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Noise Impact Assessment for the proposed Exxaro Dorstfontein West Expansion Project, Town of Kriel, Nkangala District Municipality, Mpumalanga Province

Project No: 078/2019
Compiled by: B v/d Merwe
Date: 22 February 2019

DECLARATION OF INDEPENDENCE

I, **Barend J B van der Merwe,** as duly authorised representative of **dBAcoustics**, hereby confirm my independence and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which **Nsovo Environmental Consultants CC** was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act) for the **compilation of an EIA for the Dorstfontein West expansion project. The Dorstfontein West mine is an existing mine which is situated east of Kriel in Nkangala District Municipality, Mpumalanga Province. – Noise Impact Assessment**. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it. I have disclosed, to the environmental assessment practitioner, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 and any other specific and relevant legislation (national and provincial), policies, guidelines and best practice.

Signature: 

Barend Jacobus Barnardt van der Merwe

Date	:	23 February 2019
Title / Position	:	Environmental noise and vibration specialist
Qualification(s	:	MSc Environmental Management
Experience	:	18 years
Registration(s)	:	SAAI, NACA, IAIASA and SAIG

Details of specialist and expertise

I, Barend JB van der Merwe of 43 6th Street, Linden Johannesburg have been an environmental noise and ground vibration specialist for the last 15 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise sensitive areas. I am also involved with the noise and ground vibration impact assessments and the environmental management plans compilation of large projects such as wind farms, mining, roads, trains (primarily the Gautrain) and various point noise sources. As a post-graduate student in Environmental Management at the University of Johannesburg, I obtained an MSc degree with the research project concentrating on the impact of noise and ground vibration on a village close to a new underground mine. I have played a major role in the identification, evaluation and control of physical factors such as noise and ground vibration in the following projects – wind farms, various platinum and coal mines and the quarterly noise evaluation of the Gautrain, the decommissioning of the N11 near Mokopane, construction of the P166 near Mbombela, design of the Musina by-pass, noise mitigatory measures at the N17 road near Trichardt, establishment of the weigh bridge along the N3 near Pietermaritzburg, George Western by-pass. The following large environmental companies are amongst my clients: Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Globesight Environmental Consulting, Knight Piesold Environmental (Pty) Ltd, MattMcdonold Engineering (Pty) Ltd, Nsovo Consulting and SRK Engineering (Pty) Ltd.

Qualifications

1. MSc Environmental Management – University of Johannesburg;
2. BSc Honours in Geography and Environmental Management – University of Johannesburg;
3. National Higher Diploma in Environmental Health - Witwatersrand Technikon;
4. National Diploma in Public Health - Cape Town Technikon;
5. National Certificate in Noise Pollution - Technikon SA;
6. National Certificate in Air Pollution - Technikon SA;
7. National Certificate in Water Pollution - Technikon SA;
8. Management Development Diploma - Damelin Management School; and
9. Advanced Business Management Diploma - Rand Afrikaans University.

Membership

- South African Institute of Acoustics (SAAI);
- International Association of Impact Assessment (IAIA);
- National Association of Clean Air (NACA);

- South African Association of Geographers (SAAG).

Experience

- Noise impact assessment of different mine establishments;
- Noise Control Officer i.t.o. Noise Control Regulations;
- Compilation of noise management plans;
- Annual and quarterly baseline noise surveys;
- Moderator Wits Technikon – Environmental Pollution III.
- Various road projects for SANRAL.
- Compilation of the Integrated Pollution strategy for Ekurhuleni Town Council.
- Represent clients at Town Planning Tribunals.
- Represent clients at Housing Board tribunals.
- Determine residual noise levels in certain areas as required by clients.
- Noise attenuation at places of entertainment.
- Design and implementation of sound attenuators.
- Noise projections and contouring.
- Advisory capacity regarding noise related cases to local authorities: - Sandton, Roodepoort, Randburg, Krugersdorp, Alberton, Centurion, Vereeniging. Due to my previous experience in Local Government I provide a service to these Local government departments on the implementation of the Noise Control Regulations and SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to land use, health annoyance and to speech communication.
- Identification, Evaluation and Control of noise sources in industry.

I was involved in the following noise impact assessments during the Environmental Impact Assessment process (Noise and/or Vibration):

- Airlink BID for landing in Kruger National Park;
- Coal gasification plant in Theunissen;
- Langhoogte and Wolseley wind farms;
- Widening of N3 at Howick, KZN;
- Tulu Kapi Mine, Ethiopia;
- Boabab Iron Ore Mine, Mozambique;
- N11 Decommissioning Mokopane;
- Baseline noise survey for NuCoal Mines, Woestalleen, Vuna and Mooiplaats Collieries;
- Baseline noise monitoring Mooinooi mine;

- Leeuwpan coal mine;
- N17 Road at Trichardt for KV3 Engineers;
- N17 Road in Soweto;
- Proposed new by-pass road at Musina;
- George Western By-pass road between George Airport and Outeniqua Pass;
- Gautrain baseline monitoring;
- Upgrade of Delmas Road extensions in Moreletta Park, Pretoria;
- Proposed weigh bridge, N3, Pietermaritzburg:
- Tonkolili Manganese mine, Sierra Leone;
- Proposed wind turbines in the Western Cape – Caledon;
- Extension of works at the PPC factory in Piketberg;
- Exxaro Arnot Colliery – Mooifontein;
- Hydro power plant – 2 Sites in Durban;
- Coal export terminal in Beira, Mozambique;
- Site selection for new Power Station – Kangra Mine, Piet Retief;
- Gas exploration at Ellisras;
- Noise survey and assessment of future mine shafts at various mines;
- Mining exploration at Potgietersrus – Lonmin Akani;
- New coal mines in Witbank – Dorstfontein Expansion Project;
- New coal mines in Middelburg and Ermelo;
- New Vanadium Manganese mine in Potgietersrus;
- Xolobeni mining project in Transkei;
- Glynn mines in Sabie;
- Rezoning of properties for housing at Burgersfort, Shosanguve, Hammanskraal;
- Various noise impact assessment for clients in and around Centurion;
- Relocation of night races from Newmarket racecourse to Turfontein racecourse;
- Rezoning applications for private clients.

