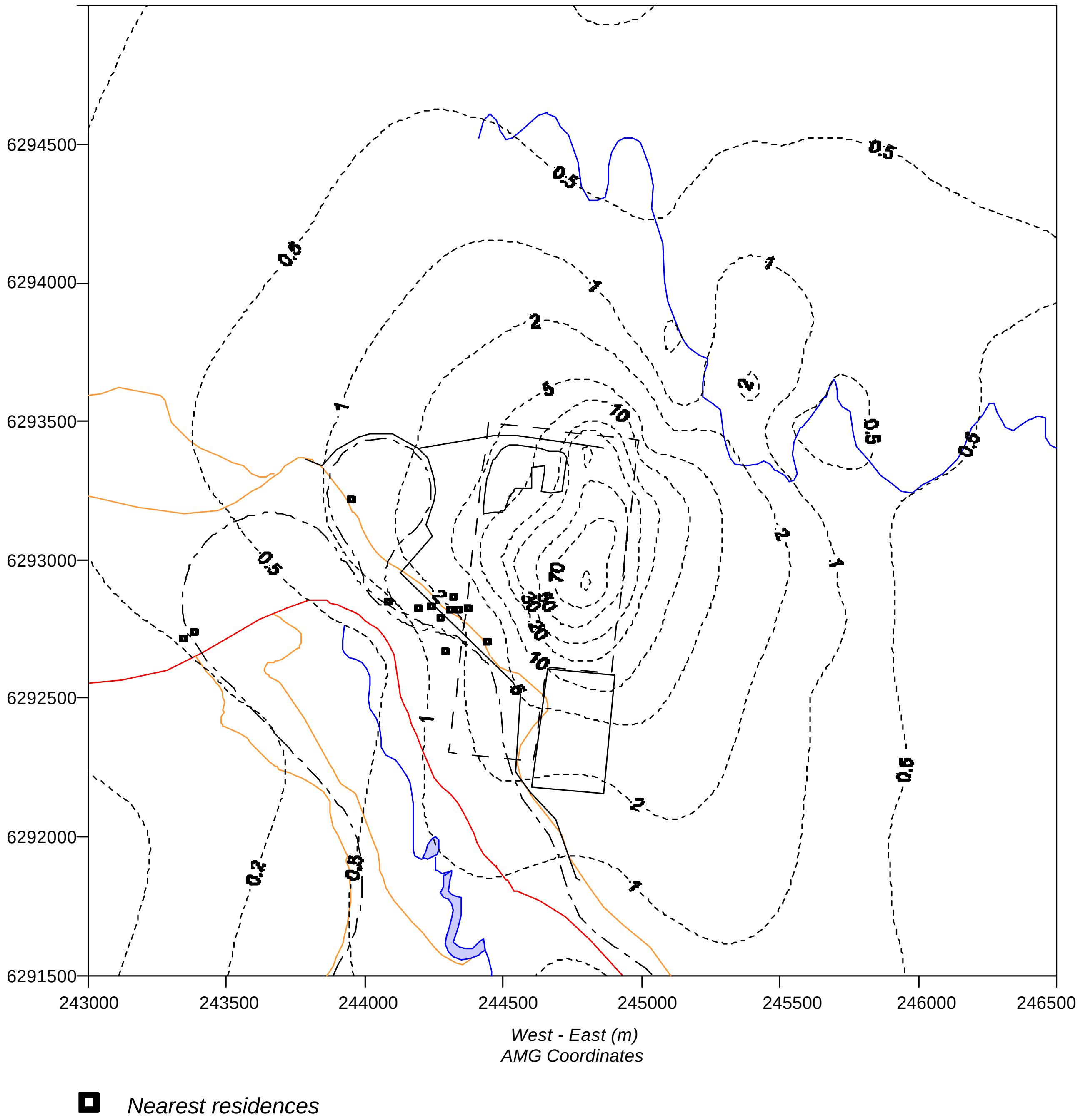


Source : Holmes Air Sciences

0 1000 metres

FIGURE 6.2

Predicted annual average PM_{10} concentration at ground-level (Stage 5 Operations) - µg/m^3

