APPENDIX J: NOISE STUDY

global environmental solutions

Development of the Proposed Commissiekraal Coal Mine
KwaZulu-Natal Province, South Africa

Noise Assessment

SLR Ref: 4AF.03471.00029

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CONTENTS

1.0 INTRODUCTION

1.1 Declaration of Independence

The noise impact assessment has been undertaken by Mr Darren Lafon-Anthony.

Mr Lafon-Anthony is a Member of the UK based Institute of Acoustics and a Fellow of the UK based Institute of Quarrying. Mr Lafon-Anthony has over 20 years of experience in the field of acoustics and noise control with the past 11 years working as a consultant at SLR Consulting Limited, where he is a Technical Director and Technical Discipline Manager for the Acoustics team in Europe. Mr Lafon-Anthony supports SLR Consulting (Africa) Limited on all noise related projects. A copy of Mr Lafon-Anthony's CV is included in Appendix A.

As the author of this noise impact assessment, I declare that I am acting as an independent consultant and have no bias towards, or financial interest in, Tholie Logistics or the Commissiekraal project other than that which enables the production of this assessment.

1.2 Project Introduction

SLR Consulting (Africa) (Pty) Limited has been appointed by Tholie Logistics (Pty) Ltd to undertake an environmental impact assessment (EIA) for the development of the proposed Commissiekraal Coal Mine, including support services and associated infrastructure in the eMadlangeni Local Municipality and the Amajuba District Municipality, KwaZulu-Natal, South Africa.

This report details the noise specialist study which will be used to inform the EIA.

Tholie Logistics will produce and export coal to meet market demands by means of underground mining and associated surface processing. The current proposals indicate that the surface infrastructure will be located in the north-eastern part of the project site near to the underground mine access. The surface infrastructure will comprise underground mine access via a 'box-cut', mobile crushing and screening equipment, temporary stockpiles, and transportation loading and movement. Coal would be transported from site either directly to customers or to a regional railway siding. For the purposes of this study, it is assumed that the regional siding will be at Paulpietersburg.

As any noise emissions from the proposed development would be limited to surface operations only, the following noise assessment does not consider underground operations.

In accordance with South African National Standard 10328:2008 Edition 3, *Methods for environmental noise impact assessments*, an assessment has been made at the nearest noise-sensitive receptors to the site in accordance with the guidance contained in South African National Standard 10103:2008 Edition 6 *The measurement and rating of environmental noise with respect to annoyance and to speech communication.*

Where necessary and feasible, mitigation measures have been considered to reduce any potential impacts.

Whilst every effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix A.

2.0 ASSESSMENT METHODOLOGY AND GUIDANCE

The potential noise impacts generated by the proposed project have been considered to the nearest existing residential receptor locations to the various noise sources under investigation.

An assessment has been made of the existing ambient noise climate and the potential impact of the proposals. Mitigation measures and/or project design changes to minimise potentially negative environmental impacts have been identified where appropriate.

A site visit was undertaken in July 2013 to determine the prevailing baseline noise climate in the area. It is considered that, due to the rural nature of the area, the baseline noise climate would not have changed considerably and the data would remain valid.

A review of the project design and layout has been made as far as is practicable and a noise model built using the proprietary noise modelling software, CadnaA. Noise levels generated by the construction and surface operations have been predicted using the calculation methodology contained in ISO9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General Method of calculation.* The model takes into account the distance between the sources and the receptor locations and the amount of attenuation due to atmospheric absorption, and barrier or ground effects due to local topography. The model assumes worst-case downwind propagation.

Noise predictions have been made for both the daytime (06:00 to 22:00 hours) and night-time (22:00 to 06:00 hours) periods as defined in South African National Standard 10103:2008 Edition 6 *The measurement and rating of environmental noise with respect to annoyance and to speech communication* (SANS10103:2008).

The results of the noise predictions have then been assessed against the guidance contained in SANS10103:2008 for the relevant type of district.

2.1.1 South African National Standard 10103:2008 Edition 6

South African National Standard 10103:2008 Edition 6 *The measurement and rating of environmental noise with respect to annoyance and to speech communication*, outlines the methods and gives guidance on the assessment of the possible annoyance of noise in various environments.

Table 2 of the guidance, duplicated below, gives typical outdoor rating levels that should not be exceeded in certain districts. The table also gives typical indoor rating levels based on the assumption that the buildings are naturally ventilated and the maximum attenuation provided by an open window is 10dB.

Table 2.1
SANS 10103:2008 – Table 2 – Typical rating levels for noise in districts

Type of District	Equivalent continuous rating level ($L_{Req,T}$) for noise, dB(A)					
	Outdoors			Indoors, with windows open		
	[a]Day/night $L_{R,dn}$	[b]Daytime $L_{Req,d}$	[b]Night-time $L_{Req,n}$	[a]Day/night $L_{R,dn}$	[b]Daytime $L_{Req,d}$	[b]Night-time $L_{Req,n}$
Rural districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops, business premises, main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

NOTE 1 – if the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.