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on scientific and recommended survey and assessment techniques. This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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Executive summary

Introduction

dBAcoustics was appointed by Nsovo Environmental Consultants CC to determine and assess the potential environmental noise impact of the proposed Dorstfontein West expansion project onto the residential areas of Kriel, Thubelihle and the abutting farm properties. The proposed expansion project will take place within the mining right boundaries of Dorstfontein West and Dorstfontein East mines.

The noise survey was carried out 1 February 2019 during the time the mine was fully operational.

The proposed mine expansion project will consist out of the following:

- Extension of the existing discard facility.
- Select between Option A or Option B overland conveyor which will have a service road next to the overland conveyor.

The following observations were made in and around the study area:

- There was a constant flow of traffic along the R544 and R547 Provincial roads during the day and intermittent during the night;
- Mining activities and traffic noise was audible at the some of the residential areas which is in the vicinity of the mine;
- The wind and weather conditions play an important role in noise propagation.

The following noise sources were identified in the vicinity of and the boundaries of the study area:

- Activities at Dorstfontein West and Dorstfontein East mines;
- Heavy duty vehicles and motor vehicles travelling along the R544 and R547 roads;
- Seasonal agricultural activities;
- Insects and birds;
- Wind noise.

Noise Impact Assessment

In terms of the Noise Regulations a noise disturbance is created when the prevailing ambient noise level is exceeded by 7.0dBA or more. Noise is part of our daily exposure to different sources which is part of daily living and some of these physical attributes which may at times be part of the ambient levels that people get used to without noticing the higher levels.

Two aspects are important when considering potential impacts of a project:

- The increase in the noise levels, and;
- The overall noise levels which will be created by the rail yard activities.

The proposed development of the project during the construction, operational and decommissioning phases will require approved management measures and ongoing noise surveys and mitigatory measures will have to be carried out to ensure compliance to the relevant noise regulations and/or standards.

Conclusion and Recommendations

There will be an upwards shift in the immediate environmental noise levels during the construction phase on a temporary basis and a more permanent basis during the operational phase in the vicinity of the different mine expansion activities. The noise increase at the abutting residential properties will however not exceed the prevailing ambient noise levels during the construction, operational and decommissioning phases as it will be below the threshold value of 7.0dBA. There will be a noise increase at Thubelihle, along the R544 and R547 roads.

The potential noise increase from the proposed Dorstfontein West expansion project can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles, compliance to the Local Noise Regulations and the International Finance Corporation’s Environmental Health and Safety Guidelines. The proposed noise management plan must be in place during the construction and operational phases so as to identify any noise increase on a pro-active basis.

The proposed Dorstfontein West expansion project will comply with the relevant Noise Control Regulations and SANS 10103 of 2008 provided that the noise mitigatory measures are in place and that the noise management plan be adhered to at all times.

Barend van der Merwe – MSc UJ
Environmental noise and vibration specialist

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This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 – Regulation 982 and the following aspects are dealt with in the report:

No.	Requirement	Section in report – page number
1a)	Details of -	
(i)	The specialist who prepared the report	3
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	3
b)	A declaration that the specialist is independent	2
c)	An indication of the scope of, and the purpose for which, the report was prepared	13
d)	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	13
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process	21
f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	27
g)	An identification of any areas to be avoided, including buffers	27
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	27
i)	A description of any assumption made and any uncertainties or gaps in knowledge	40
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment	40
k)	Any mitigation measures for inclusion in the EMPr	42
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p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q)	Any other information requested by the competent authority	n/a

1 Introduction

dBAcoustics was appointed by Nsovo Environmental Consulting to determine and assess the potential environmental noise impact of the proposed Dorstfontein West Expansion Project. The noise survey was carried out on 1 February 2019 during a period when the mine was operational.

Dorstfontein West Mine(Pty) Ltd also known as Dorstfontein Coal Mine (Pty)Ltd (hereafter referred as DCM West) is an underground mine with both 2 and 4 -Seams operated by Exxaro Coal Central (Pty) Ltd ("Exxaro"), located within the jurisdiction of Emalahleni Local Municipality in the Mpumalanga Province. Dorstfontein West is currently mining 2 and 4 Seam via bord and pillar underground mining method on the western portion of their Mining Right area and proposes to mine 4 Seam, which will extend the life of mine to 23 years. Further, a discard dump facility is required to accommodate the disposal of the discard and slurry for the next 15 years of Life of Mine (LOM). Subsequently, Exxaro proposes to undertake the following activities:

• Expansion of the existing discard dump which is coming to the end of its life a by 2022; and

• The construction of a conveyor belt and associated service road, from DCM West which will be linked to the conveyor systems at DCM East to ensure that coal is conveyed from DCM West to DCM East where the coal will be loaded into trains and thereafter transported to Richards Bay Terminal

Figure 1.1 illustrates the extension of the existing discards facility and the proposed conveyor (Proposed Route A – Turquoise and Route B - Red) with the service road.