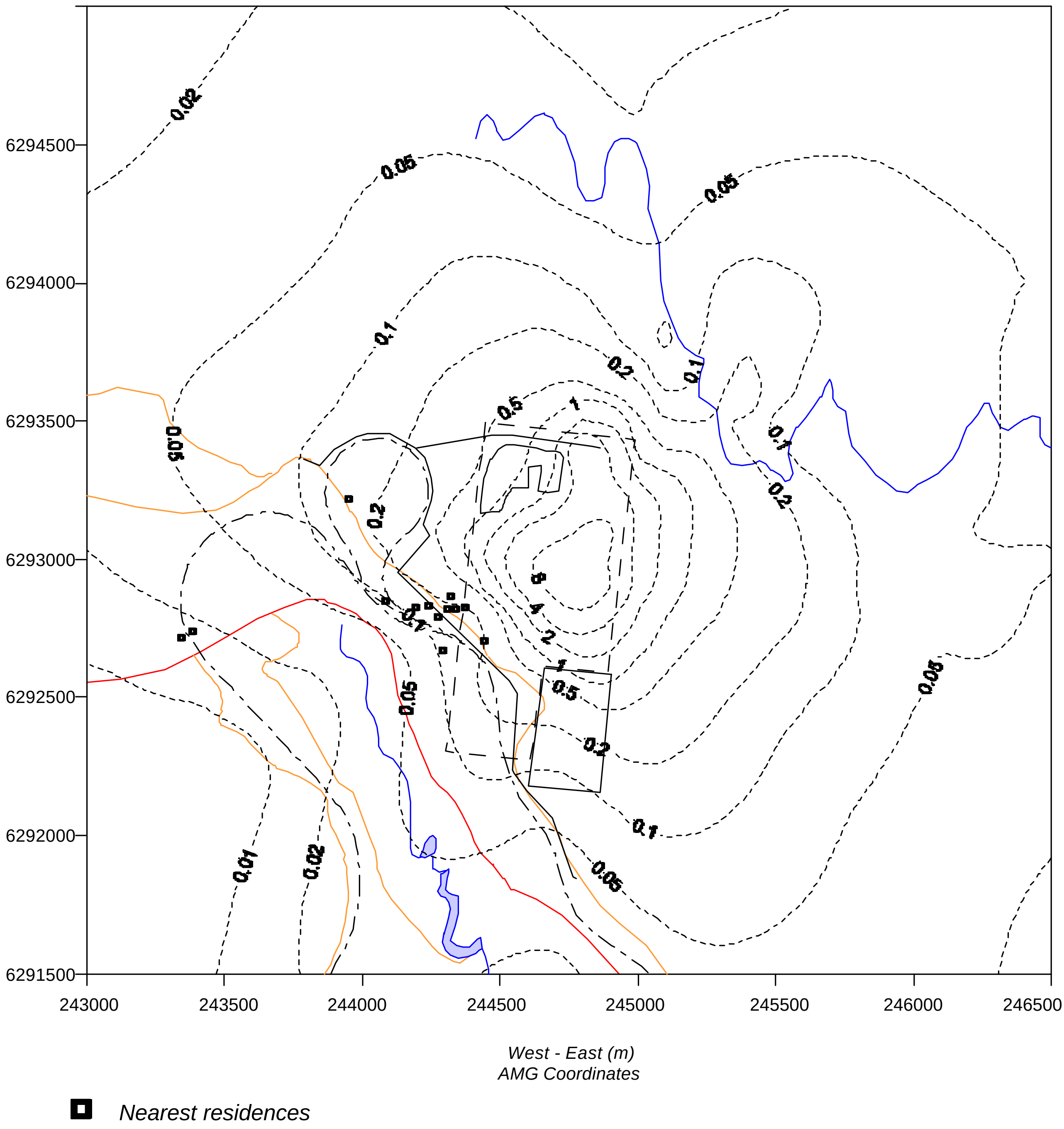


Source : Holmes Air Sciences

0 1000 metres

FIGURE 6.3

Predicted annual average TSP concentration at ground-level (Stage 5 Operations) - $\mu g/m^3$