NOTE 2 – if the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards low frequencies is suspected, special precautions should be taken, and specialist advice should be obtained. In this case the indoor sound level might significantly differ from the values given in the relevant columns above.

NOTE 3 – in districts where outdoor $L_{R,dn}$ exceeds 55dB(A), residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor $L_{Req,T}$ values in line with those given in Table 1 of SANS10103:2008

NOTE 4 – for industrial districts, the $L_{R,dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24h day/night cycle, $L_{Req,d}$ = $L_{Req,n}$ = 70dB(A) can be considered as typical and normal.

NOTE 5 – The values given for day/night for both outdoor and indoor noise are equivalent continuous noise rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.

NOTE 6 – the noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum A-weighted sound pressure level of 50dB(A) at a distance of 15m from each individual source.

a – the values given are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day

b – the values given are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise.

Table 5 of the guidance, also duplicated below, gives an estimate of the possible community response when the noise rating level exceeds the ambient noise level by certain amounts.

Table 2.2
SANS10103:2008 – Table 5 – Categories of community or group response

Excess ($\Delta L_{Req,T}$)[a] dB(A)	Estimated community or group response	
	Category	**Description**
0 to 10	Little	Sporadic complaints
5 to 15	Medium	Widespread complaints
10 to 20	Strong	Threat of community or group action
>15	Very strong	Vigorous community or group action

NOTE – Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

a – $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:

1. $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation;
2. $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in Table 1 of SANS 10103:2008;
3. $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from Table 2 of SANS 10103:2008; or
4. The expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.

2.1.2 Consultation Process

Other than carrying out a review of the *interested and/or affected party (IAP)* comments received by the EIA consultant during the EIA process, no further consultation has taken place as part of the noise study.

3.0 BASELINE CONDITIONS

An environmental noise survey was carried out on 2nd July 2013 at locations representative of the nearest accessible noise-sensitive receptors to the proposed development site.

The noise monitoring locations shown in Table 3.1 are also shown on the aerial photograph in Figure 3-1. Additional nearest receptor locations are identified as R4 to R7.

Table 3.1
Noise Monitoring Locations

Location Ref	Location Name
L1	Area adjacent to the school & small settlement at the end of the access road to Commissiekraal Farm representative of receptor R1
L2	Area within the Commissiekraal Farm property representative of receptor R2
L3	Area along the D699 and to the east of the development area representative of receptor R3

3.1 Site Description

The proposed coal mine will be located on the farm Commissiekraal 90 HT in the Amajuba District Municipality of the KwaZulu-Natal province of South Africa.

The project includes underground mining accessed via a 'box-cut', on-site crushing and screening, temporary stockpiling of coal ore, and transportation off-site by truck either directly to customers or via a regional railway siding at Paulpietersburg.

3.2 Description and Justification of Monitoring Locations

The monitoring locations were chosen considering proximity to the potentially sensitive receptors, the safety of monitoring staff (particularly during the night-time period), and to avoid disturbance to landowners/stakeholders by monitoring staff during the monitoring periods.

3.3 Monitoring Equipment

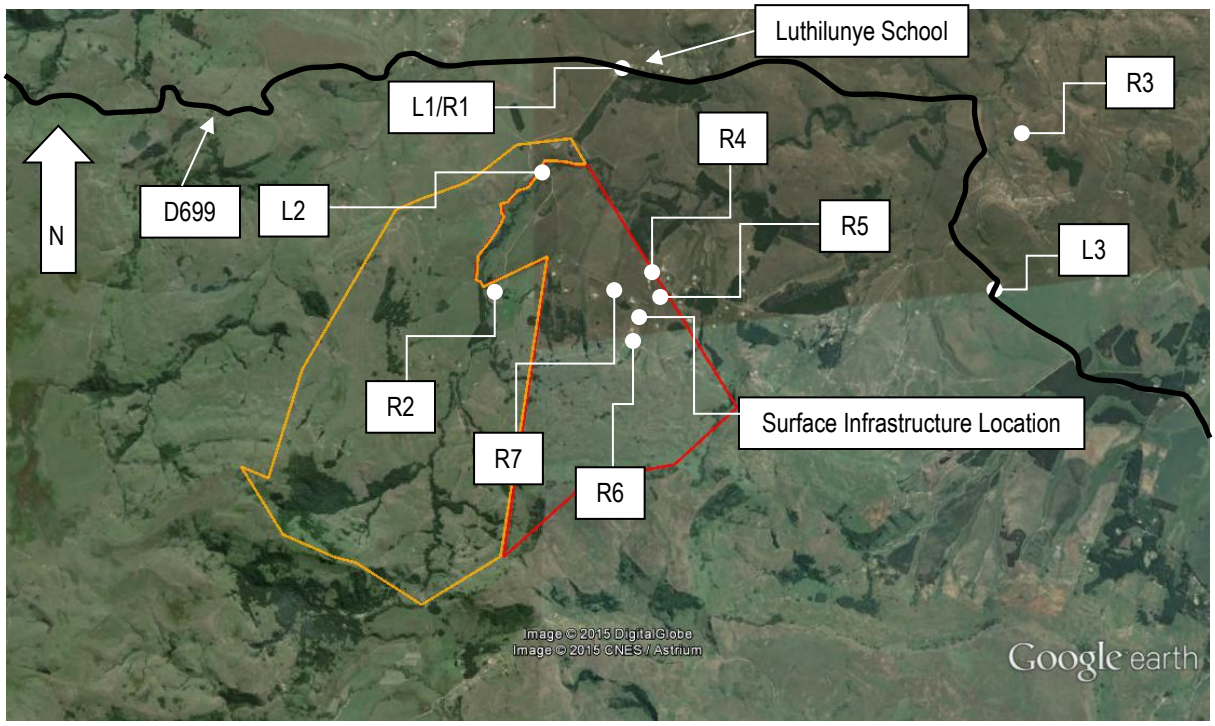
The noise monitoring equipment used during the surveys is detailed in Table 3.2 below. The equipment had been laboratory calibrated to a traceable standard within the 24-month period preceding the surveys. All noise monitoring equipment was field calibrated before and after the measurements and no drift in calibration was found to have occurred.