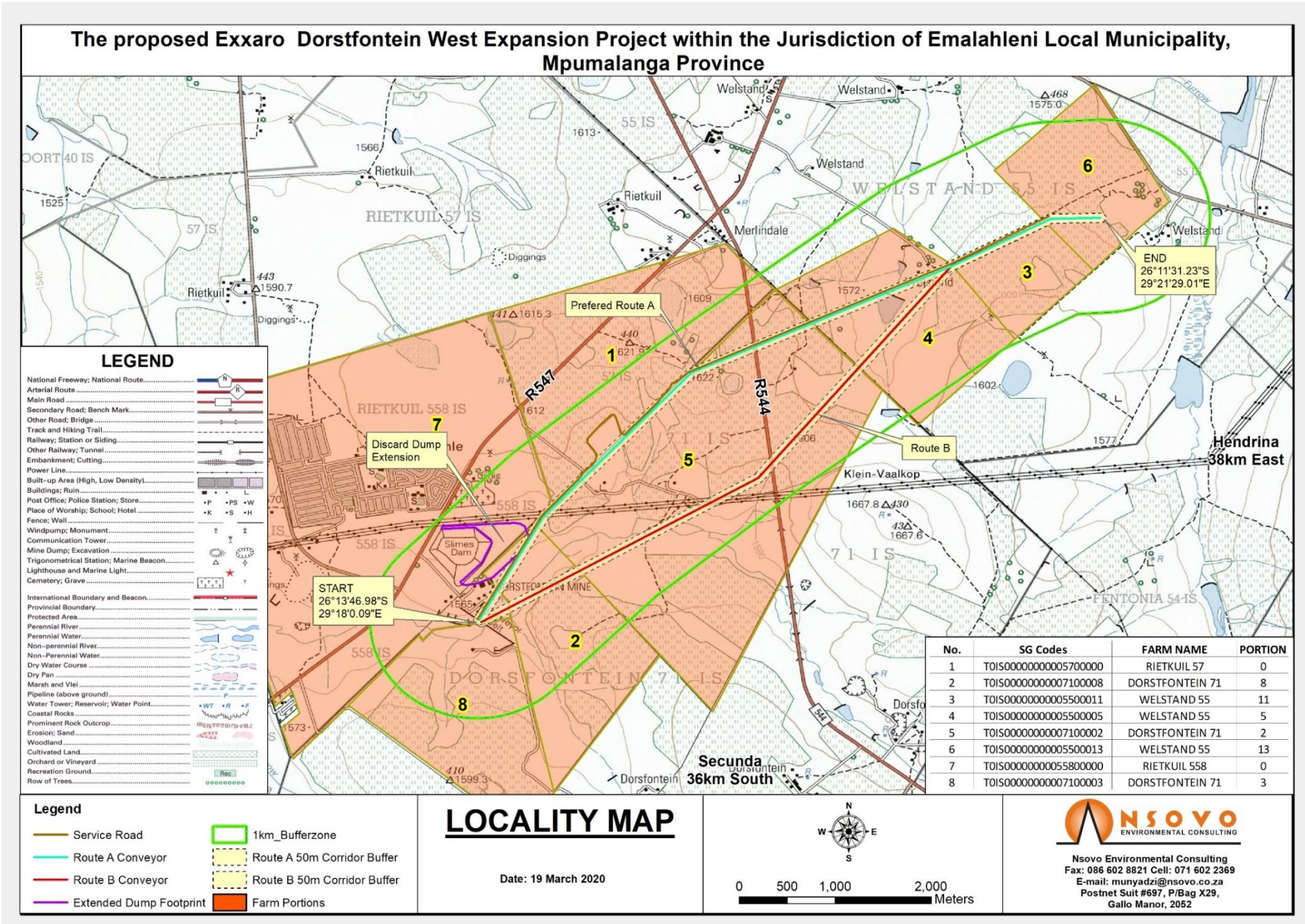


Figure 1.1: Expansion of the existing discard facility

An aerial imagery of the study area is illustrated in Figure 1.2.

Figure 1.2: Study area

The purpose of the environmental noise study and impact assessment was to determine the noise impact from the activities at the:

- Expansion of the discard dump.
- New overland conveyor and service road.

The environmental noise baseline information at the measuring points will be used to calculate the potential noise intrusion levels at the abutting noise receptors.

2 Background to environmental noise

2.1 Environmental noise

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s.

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – inverse square law. Expressed logarithmically as decibels, this means the sound level decreases 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance. The decibel scale is logarithmic, therefore decibel levels cannot be added in the normal arithmetic way, for example, two sound sources of 50.0dB each do not produce 100.0dB but 53.0dB, nor does 50.0dB and 30.0dB equal 80.0dB, but remains 50.0dB. Air absorption is important over large distances at high frequencies and it depends on the humidity but is typically about 40.0dB/km @ 4000 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. The sound may be propagated during upwind conditions upwards to create a sound shadow. A downwind refracts the sound towards the ground producing a slight increase in sound level over calm isothermal conditions. The velocity of sound is inversely proportional to the

temperature therefore a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards.

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz. Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3.0-5.0dBA.

There are certain effects produced by sound which, if it is not controlled by approved acoustic mitigatory measures, seem to be construed as undesirable by most people and they are:

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95.0 dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analyzed due to loud noises;
- Excessive loudness;
- Annoyance.

A number of factors, for example clarity of speech, age of listener and the presence of noise induced threshold displacement, will influence the comprehensibility of speech communication. The effect of noise (with the exception of long duration, high level noise) on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noisemaker, the time of day or night and the day of the week.

Types of noise exposure:

- Continuous exposure to noise – The level is constant and does not vary with time e.g. traffic on freeway and an extractor fan;

- Intermittent exposure to noise – The noise level is not constant and occurs at times e.g. car alarms and sirens;
- Exposure to impact noise – A sharp burst of sound at intermittent intervals e.g. explosions and low frequency sound.

Noise affects humans differently and the new noise which will be coming from the mine establishment and the associated activities will depend upon the intensity of the sound, the length of time of exposure and how often over time the ear is exposed to it. Urban dwellers are besieged by noise, not only in the city streets but also in the busy workplaces and household noises.

The time-varying characteristics of environmental noise are described using statistical noise descriptors:

- Leq: The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same period of time.

- L_{Max}: The instantaneous maximum noise level for a specified period of time.

- L_{Min}: The instantaneous minimum noise level for a specified period of time.

The following relationships occur for increases in A-weighted noise levels:

- The trained healthy human ear is able to discern changes in sound levels of 1.0dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3.0dBA;
- A change in sound level of 5.0dBA is a readily perceptible increase in noise level;
- A 10.0dBA change in the sound level is perceived as twice as loud as the original source.

The World Bank in the Environmental Health and Safety Regulations has laid down the following noise level guidelines:

- Residential area – 55.0dBA for the daytime and 45.0dBA for the nighttime period;
- Industrial area – 70.0dBA for the day- and nighttime periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. In order to evaluate such, there must be uniform guidelines to evaluate each scenario. SANS 10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 2.1.

Table 2-1: Recommended noise levels for different districts.

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for ambient noise - dBA					
	Outdoors			Indoors, with open windows		
	Day-night L_{Rdn}	Daytime L_{Reqd}	Night-time L_{Reqn}	Day-night $L_{R.dn}$	Daytime $L_{Req.d}$	Night-time $L_{Req.n}$
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

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, $L_{Req.d} = L_{Req.n} = 70$dBA can be considered as typical and normal.