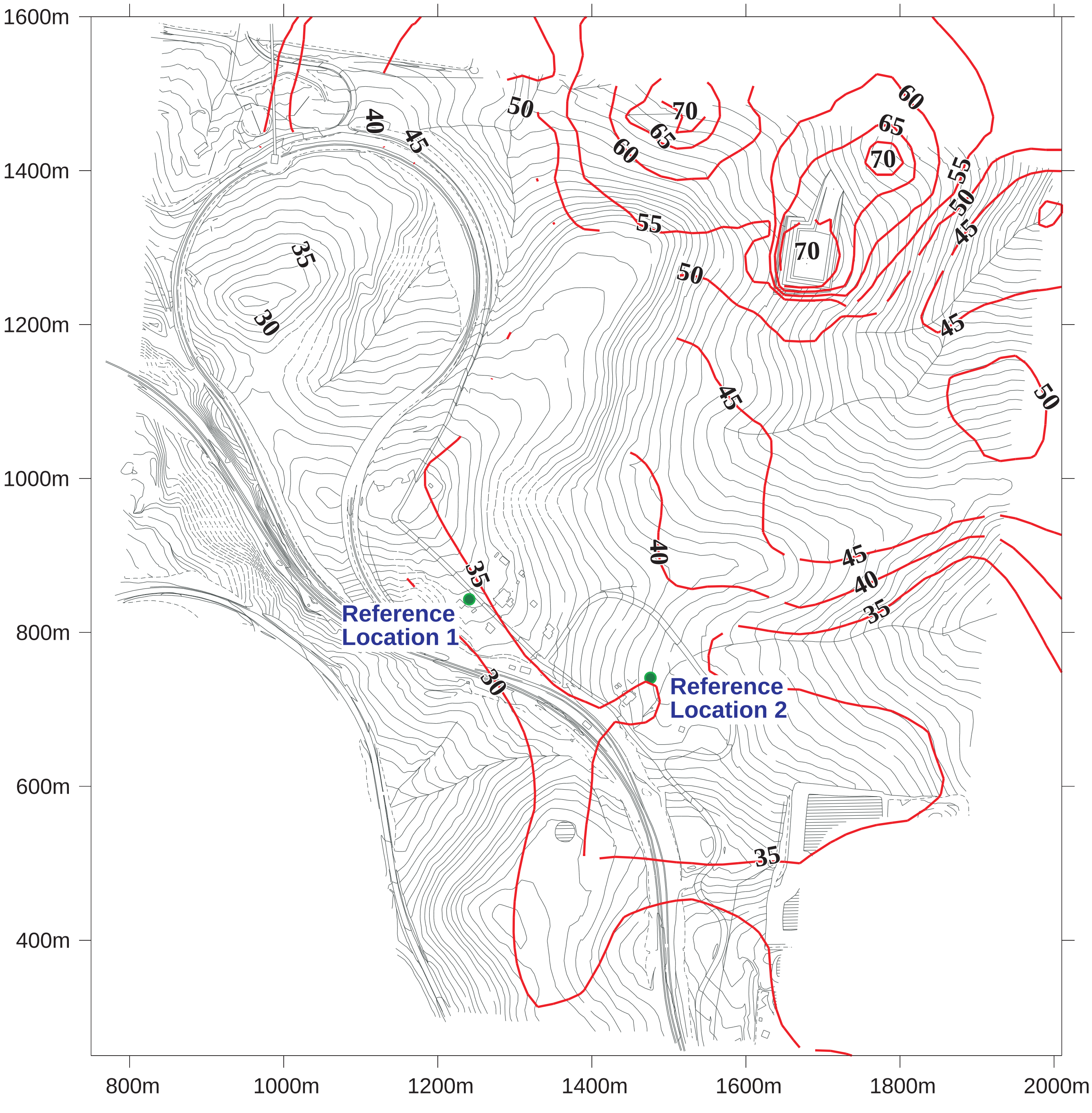


Source : Holmes Air Sciences

0 1000 metres

FIGURE 6.4

Predicted annual average dust deposition concentration at ground-level (Stage 5 Operations) - g/m^{2}month