Table 3.2
Noise Monitoring Equipment

Description of Equipment	Serial No.
Cirrus CR:831B Class 1 sound level meter	C17175FF
Cirrus CR:511E acoustic calibrator	036342

The sound level meter complies with the accuracy requirements of a class 1 instrument in accordance with the UK equivalent of SANS656, SANS658 and SANS61672-1. The calibrator complies with the accuracy requirements of a class 1 instrument in accordance with the UK equivalent of SANS60942.

Figure 3.1
Noise Monitoring/Receptor Locations



3.4 Survey Results

It is considered that the weekend and weekday noise levels would not differ significantly due to the remoteness of the project site therefore monitoring has been undertaken on a normal weekday only.

At the measurement positions the following noise level indices were recorded:

$L_{Aeq,T}$	The A-weighted equivalent continuous noise level over the measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise.
L_{Amax}	The maximum A-weighted noise level during the measurement period.

Weather conditions during the survey periods undertaken near to the proposed development area were not ideal for noise monitoring, although it was warm, sunny and dry, wind speeds were above 5.0ms^{-1} at times. However, this was not considered to materially affect the noise measurements in any way.

The results of the noise surveys are presented in full in Appendix B and are summarised in Tables 3.3 below.

Table 3.3
Summarised Midweek Noise Monitoring Results

Monitoring Position	Period	$L_{Aeq,T}$	L_{A90}	L_{Amax}
L1 – Luthilunye Primary School Area	Daytime	49.1	36.3	78.6
	Night-time	34.7	27.8	57.7
L2 – Commissiekraal Farm Area	Daytime	37.2	30.1	58.0
	Night-time	36.1	31.0	52.4
L3 – Farm to East Area	Daytime	35.2	28.7	62.7
	Night-time	29.6	27.3	59.6

3.5 Description of Noise Climate

3.5.1 Location 1 – Luthilunye Primary School and adjacent Settlement

This location is adjacent to the D699 district road and access road to Commissiekraal Farm.

The noise climate during the daytime comprised very occasional vehicle movements along the district road, pedestrians walking along the district road and accessing the school/settlement and wind in nearby trees. Wind speeds were quite high, above 5.0ms^{-1} for the majority of the survey period.

During the night-time there was no activity in the area except the monitoring staff and wind in the nearby trees. Wind speeds had subsided for the night-time monitoring.

3.5.2 Location 2 – Area within Commissiekraal Farm

This location was part way along the access road to Commissiekraal Farm.

The noise climate during the daytime comprised of wind in the long grass, occasional movements of the monitoring staff, and one occurrence of a propeller aircraft in the distance. There were no traffic movements during the survey period. Again wind speeds were quite high, above 5.0ms^{-1} for the majority of the survey period.

During the night-time there was no activity in the area except the monitoring staff and wind moving the long grass. Wind speeds had subsided for the night-time monitoring.

3.5.3 Location 3 – Area along the D699 and to the east of the proposed development site

The monitoring was undertaken adjacent to the gravel farm road to the east of the proposed development site.

The daytime noise climate at this location comprised livestock in an adjacent field and wind in the long grass. There were no traffic movements during the monitoring period. The wind speed was again quite high, being above 5.0ms^{-1} for most of the survey period.

During the night-time there was no activity in the area except the monitoring staff and wind in the tall grass. Wind speeds had subsided for the night-time monitoring.

4.0 POTENTIAL IMPACTS FROM THE DEVELOPMENT

4.1 Derived Noise Limits

Based on the guidance contained in SANS10103:2008 and the results of the baseline noise monitoring the following typical rating levels for noise in districts have been adopted for the purpose of this assessment.