The response to noise can be classified as follows:

- An increase of 1.0dBA to 3.0dBA above ambient noise level will cause no response from the affected community. For a person with normal hearing an increase of 0dBA to 3.0dBA will not be noticeable
- An increase between 1.0dBA – 10.0dBA will elicit little to sporadic response. When the difference is more than 5.0dBA above the ambient noise level a person with normal hearing will start to hear the difference.
- An increase between 5.0dBA and 15.0dBA will elicit medium response from the affected community.
- An increase between 10.0dBA and 20.0dBA will elicit strong community reaction.

Because there is no clear-cut transition from one community response to another as well as several variables, categories of responses can overlap. This should be taken into consideration during the evaluation of a potential noise problem. There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e. residential, industrial and feeder roads in close proximity of each other. The ambient noise level will therefore differ throughout

the study area, depending on the region and the measuring position in relation to areas with existing mining activities. People exposed to an increase in the prevailing ambient noise level will react differently to the noise levels and the response is given in Table 2.2.

Table 2-2: Response when ambient noise levels is exceeded

Excess dB	Estimated community/group response	
	Category	Description
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

3 Study methodology

3.1 Instrumentation

The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1994 and the SANS 10103 of 2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) using a digital Larson Davis 831 – Class 1 meter with Logging, Environmental 1/1, 1/3 Octave Band and percentiles Sound Level Meter (Class 1). On taking measurements the device-meter scale was set to the “A” weighed measurement scale which enables the device to respond in the same manner as the human ear. The device was held approximately 1.5 m above the surface and at least 3.0m away from hard reflecting surfaces. A suitable wind shield was used on the microphone for all measurements in order to minimise wind interference. The Instrument was checked and calibrated prior to use and maintained in accordance with equipment and coincided below 1.0dBA.The following instruments were used in the noise survey:

- Larsen Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072;
- Larsen Davis Pre-amplifier – Serial no.PRM831 0206;
- Larsen Davis ½” free field microphone – Serial no. 377 B02 SN 102184;
- Larsen Davis Calibrator 200 – Serial no.9855;
- Certificate Number: 2018-AS-0912;
- Date of Calibration: 15 August 2018; and,
- Date of next calibration August 2019.

The instrument was calibrated before and after the measurements was done and coincided within 1.0dBA. Batteries were fully charged and the windshield was in place at all times.

The noise survey was carried out in terms of the Noise Control Regulations being:
“16 (1) Any person taking readings shall ensure that -

(a) sound measuring instruments comply with the requirements for type I instrument in accordance with SABS-IEC 60651, SABS-IEC 60804 and SABS-I EC 60942 as the case may be;

(b) the acoustic sensitivity of sound level meters is checked before and after every series of measurements by using a sound calibrator, and shall reject the results if the before and after calibration values differ by more than 1 dBA;

(c) the microphones of sound measuring instruments are at all times provided with a windshield;

(d) the sound measuring instruments are operated strictly in accordance with the manufacturer's instructions; and

(e) sound measuring instruments are verified annually by a calibration laboratory for compliance with the specifications for accuracy of national codes of practice for acoustics, to comply with the Measuring Units and National Measuring Standards Act 1973 (Act No. 76 of 1973).

(2) The measuring of dBA values in respect of controlled areas, ambient sound levels or noise levels in terms of these regulations shall be done as follows:

(a) outdoor measurements on a piece of land: By placing the microphone of an integrating impulse sound level meter at least 1,2 metres, but not more than 1,4 metres, above the ground and at least 3,5 metres away from walls, buildings or other sound reflecting surfaces”.

The calibration certificates are attached as Appendix A. The measured ambient noise levels during the daytime and night time periods will be the baseline ambient noise criteria for the study area and will be evaluated in terms of SANS 10103 of 2008.

3.2 Measuring points

The measuring points for the study area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources such as distant mining activities, power station noise, traffic and domestic noise. The measuring points are illustrated in Figure 3.1.