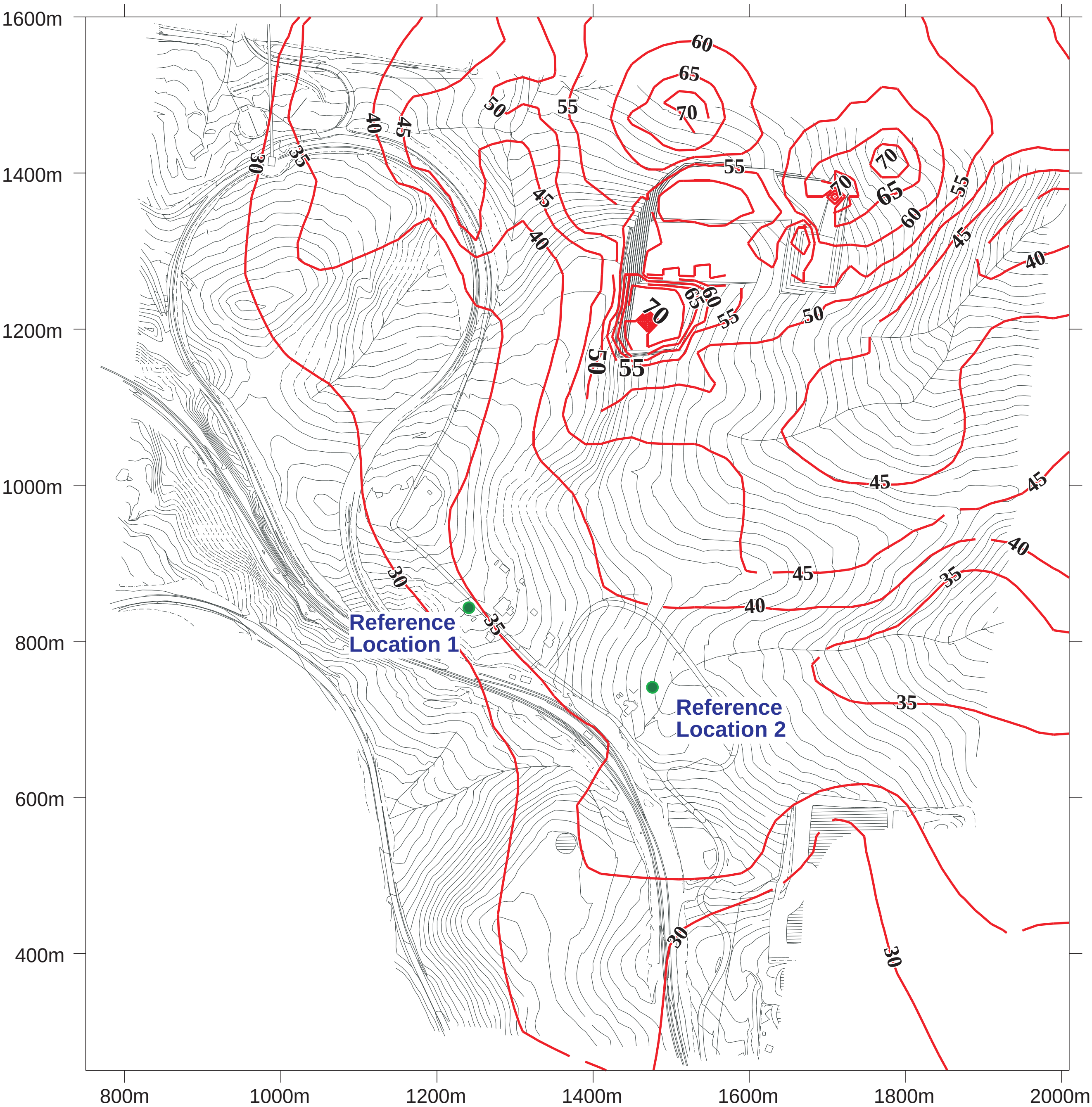


Source : Atkins Acoustics, Jul 2001

0 100 200 metres

N

FIGURE 6.5
Noise Contour Plot - Extraction (Calm)
Stage 1