Table 4.1
Derived Rating Levels for Noise, dB

Location	Type of District	Daytime, $L_{Req,d}$	Night-time, $L_{Req,n}$
All residential locations & Schools	Rural district	45	35

In all instances, noise levels generated by construction and surface operations have been predicted using the proprietary noise modelling software, CadnaA, which implements a wide range of calculation methodologies. In this instance, the calculation algorithms set out in ISO9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation* have been used.

Predictions are based on 100% soft ground between the sources and the nearby receptors and under weather conditions considered favourable for noise propagation leading to a conservative result.

Noise predictions have been undertaken for a worst-case scenario in terms of equipment location and operational periods, where the mobile equipment is operating at the closest approach to the nearby noise-sensitive receptor locations and/or at elevations where noise reduction due to barriers would be at a minimum, and when the equipment is operating for 100% of the time.

4.2 Construction Phase

4.2.1 Predicted Construction Noise Levels

The construction phase will entail the establishment of the site infrastructure required to operate the mine. Temporary facilities will be established during the initial development of the mine. These will include, but not be limited to:

- Contractor laydown areas;
- Workshops, stores, wash bays, fuel handling and storage area, offices and ablution facilities;
- Construction material handling and storage areas;
- Water management infrastructure;
- Temporary power supply generators;
- Temporary access roads;
- Drilling equipment for on-going geotechnical drilling operations;
- Portable air compressors (decline shaft establishment); and
- Explosives stores.

These facilities will either be incorporated into the layout of the operational mine where feasible, or removed following the completion of the construction phase of the development.

The following activities are expected to be undertaken during the construction phase of the development:

- Establishment of contractor facilities;
- Clearing of vegetation for establishment of surface infrastructure;
- Stripping and stockpiling of soils;
- Earth moving activities;
- Establishment of access roads (temporary and permanent);
- Establishment of operational areas;
- Development of 'box-cut' and decline shaft;
- Delivery of materials; and
- General building/construction activities.

The majority, if not all, of the above activities will require the use of some heavy mechanical equipment such as cranes, excavators, dumper trucks and bulldozers. These activities will be concentrated within the site infrastructure area in the north-eastern area of the site with the exception of delivery vehicles which would access the site from the D699.

Table 4.2 gives an indication of the heavy mechanical equipment which is likely to be used during the construction phase of the development. Smaller equipment and light vehicles would also be used for movement of construction materials and worker movements however these are unlikely to generate significant levels of noise compared to the heavier equipment.

Table 4.2
Likely Mechanical Construction Equipment

Operations	Equipment	Sound Power Level, L_{WA}	No. of Equipment
Box-cut & decline shaft	PC600 Excavator	108	2
	Bell 40T Articulated Dumpers	104	4
	D85 Bulldozer	109	1
Site clearance, soil stripping and stockpiling, earth moving	PC240 Excavator	103	2
	Bell 40T Articulated Dumpers	104	4
	D85 Bulldozer	109	2
General	Fuel Bowser	104	2
	Hitachi 400R Crane	90	2
	Wash bay (jet washer)	92	2
	Thwaites 9T dumper	102	4
	Diesel Generator	105	4
	Hyster Forklift	86	4
	Toyota Hilux	78	10
	CAT966 Wheeled Loader	107	2
	Delivery Trucks (worst-case)	104	2 per hour

The noise predictions have been based on the above equipment working in the same general area of the site, i.e. within the main infrastructure area in the north-east of the site.

Table 4.3 shows the predicted noise levels during the site infrastructure construction phase of the proposed development at the nearby receptor locations compared to the derived rating limits outlined in Table 4.1.

The predicted noise levels have been corrected for tonal and/or impulsive content of the noise source, as well as for the time of day, in accordance with the guidance contained in SANS10103:2008 to give a corrected noise rating level.

In this instance, due to the separation distances between the noise sources and the receptor locations, it is unlikely that any tonal content of the sound source would be audible therefore no correction has been made for tonality. The noise sources may have some impulsive content, particularly bucket bangs, which could be heard at the nearest receptors therefore a 5dB penalty has been added for impulsivity. In accordance with the guidance an additional 10dB penalty has been applied to night-time operations.

Predictions have been made to the three monitoring locations and the nearest residences to the north (R4), east (R5), south (R6) and west (R7) of the proposed development site.

Table 4.3
Predicted Construction Noise Levels Compared to Derived Rating Levels, dB

Location	Period	Predicted Noise Level, $L_{Aeq,1hr}$	Corrected Noise Rating Level, $L_{Req,1hr}$	Derived Rating Limit, $L_{Req,T}$	Difference
L1	Daytime	20	25	45	-20
	Night-time	20	35	35	0
L2	Daytime	28	33	45	-12
	Night-time	28	43	35	+8
L3	Daytime	11	16	45	-29
	Night-time	11	26	35	-9
R4 (north)	Daytime	37	42	45	-3
	Night-time	37	52	35	+17
R5 (east)	Daytime	37	42	45	-3
	Night-time	37	52	35	+17
R6 (south)	Daytime	42	47	45	+2
	Night-time	42	57	35	+22
R7 (west)	Daytime	40	45	45	0
	Night-time	40	55	35	+20

Table 4.3 shows that noise levels generated by construction operations associated with the establishment of the surface infrastructure and initial box cut for the decline shaft would meet the derived daytime noise rating limit at all but the nearest receptor to the south, where there would be a slight exceedance. At night the derived noise rating limits are exceeded at most of the nearby receptors.