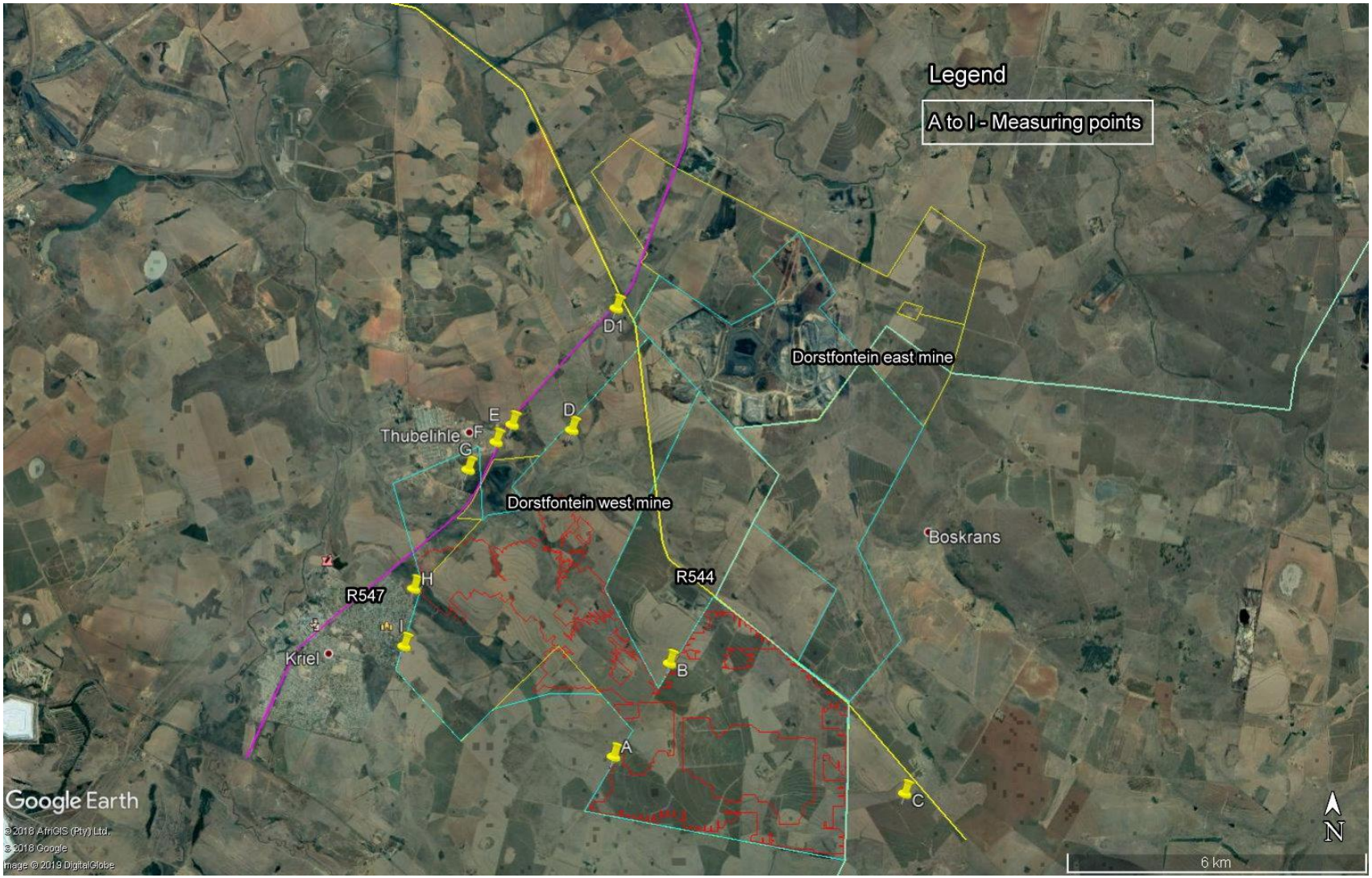


Figure 3-1: Measuring points

The location of the measuring points throughout the study area and the physical attributes of each measuring point are illustrated in Table 3.1.

Table 3-1: Measuring points and co-ordinates for the study area

Position	Latitude	Longitude	Remarks
A	26^0 16.542'S	29^0 19.183'E	Gravel road which runs through the eastern side of mining area.
B	26^0 15.534'S	29^0 19.855'E	Gravel road which runs through the eastern side of mining area.
C	26^0 16.927'S	29^0 22.668'E	Along a gravel road in the vicinity of the R544 road.
D	26^0 16.542'S	29^0 19.183'E	Northern side of the mining area in the vicinity of the R547 road.
D1	26^0 11.723'S	29^0 19.217'E	Northern side of the mining area in the vicinity of the R547 road.
E	26^0 12.973'S	29^0 17.969'E	Residential area facing Dorstfontein west mine.
F	26^0 13.160'S	29^0 17.776'E	Along section of Thubelihle facing Dorstfontein west mine.
G	26^0 13.457'S	29^0 17.438'E	Along section of Thubelihle facing Dorstfontein west mine.
H	26^0 14.739'S	29^0 16.784'E	Kriel residential area facing the underground coal mining activities.
I	26^0 15.357'S	29^0 16.670'E	Kriel residential area facing the underground coal mining activities.

The following is of relevance to the ambient noise measurements:

- The L_{Aeq} was measured over a representative sampling period exceeding 10 minutes at each measuring point;
- The noise survey was carried out during the day and nighttime period being 6h00 to 22h00 for the day time and 22h00 to 6h00 for the night time period.

3.3 Site Characteristics

The following observations were made in and around the study area:

- There was a continuous to intermittent flow of traffic along the R544 and R547 Roads;
- Traffic along the gravel roads can be classified as intermittent traffic flow;
- Seasonal agricultural activities contribute to the prevailing ambient noise levels at times;
- Distant mining activities and traffic noise were audible at times at the abutting residential communities (Kriel, Thubelihle, farm houses) ; and,
- The wind and weather conditions play an important role in noise propagation.

The distances between the proposed activities of the DCM west expansion project and the abutting residential areas are illustrated in Table 3.2.

Table 3.2: Distance between the residential area and the mining activities

Residential area	Distance between the residential areas and the proposed mine activities in meters			
	Proposed Route A and service road	Proposed Route B and service road	Extension of the existing discard dump	Entrance to the Pillar and Post mining activities
1	1 519	2 416	3 667	4 851
2	1 526	2 967	3 317	4 623
3	1 831	3 137	3 386	4 737
4	759	2 845	549	2 131
5	1 133	844	384	2 035
6	947	1 021	1 054	1 933
7	2 854	2 939	3 407	2 968
8	3 297	3 444	3 964	3 291
9	4 900	5 150	5 544	4 442
10	7 682	7 173	7 788	6 361
11	6 028	5 358	6 147	4 633
12	10 441	9 727	10 608	8 885
13	10 640	9 726	10 805	9 084
14	9 512	7 974	9 899	8 656

3.4 Current noise sources

The following are noise sources in the vicinity of and the boundaries of the study area:

- Domestic/ seasonal farming activity noises;
- Intermittent traffic along the feeder roads and gravel roads;
- Distant traffic noise from the abutting feeder roads;
- Insects and birds; and,
- Wind noise.

3.5 Atmospheric conditions during the noise survey

The noise readings were carried out at the different measuring points and the prevailing atmospheric conditions i.e. wind speed, wind direction and temperature were taken into consideration. The following meteorological conditions were recorded:

1 February 2019

Daytime

- Wind speed – less than 2.9m/s;
- Temperature – 26.5^{o}C – No strong temperature gradient occurred near the ground;
- Cloud cover – Scattered clouds;
- Wind direction – The wind was blowing from a north-westerly direction;

- Humidity – less than 5% humidity.

Night time

- Wind speed – No wind;
- Temperature – 17.5^{o}C ;
- Cloud cover – No clouds;
- Wind direction – There was no wind;
- Humidity – less than 5% humidity.

The wind speed and wind direction will determine the propagation of the mining noises and how the residents will perceive the distant existent mining activity noises.

4 Regulatory and Legislative requirements

There are specific regulatory and legislative requirements which regulate the proposed development in terms of environmental noise. The legislative documents are as follows:

4.1 Department of Environment Affairs: Noise Control Regulations promulgated under the Environment Conservation Act**,** (Act No. 73 of 1989), Government Gazette No. 15423, 14 January 1994.

These noise control regulations are applicable in the study area and the main aspect of these noise control regulations is that you may exceed the prevailing ambient noise levels by 7.0dBA before a noise disturbance is created.