Source : Atkins Acoustics, Jul 2001

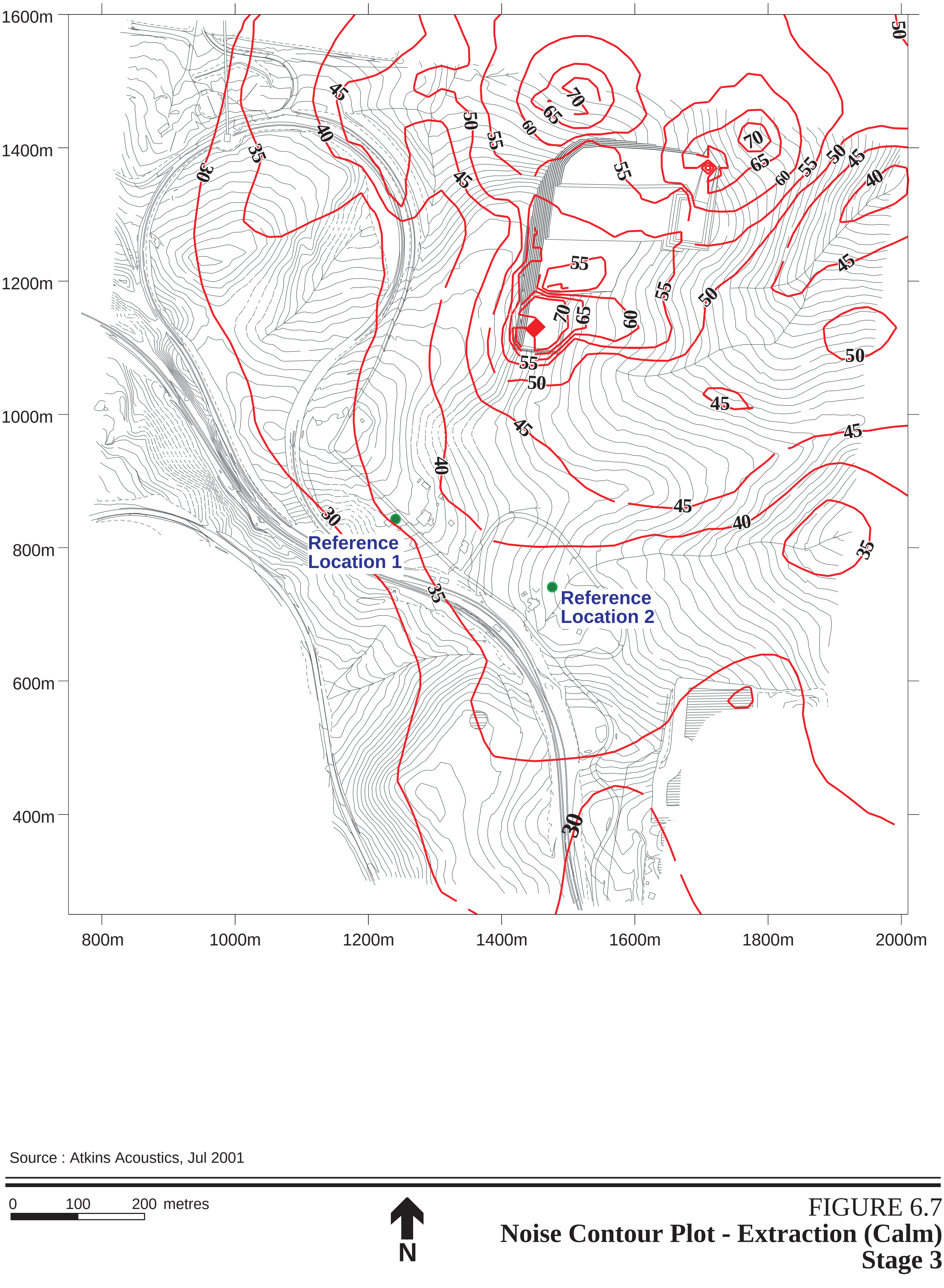
0 100 200 metres

N

FIGURE 6.6

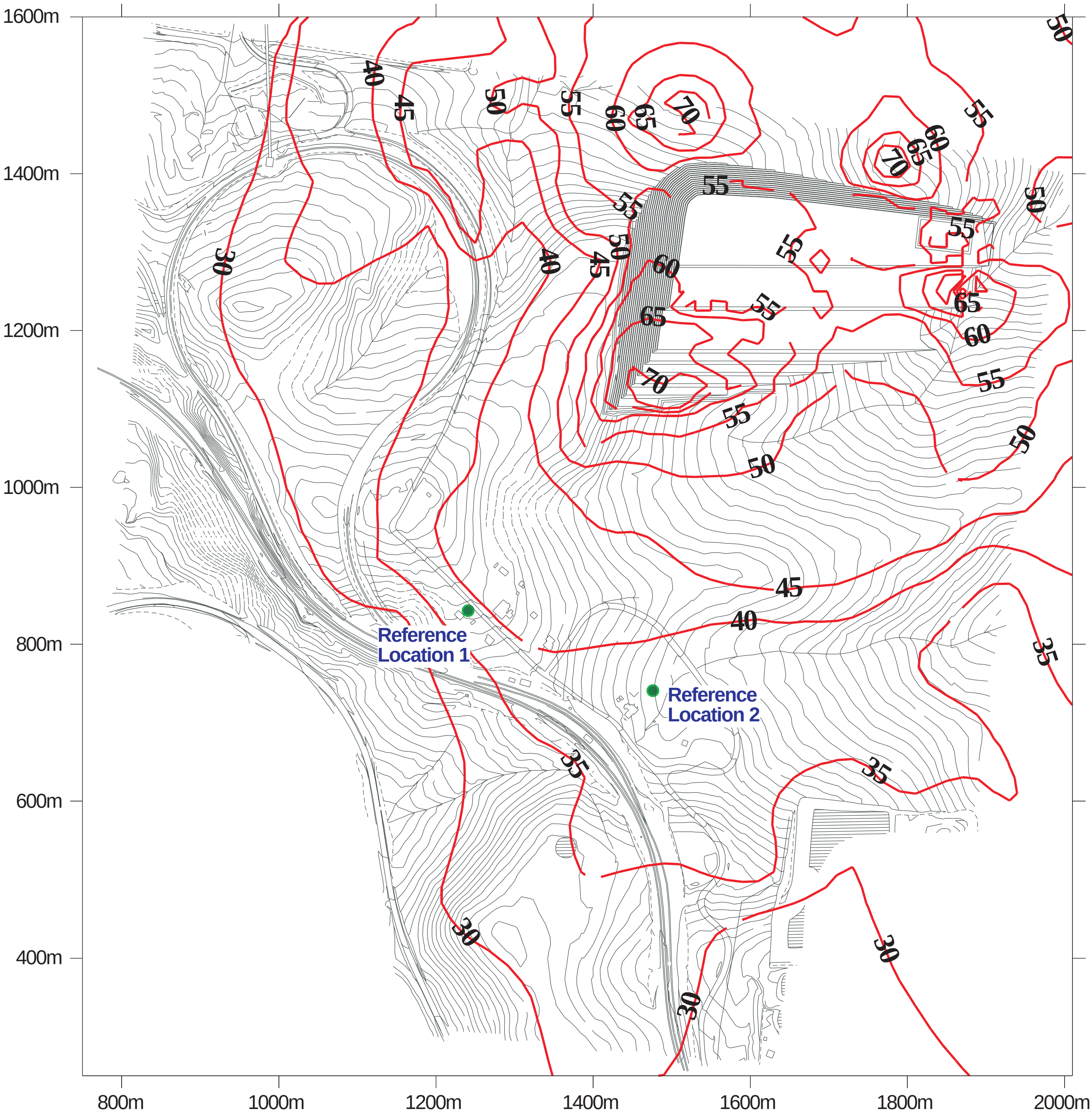
Noise Contour Plot - Extraction (Calm)