It should be noted that construction operations are relatively short-term when considering the overall life of the project. The noise levels quoted in the table are considered to be

representative of a worst-case situation when all mechanical equipment is operating simultaneously and at full power.

Any noise generated by construction activities associated with any upgrades to the road network is not included within the scope of this assessment. However, it is considered that the potential short-term impacts of construction operations associated with levelling and re-surfacing of the road will lead to longer-term benefits at nearby receptors as noise levels from passing vehicles are likely to be lower due to the new surface.

4.2.1 Construction Operation Impact against Prevailing Ambient Noise Levels

Noise levels generated by operations during construction of the site infrastructure have been assessed against the prevailing ambient noise levels to determine the category of community or group response in accordance with SANS 10103:2008.

The predicted future ambient noise level has been calculated by logarithmically adding the predicted noise rating levels from construction operations to the prevailing ambient noise level measured during the noise surveys.

Table 4.4 below shows the assessment against the prevailing ambient noise levels at each of the assessment locations. The ambient noise levels measured at L2 are considered representative of the ambient noise levels for the closest receptors to the north (R4), east (R5), south (R6) and west (R7) due to their relative distance from other noise sources being similar to that of L2.

Table 4.4
Assessment against Prevailing Ambient Noise Levels, dB

Location	Period	Prevailing Ambient Noise Level, $L_{Aeq,T}$	Predicted Future Ambient Noise Level, $L_{Req,T}$	Change in Ambient, $\Delta L_{Req,T}$	Category of Community or Group Response
L1	Daytime	49.1	49.1	0	Little
	Night-time	34.7	37.9	+3.2	Little
L2	Daytime	37.2	38.4	+1.2	Little
	Night-time	36.1	43.8	+7.7	Little/Medium
L3	Daytime	35.2	35.3	+0.1	Little
	Night-time	29.6	31.2	+1.6	Little
R4 (north)	Daytime	37.2	43.2	+6.0	Little/Medium
	Night-time	36.1	52.1	+16.0	Strong/Very Strong
R5 (east)	Daytime	37.2	43.2	+6.0	Little/Medium
	Night-time	36.1	52.1	+16.0	Strong/Very Strong
R6 (south)	Daytime	37.2	47.4	+10.2	Medium/Strong
	Night-time	36.1	57.0	+20.9	Very Strong
R7 (west)	Daytime	37.2	45.7	+8.5	Little/Medium
	Night-time	36.1	55.1	+19.0	Strong/Very Strong

Table 4.4 shows that during both the daytime and night-time periods the predicted future ambient noise rating levels, i.e. those including the existing noise levels in the area prior to

the development and those generated by construction of the site infrastructure, would, at times, be higher than those currently experienced at the nearby receptors.

Based on the guidance contained in Table 5 of SANS10103:2008 Edition 6, which is reproduced in Section 2 of this report, the predicted change in daytime ambient noise levels would fall into the "*Medium*" category leading to the potential for "*widespread complaints*" at the nearest receptors.

During the night the predicted change in ambient noise rating levels would fall into the "*Strong*" and "*Very Strong*" categories, at the nearest receptors, potentially leading to a "*threat of community or group action*" or "*vigorous community or group action*".

4.3 Mining Operations

4.3.1 Predicted Operational Noise Levels

The following activities are expected to be undertaken during the operational phase of the proposed development:

- Underground mining activities;
- Movement of trucks between the decline shaft and the ROM area;
- Crushing;
- Screening and stockpiling;
- Loading of coal onto trucks; and
- Exporting of coal off-site.

Noise levels generated by heavy equipment utilised during the operational phase of the development have been predicted using the noise modelling software, CadnaA. The calculation methodology contained in ISO9613-2 has again been used.

As before, the predictions are based on 100% soft ground between the sources and the nearby receptors under weather conditions considered favourable for noise propagation leading to a conservative result.

Noise predictions have been made for a worst-case situation in terms of equipment locations and operational periods, where mobile equipment is operating at its closest approach to the nearby noise-sensitive receptors and/or at elevations where noise attenuation due to the local topography would be at a minimum, and when equipment is operating for 100% of the time.

Based on previous experience with mining projects, the equipment set out in Table 4.5 below, together with the adopted sound power levels used for the predictions and assessment, are considered to be typical of the surface operations of an underground mine. The sound power levels are derived from discussions with the relevant equipment manufacturers, measurement of similar equipment at similar sites, or from the tables contained in British Standard 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites*.