4.2 South African National Standards – SANS 10103 of 2008

The South African National Standards provide the guidelines for the different recommended prevailing ambient noise levels and how to evaluate when a specific operation or activity is creating a noise disturbance and what reaction can be expected if a noise disturbance is created.

4.3 South African National Standards – SANS 10210 of 2004

This national standard is used when calculating or predicting increased road traffic noise during new developments.

4.4 Environmental, Health and Safety Guidelines of the IFC of the World Bank

The recommended noise level for a noise sensitive area is 55.0dBA during the day and 45.0dBA during the night.

The Constitution of the Republic of South Africa Act, (Act No 108 of 1996) makes provision for the health and well-being of the citizens and to prevent pollution and to promote conservation.

According to Article 24 of the Act, everyone has the right to:

(a) an environment that is not harmful to their health and well-being; and

(b) have the environment protected for the present and future generations through reasonable legislative and other measures that-

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecological sustainable development and use of natural resources, while promoting justifiable economic and social development.

5 Description of the receiving environment

The prevailing ambient noise levels in Thubelihle, Kriel and some of the farm houses were made up out of distant traffic and domestic type noises. The farm houses are spread out throughout the study area and the location of the residential and farm houses are illustrated in Figure 5.1.

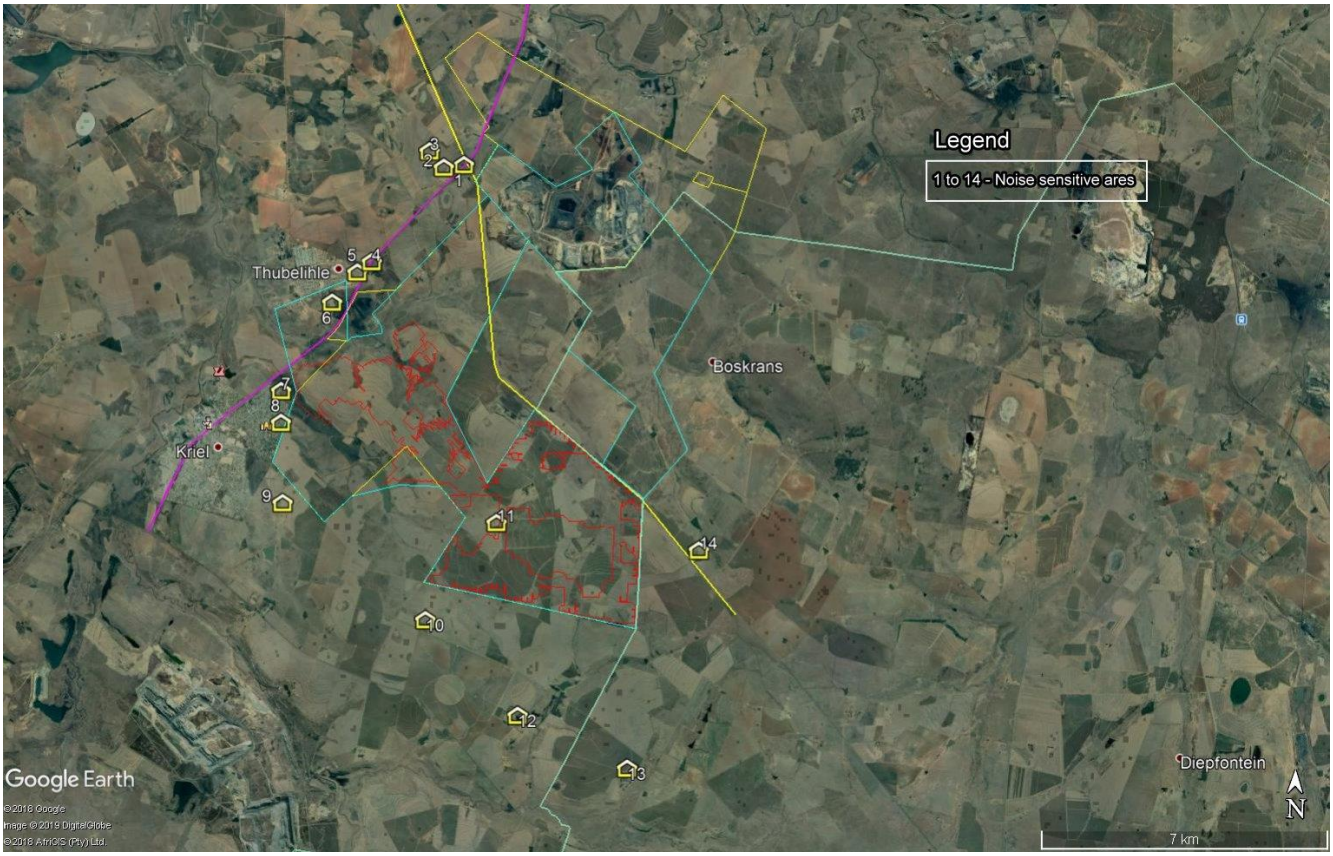


Figure 5-1: Location of the residential and farm houses within the study area

6 Results of the noise survey

The prevailing ambient noise levels at the different measuring points are given in Table 6.1. These noise levels include all the noise sources currently in the area such as distant traffic noise, distant mine noise and natural noise sources. A noise survey was carried out at the existing ventilation upcast shaft and the noise level was 70.5dBA and the prevailing noise level along the R544 was 58.4dBA. The Leq is the average noise level for the specific measuring point over a period of time, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for the specific area in dBA.

Table 6-1: Noise levels for the day and night time at the study area.