Stage 2



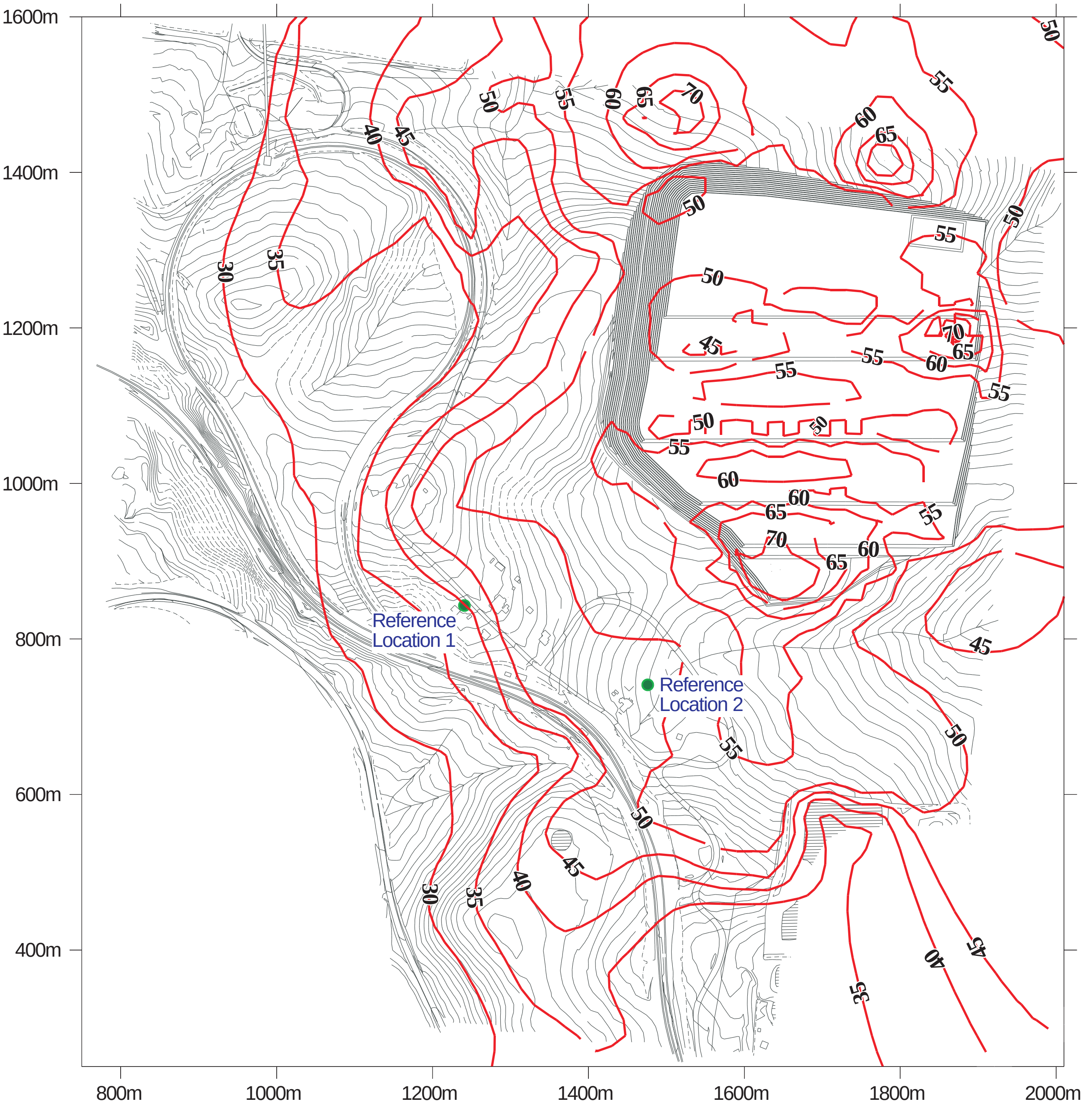
Source : Atkins Acoustics, Jul 2001

FIGURE 6.7
Noise Contour Plot - Extraction (Calm)
Stage 3



Source : Atkins Acoustics, Jul 2001