The predicted noise levels have been corrected for tonal and/or impulsive content of the noise source, as well as for the time of day, in accordance with the guidance contained in SANS10103:2008 to give a corrected noise rating level. In this instance, due to the separation distances between the noise sources and the receptor locations, it is unlikely that any tonal content of the sound source would be audible, therefore no correction has been

made for tonality. The noise sources may have some impulsive content, particularly bucket bangs, which could be heard at the nearest receptors therefore a 5dB penalty has been added for impulsivity. In accordance with the guidance an additional 10dB penalty has been applied to night-time operations.

Table 4.5
Surface Operations Equipment Details

Equipment Item	Equipment L_{WA} dB	No. of Equipment
Shaft winding plant	75	2
Surface fans	107	2
Semi-mobile crusher	115	1
Semi-mobile screen	109	1
Diesel generator	105	1
Loading shovel - ROM	108	1
Loading shovel - stockpile	108	2
Fuel Bowser	104	2
Hilux	78	10
Wash bay	92	1
Conveyors	85	1

It is assumed that there would be nine coal trucks arriving or leaving the site per hour during the daytime only, i.e. 18 movements along the access road, and that all trucks would use the D699 to/from the east. For the purpose of this assessment, the predicted noise level is based on trucks travelling at a speed of 50kph irrespective of the type of road being traversed. The results of the noise predictions are shown in Table 4.6 below.

Predictions have been made to the three monitoring locations and the nearest residences to the north, east, south and west of the proposed development site.

Table 4.6
Predicted Operational Noise Levels Compared to Derived Rating Levels, dB

Location	Period	Predicted Noise Level, $L_{Aeq,1hr}$	Corrected Noise Rating Level, $L_{Req,1hr}$	Derived Rating Limit, $L_{Req,T}$	Difference
L1	Daytime	22	27	45	-18
	Night-time	22	37	35	+2
L2	Daytime	30	35	45	-10
	Night-time	30	45	35	+10
L3	Daytime	13	18	45	-27
	Night-time	12	27	35	-8
R4 (north)	Daytime	41	46	45	+1
	Night-time	41	56	35	+21
R5 (east)	Daytime	43	48	45	+3
	Night-time	43	58	35	+23
R6 (south)	Daytime	43	48	45	+3
	Night-time	43	58	35	+23
R7 (west)	Daytime	44	49	45	+4
	Night-time	44	59	35	+24

Table 4.6 shows that noise levels generated by surface operations during the daytime slightly exceed the derived noise rating limits at the nearest receptors to the north, east, south and west. During the night, the derived noise rating limits are exceeded at these locations and at locations L1 and L2.

The noise levels quoted in the table are considered to be representative of a worst-case situation when all mechanical equipment is operating simultaneously and at full power.

4.3.2 Mining Operation Impact against Prevailing Ambient Noise Levels

Noise levels generated by surface operations have been assessed against the prevailing ambient noise levels to determine the category of community or group response in accordance with SANS 10103:2008.

The predicted future ambient noise level has been calculated by logarithmically adding the predicted noise rating levels from surface operations to the prevailing ambient noise level measured during the noise surveys.

Table 4.7 below shows the assessment against the prevailing ambient noise levels at each of the assessment locations. The ambient noise levels measured at L2 are considered representative of the ambient noise levels for closest receptors to the north, east, south and west due to their relative distance from other noise source being similar to that of L2.

Table 4.7
Assessment against Prevailing Ambient Noise Levels, dB

Location	Period	Prevailing Ambient Noise Level, $L_{Aeq,T}$	Predicted Future Ambient Noise Level, $L_{Req,T}$	Change in Ambient, $\Delta L_{Req,T}$	Category of Community or Group Response
R1	Daytime	49.1	49.1	0	Little
	Night-time	34.7	39.0	+4.3	Little
R2	Daytime	37.2	39.3	+2.1	Little
	Night-time	36.1	45.5	+9.4	Little/Medium
R3	Daytime	35.2	35.3	+0.1	Little
	Night-time	29.6	32.0	+1.4	Little
R4 (north)	Daytime	37.2	46.5	+9.3	Little/Medium
	Night-time	36.1	56.0	+19.9	Strong/Very Strong
R5 (east)	Daytime	37.2	48.3	+11.1	Medium/Strong
	Night-time	36.1	58.0	+21.9	Very Strong
R6 (south)	Daytime	37.2	48.3	+11.1	Medium/Strong
	Night-time	36.1	58.0	+21.9	Very Strong
R7 (west)	Daytime	37.2	49.3	+12.1	Medium/Strong
	Night-time	36.1	59.0	+22.9	Very Strong

Table 4.7 shows that, during both the daytime and night-time periods, the predicted future ambient noise rating levels, i.e. that including the existing noise climate and the noise generated by surface activities, will be higher than those currently experienced at the nearby receptors.

Table 4.7 also shows, in the final column, that the change in ambient noise levels at the nearest receptors to the north, east, south and west are likely to lead to widespread complaints or the "*threat of community or group action*" during the daytime and "*vigorous community or group action"* at night.