Position	Day time				Night time			
	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks	Leq - dBA	Lmax (Fast) - dBA	Lmin (Fast) - dBA	Remarks
A	**31.9**	59.5	25.1	Wind in crops	**26.6**	49.2	18.2	Distant insects
B	**35.1**	60.9	23.4	Distant traffic, wind noise and birds	**32.6**	55.1	21.2	Distant traffic and crickets
C	**34.9**	52.1	24.8	Distant traffic, wind noise and birds	**39.8**	59.1	23.3	Distant traffic and crickets
D	**41.3**	62.2	32.6	Reverse signal, birds, wind noise	**41.1**	51.5	32.1	Sirens from mine, crickets
D1	**44.9**	64.0	34.8	Traffic and birds	**49.4**	59.4	34.7	Intermittent traffic and insects
E	**49.4**	66.2	38.9	Traffic and birds	**52.8**	62.6	42.5	Intermittent traffic and insects
F	**59.2**	69.6	39.1	Traffic, birds and hauling vehicles	**58.3**	72.9	39.9	Traffic and insects
G	**61.9**	80.0	45.5	Traffic and domestic noise	**61.2**	75.9	47.5	Traffic and domestic
H	**38.9**	62.9	29.9	Domestic and birds	**41.3**	59.8	30.4	Traffic and domestic
I	**38.9**	63.4	32.8	Domestic and municipal water pump at reservoir	**40.7**	56.8	29.0	Domestic and municipal water pump at reservoir

The arithmetic ambient noise level throughout the study area is as follows:

- Along the gravel road to the south-east
  - Daytime – 33.5dBA;
  - Night time – 29.6dBA.
- Along 544
  - Daytime – 58.4dBA.
- Residential areas along R547 – north western side
  - Daytime – 45.2dBA;
  - Night time – 47.8dBA.
- Thubelihle – boundary onto R547
  - Daytime – 60.6dBA;
  - Night time – 59.8dBA.
- Residential areas in Kriel abutting the mine
  - Daytime – 38.9dBA;
  - Night time – 41.0dBA.

The following noise levels are from construction machinery which is used during the construction and earth works. The machinery will not work all at once and the rock drill operation will work individually when it will be required. This will be a point source like many of the machinery whereas dump trucks/hauling vehicles will create a linear noise source.

The noise reduction calculated in Table 6.2 is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is

perceived by the occupants of nearby noise receptors. The cumulative noise level of the machinery and equipment will be 64.9dBA at 60m and 40.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time (this is for direct line of sight with no earth berm in place).

Table 6-2: Sound pressure levels of construction machinery

Equipment	**Reduction in the noise level some distance from the source - dBA**								
Cumulative distance from source in meters	2m from the source	15m	30m	60m	120m	240m	480m	960m	1920m
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
Backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Drilling Equipment	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Flatbed truck	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pickup truck	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Tractor trailer	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Crane	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pumps	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Welding Machine	72.0	43.5	37.5	31.4	25.4	19.4	13.4	7.4	1.3
Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pile driver	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Jackhammer	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Rock drills	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from the construction activities when all of such work within a radius of 30m	**105.5**	**76.9**	**70.9**	**64.9**	**58.9**	**52.9**	**46.8**	**40.8**	**34.8**

7 Noise impact levels at the different residential areas

7.1 Environmental noise level calculations

The assessment of environmental noise impacts will vary because of the different prevailing ambient noise levels in different districts according to Table 2 of SANS 10103 of 2008. There is recommended noise levels for ambient noise levels in different districts. (See Table 2-1). The increase in the in the prevailing ambient noise level is quantified as follow:

The increase in the prevailing ambient noise level is calculated in the following manner:

$\Delta L\text{Req,T} = L\text{Req,T (post)} - L\text{Req,T (pre)}$

where,

LReq,T (post) – noise level after completion of the project – projected or calculated noise levels;

*L*Req,T (pre) – noise level before the proposed project – ambient noise level.

The criteria for assessing the magnitude of a noise impact are illustrated in Table 7.1.

Table 7-1: Noise intrusion level criteria

Increase Δ-dBA	Assessment of impact magnitude	Color code
$0 < \Delta \leq 1$	Not audible	
$1 < \Delta \leq 3$	Very Low	
$3 < \Delta \leq 5$	Low	
$5 < \Delta \leq 10$	Medium	
$10 < \Delta \leq 15$	High	
$15 < \Delta$	Very High	

The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor. The following formula was used to calculate the noise level at the noise sensitive areas during the construction, operational and decommissioning phases of the project:

$$Lp = Lw - 20\log R - \alpha$$

Where, Lp is the sound level at a distance from the source in dBA;
Lw is the sound level at the source in dBA;
α is the noise reduction due to the distance from the source (5.0dBA);
R is the distance from the source.

The above equation and the Interactive noise calculator (ISO 9613) will be used to determine the noise levels during the construction, operational and decommissioning phases of the project. The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor.

The following sound levels were used in determining the noise level at the residential areas during the construction phase of the extension of the discard dump with the two different options (overland conveyor and the haul road):

- Site clearing and grubbing of footprint – 90.5dBA;
- Earthmoving activities – 87.5dBA;
- Preparation of ground at the extension of the discard dump – 85.0dBA;
- Construction of the access roads – 85.5dBA; and

- Construction of the overland conveyor – 87.5dBA.

The noise intrusion level during the operational phase will be based on the following noise levels:

A Overland conveyor and service road
- Overland conveyor – 75.5dBA;
- Siren at overland conveyor – 90.5dBA;
- Service road – 80.0dBA;
- Maintenance activities – 75.5dBA

B Activities at the discard dump
- Pump at the discard dump – 85.5dBA;
- Access roads, return water pipeline and slurry feed line activities – 80.5dBA;
- Maintenance activities – 75.0dBA.

C Entrance to pillar and post mining
- Mining vehicles at entrance – 90.5dBA;
- Mechanical ventilation – 85.5dBA;
- Power generation – 87.5dBA;
- Maintenance activities – 75.0dBA;
- Emergency siren – 95.5dBA.

The noise intrusion level during the decommissioning phase will be based on the following noise levels at the source:

- Removal of infra-structure – 85.0dBA; and
- Rehabilitation of disturbed footprint – 85.0dBA.

8 Noise Impact Assessment Analysis

8.1 Construction phase

The noise intrusion levels at the residential areas 1 to 14, (in dBA) will be insignificant, during the construction phase of the different proposed mining activities and is illustrated in the following tables.