FIGURE 6.8
Noise Contour Plot - Extraction (Calm)
Stage 4

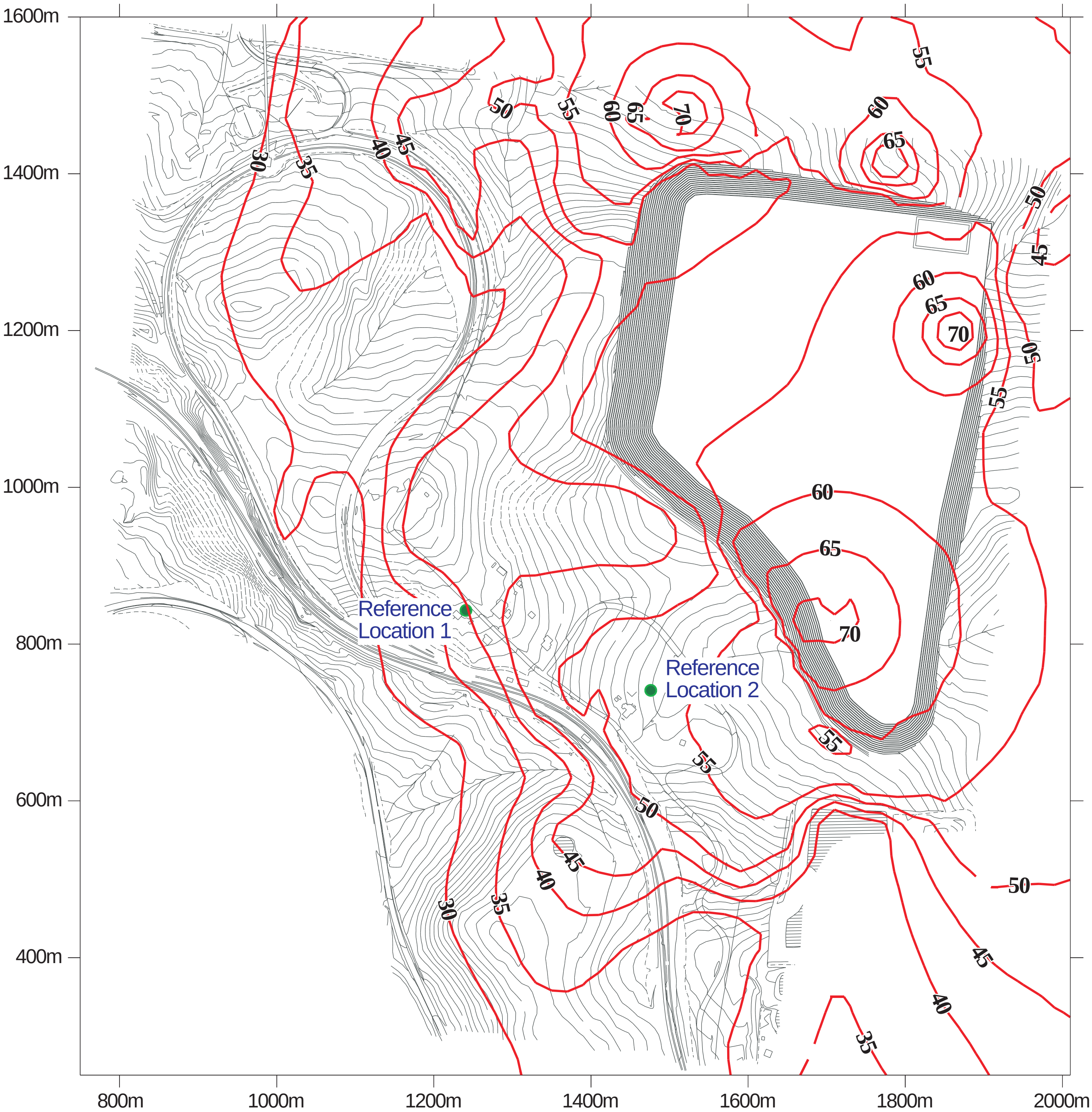


Source : Atkins Acoustics, Jul 2001

0 100 200 metres

N

FIGURE 6.9