In the wider assessment area the change in ambient noise levels would lead only to sporadic complaints.

Based on the above assessment, mitigation to reduce noise levels generated by surface operations is considered necessary and is outlined in Section 5 of this report.

4.3.3 Predicted Traffic Noise Levels beyond the Project Site

An assessment has been made of the noise levels generated by coal trucks traversing the route between the project site and the R33 interchange.

A review of the available information and aerial photographs shows that there are no identifiable residential properties within 50m of the route between the project site and the R33 interchange. Therefore, to present a worst-case situation 50m has been used as the distance to the nearest receptor.

The predictions are based on the methodology outlined in BS5228-1:2009+A1:2014 using a vehicle speed of 50kph with 18 vehicles per hour passing the receptor location. The results are shown in Table 4.8.

Table 4.8
Predicted Traffic Noise Levels Compared to Derived Rating Levels, dB

Location	Period	Predicted Noise Level, $L_{Aeq,1hr}$	Corrected Noise Rating Level, $L_{Req,1hr}$	Derived Rating Limit, $L_{Req,T}$	Difference
50m Receptor	Daytime	22	27	45	-18
	Night-time	22	37	35	+2

Table 4.8 shows that noise levels generated by traffic movements between the project site and the R33 would meet the derived noise rating limits at the 50m notional receptor during the daytime but would exceed the derived noise rating limits at night.

4.4 Decommissioning Phase

It is considered that decommissioning would, for the most part, be the reverse of the construction phase of the development, i.e. all infra structure would be removed and the shafts sealed. To that end it is envisaged that the decommissioning process would employ similar equipment.

Noise emission levels from decommissioning operations would be no greater than those produced by construction operations.

4.5 Closure Phase

Mine closure operations are unlikely to generated significant amounts of noise which would be perceptible beyond the site boundary.

4.6 Effects on Wildlife

UK-based guidance on the effects of industrial noise on wildlife, AQTAG09, states that where specific noise from industry, measured at the habitat/nest site is below the levels shown in Table 4.9, it is considered that it is unlikely that there will be an adverse impact on designated species. Where these levels are exceeded further, more detailed, assessment will be required.

Table 4.9
Guidance Noise Level for Wildlife, dB

Parameter	Level, dB
$L_{Aeq,1hr}$	55
L_{Afmax}	80

The above figures refer to the predicted $L_{Aeq,1hr}$ noise levels rather than the rating levels. Therefore, only a very small area close to the site infrastructure and very close to the access road would be affected.

5.0 MITIGATION MEASURES

The assessment has shown that both construction and surface operations would exceed the derived noise rating levels in districts and increase the ambient noise levels where there is the potential for community or group action at some of the nearest receptor locations.

Therefore, mitigation measures to reduce the noise levels to meet the guidance are considered necessary.

5.1 Suggested Mitigation Measures

5.1.1 Construction

The main noise impacts generated by infrastructure construction operations relate to earth moving operations, i.e. the establishment of the box-cut and decline shaft and site clearance, soil stripping and stockpiling, etc.

Due to the nature of the surrounding area, and the amount by which the predicted future ambient noise level changes, the only mitigation measure considered appropriate is to limit construction operations to the daytime period only.

5.1.2 Surface Operations

The assessment of surface operations has shown that the predicted noise rating levels exceed the derived noise rating levels in districts at location R2 at night and at the nearest receptors to the north, east, south and west during both the day and night.

The assessment has also shown that, at the nearest receptors to the north, east, south and west, the predicted changes in ambient noise levels would lead to the "*threat of community or group action*" during the day and "*vigorous community or group action*" during the night.

If operational noise monitoring verifies the noise predictions the consideration should be given to housing crushing and screen operational plant within a building or high walled compound and fitting the ventilation fans with silencer systems.

Mobile equipment fitted with reverse warning systems such as bleepers should be retro-fitted with broadband style warning systems. If new equipment is to be specified, broadband reverse warning systems should be specified as standard.

It is considered that such mitigation measures would reduce noise levels at location R2 close to the derived noise rating level in districts during the night.

Good site practice measures should also be employed which could also provide some mitigation against potential noise impacts. These measures could include, but are not limited to the following:

- Ensuring that all internal haul roads are kept clean and maintained in good state of repair to avoid unnecessary rattles, bangs and 'body-slap' on mine vehicles and visiting coal wagons.
- Equipment should be operated in a proper manner with respect to minimising noise emissions, for example, minimising drop heights when loading or unloading, no unnecessary engine revving, etc.

- Equipment should be subject to regular maintenance. All equipment should be fitted with effective exhaust silencers which should be maintained in accordance with the manufacturers' guidelines. Defective silencers should be replaced immediately.
- Equipment used intermittently should be shut down between operational periods.
- Pumps, compressors and generators should be fitted with acoustic enclosures.
- Overburden and stripped soils should be used to create screening mounds between the noise sources and the sensitive receptor locations.

5.2 Noise Monitoring Scheme

It is suggested that periodic ambient noise monitoring should be undertaken during operations to assess the potential noise impact and verify that operations are meeting the requirements of SANS10103:2008 Edition 6.

Noise monitoring should be undertaken at regular intervals at the receptors nearest to the site. It is suggested that the noise monitoring should be undertake as follows:

- Once when the equipment becomes operational to verify the predicted noise impacts;
- Once following the implementation of any mitigation measures applied to reduce noise impacts;
- Once every three months during the first year of operation to ensure that noise emissions remain within the derived criteria;
- Once every year thereafter to ensure that noise emissions remain within the derived criteria; and
- When a complaint about noise from surface operations is received to determine the cause of any such complaint.

The noise monitoring should be undertaken in accordance with the guidance contained in SANS10103:2008 Edition 6.

Measurements should be undertaken at each location for a minimum of 1-hour during the daytime and 30-minutes during the night.

6.0 CONCLUSION

SLR Consulting (Africa) (Pty) Limited has been appointed by Tholie Logistics (Pty) Ltd to undertake an environmental impact assessment for the proposed Commissiekraal Coal Mine development, including support services and associated infrastructure, in the eMadlangeni Local Municipality and the Amajuba District Municipality of the KwaZulu Natal Province of South Africa. This report details the noise specialist study which will be used to inform the EIA.

In accordance with South African National Standard 10328:2008 Edition 3, *Methods for environmental noise impact assessments*, an assessment has been made at the nearest noise-sensitive receptors to the site in accordance with the guidance contained in South African National Standard 10103:2008 Edition 6 *The measurement and rating of environmental noise with respect to annoyance and to speech communication.*

The assessment of construction noise related to the establishment of the surface infrastructure has shown that the predicted levels would meet the derived maximum noise rating levels at all receptors during the daytime with the exception of the nearest receptor to the south (R6). During the night, the derived maximum noise rating levels are exceeded at most of the receptors assessed.

When assessed against the ambient noise levels, the predicted change in daytime ambient noise levels would fall into the "*Medium*" category leading to the potential for "*widespread complaints*" at the nearest receptors. During the night the predicted change in ambient noise rating levels would fall into the "*Strong*" and "*Very Strong*" categories, at the nearest receptors, potentially leading to a "*threat of community or group action*" or "*vigorous community or group action*".

The assessment of noise associated with surface operations has shown that during the daytime the derived maximum noise rating levels in districts is exceeded at the nearest receptor locations (R4 to R6), and during the night at location R2 and the nearest receptor locations (R4 to R6).

When assessed against the ambient noise levels, the predicted change in ambient noise levels at the nearest receptors locations are likely to lead to widespread complaints, or the "*threat of community or group action*" during the daytime, and "*vigorous community or group action"* at night. In the wider assessment area the change in ambient noise levels would lead only to sporadic complaints.

The assessment of traffic noise on the transport route between the site and the R33 has shown that, at the 50m notional receptor, noise levels generated by coal truck movements would not exceed the derived noise rating limits.

Mitigation measures have been suggested to reduce the potential impacts.

As well as the mitigation measures suggested for construction and operational elements of the proposed development, it is also recommended that periodic ambient noise monitoring during surface operations is undertaken to verify that operations meet the derived maximum noise rating levels in districts.

7.0 DISCLAIMER

This report has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Tholie Logistics (Pty) Ltd; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale, is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1.1
Noise Levels Commonly Found In the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at one metre away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$ Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & L_{90} If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

L_{Amax} L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise

where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

APPENDIX B – NOISE SURVEY RESULTS

Table B1.1
Measured Ambient Noise Levels at Location 1, free-field, dB

Day/Date	Time	$L_{Aeq,T}$	L_{A90}	L_{Amax}
Tuesday 02/07/2013	11:45	44.7	36.6	67.8
	12:00	42.5	36.0	63.5
	12:15	53.7	37.0	78.6
	12:30	46.7	35.5	74.3
	22:47	36.2	27.6	57.7
	23:02	32.3	28.0	43.6

Table B1.2
Measured Ambient Noise Levels at Location 2, free-field, dB

Day/Date	Time	$L_{Aeq,T}$	L_{A90}	L_{Amax}
Tuesday 02/07/2013	13:00	40.4	32.3	56.9
	13:15	37.7	30.1	53.0
	15:14	32.5	28.6	49.4
	15:29	33.6	29.2	58.0
	23:27	34.4	30.4	47.5
	23:42	37.3	31.6	52.4

Table B1.3
Measured Ambient Noise Levels at Location 3, free-field, dB

Day/Date	Period	$L_{Aeq,T}$	L_{A90}	L_{Amax}
Tuesday 02/07/2013	13:53	33.9	28.8	47.7
	14:11	35.4	28.4	62.7
	14:26	34.7	28.6	50.8
	14:41	36.3	28.9	58.8
	22:00	29.5	27.3	48.9
	22:15	29.6	27.2	59.6

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