Noise Contour Plot - Extraction (Calm)
Stage 5



N

FIGURE 6.10
Noise Contour Plot - Extraction (Calm)
Stage 6

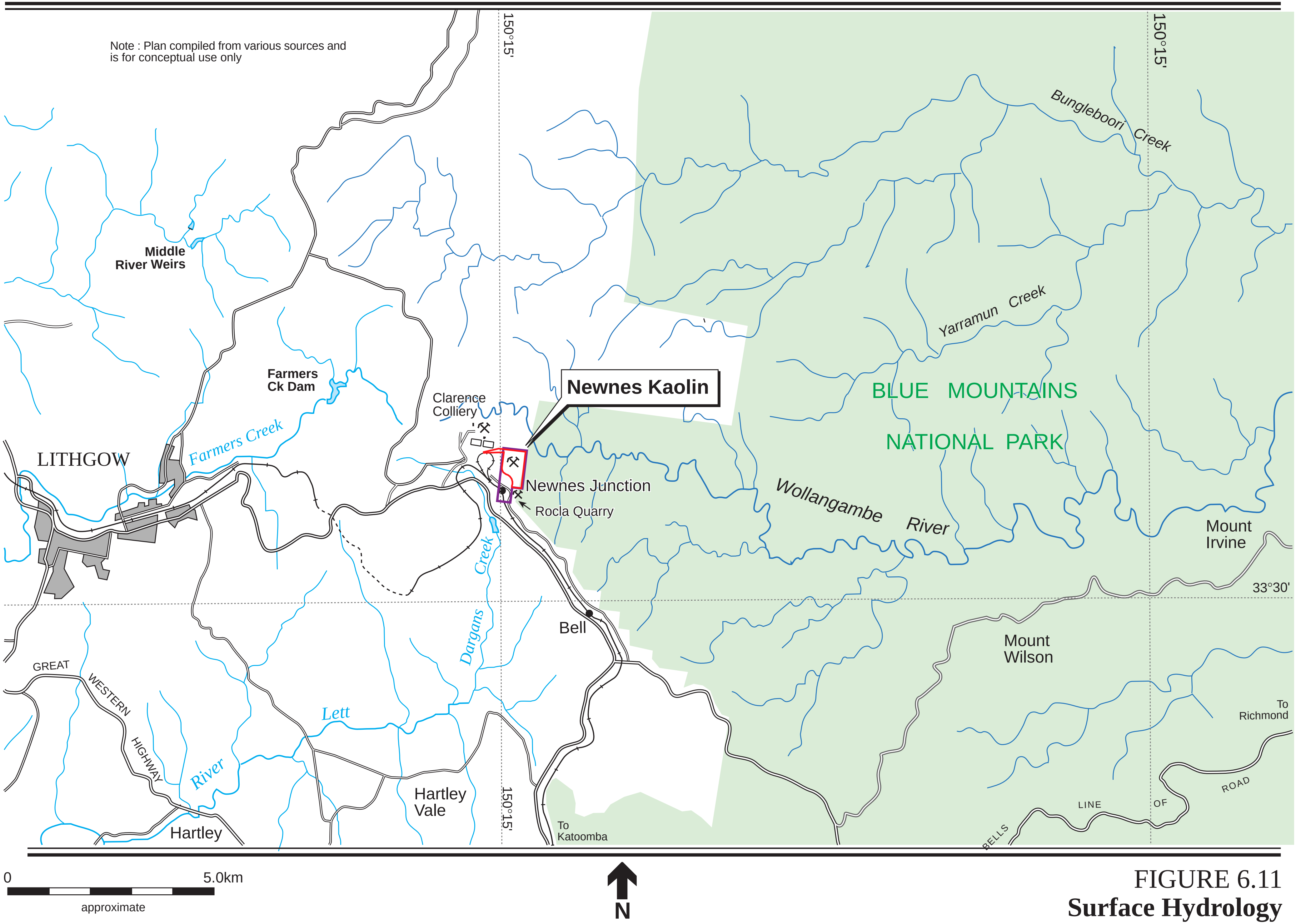


FIGURE 6.11
Surface Hydrology