Table 8-1: Noise intrusion levels in dBA during construction phase – Extension of existing discard dump

Residential property	Site clearing and grubbing of footprint	Earthmoving activities	Preparation of ground at the extension of the discard dump	Construction of the Access roads, return water pipeline and slurry feed line	Construction of the access roads	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - Daytime
1	14.2	14.2	9.2	8.7	11.2	19.2	60.6	0.0
2	15.1	15.1	10.1	9.6	12.1	20.0	60.6	0.0
3	14.9	14.9	9.9	9.4	11.9	19.9	60.6	0.0
4	30.7	30.7	25.7	25.2	27.7	35.6	60.6	0.0
5	33.8	33.8	28.8	28.3	30.8	38.7	60.6	0.0
6	25.0	25.0	20.0	19.5	22.0	30.0	60.6	0.0
7	14.9	14.9	9.9	9.4	11.9	19.8	39.0	0.1
8	13.5	13.5	8.5	8.0	10.5	18.5	38.9	0.0
9	10.6	10.6	5.6	5.1	7.6	15.7	33.6	0.1
10	7.7	7.7	2.7	2.2	4.7	12.8	33.5	0.0
11	9.7	9.7	4.7	4.2	6.7	14.8	33.6	0.1
12	5.0	5.0	0.0	-0.5	2.0	10.3	33.5	0.0
13	4.8	4.8	-0.2	-0.7	1.8	10.2	33.5	0.0
14	5.6	5.6	0.6	0.1	2.6	10.9	58.4	0.0

Table 8-2: Noise intrusion levels in dBA during construction phase – Overland conveyor (Option A) and service road

Residential property	Site clearing and grubbing of footprint	Earthmoving activities	Preparation of ground at the extension of the discard dump	Construction of the Access roads, return water pipeline and slurry feed line	Construction of the access roads	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - Daytime
1	21.9	21.9	16.9	16.4	18.9	26.8	60.6	0.0
2	21.8	21.8	16.8	16.3	18.8	26.7	60.6	0.0
3	20.2	20.2	15.2	14.7	17.2	25.2	60.6	0.0
4	27.9	27.9	22.9	22.4	24.9	32.8	60.6	0.0
5	24.4	24.4	19.4	18.9	21.4	29.3	60.6	0.0
6	26.0	26.0	21.0	20.5	23.0	30.9	60.6	0.0
7	16.4	16.4	11.4	10.9	13.4	21.3	39.0	0.1
8	15.1	15.1	10.1	9.6	12.1	20.1	39.0	0.1
9	11.7	11.7	6.7	6.2	8.7	16.6	33.6	0.1
10	7.8	7.8	2.8	2.3	4.8	12.7	33.5	0.0
11	9.9	9.9	4.9	4.4	6.9	14.8	33.6	0.1
12	5.1	5.1	0.1	-0.4	2.1	10.0	33.5	0.0
13	5.0	5.0	0.0	-0.5	2.0	9.9	33.5	0.0
14	5.9	5.9	0.9	0.4	2.9	10.8	58.4	0.0

Table 8-3: Noise intrusion levels in dBA during construction phase – Overland conveyor (Option B) and service road

Residential property	Site clearing and grubbing of footprint	Earthmoving activities	Preparation of ground at the extension of the discard dump	Construction of the Access roads, return water pipeline and slurry feed line	Construction of the access roads	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - Daytime
1	17.8	17.8	12.8	12.3	14.8	22.8	60.6	0.0
2	16.1	16.1	11.1	10.6	13.1	21.0	60.6	0.0
3	15.6	15.6	10.6	10.1	12.6	20.5	60.6	0.0
4	16.4	16.4	11.4	10.9	13.4	21.3	60.6	0.0
5	27.0	27.0	22.0	21.5	24.0	31.9	60.6	0.0
6	25.3	25.3	20.3	19.8	22.3	30.2	60.6	0.0
7	16.1	16.1	11.1	10.6	13.1	21.0	39.0	0.1
8	14.8	14.8	9.8	9.3	11.8	19.7	39.0	0.1
9	11.3	11.3	6.3	5.8	8.3	16.2	33.6	0.1
10	8.4	8.4	3.4	2.9	5.4	13.3	33.5	0.0
11	10.9	10.9	5.9	5.4	7.9	15.8	33.6	0.1
12	5.7	5.7	0.7	0.2	2.7	10.7	33.5	0.0
13	5.7	5.7	0.7	0.2	2.7	10.7	33.5	0.0
14	7.5	7.5	2.5	2.0	4.5	12.4	58.4	0.0

8.1.1 Construction phase of the discard dump, access roads, and overland conveyor

Table 8-4: Site clearing and grubbing of footprint

Issue	***Site clearing and grubbing of footprint***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-5: Earthmoving activities

Issue	***Earthmoving activities***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-6: Preparation of ground for the mining extension activities

Issue	***Preparation of ground for the mine extension activities***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-7: Construction of the access roads, return water pipeline and slurry feed line at discard dump

Issue	***Construction of the access roads, return water pipeline and slurry feed line at discard dump***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-8: Construction of the access roads

Issue	***Construction of the access roads***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-9: Construction of the overland conveyor and service road

Issue	***Construction of the overland conveyor and service road***							
Impact Summary	*Noise increase at the different mining extension activities and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

8.2 Operational Phase

The environmental noise impact during the operational phase (overland conveyor) at the noise receptors is illustrated in Table 8.11 (overland conveyor A and Service road), Table 8.12 (Overland conveyor B and Service road) Table 8.13 (Extension of discard dump)

Table 8-10: Noise intrusion levels in dBA during the operational phase – Overland conveyor A and Service road

Residential property	Overland Conveyor	Siren at overland conveyor	Service road	Maintenance work	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
1	6.9	21.9	11.9	6.9	22.6	60.6	49.5	0.0	0.0
2	6.8	21.8	11.8	6.8	22.6	60.6	49.5	0.0	0.0
3	5.2	20.2	10.2	5.2	21.0	60.6	49.5	0.0	0.0
4	12.9	27.9	17.9	12.9	28.6	60.6	49.5	0.0	0.0
5	9.4	24.4	14.4	9.4	25.1	60.6	49.5	0.0	0.0
6	11.0	26.0	16.0	11.0	26.7	60.6	49.5	0.0	0.0
7	1.4	16.4	6.4	1.4	17.4	38.9	41.0	0.0	0.0
8	0.1	15.1	5.1	0.1	16.2	38.9	41.0	0.0	0.0
9	-3.3	11.7	1.7	-3.3	13.3	33.5	29.7	0.0	0.1
10	-7.2	7.8	-2.2	-7.2	10.4	33.5	29.7	0.0	0.1
11	-5.1	9.9	-0.1	-5.1	11.9	33.5	29.7	0.0	0.1
12	-9.9	5.1	-4.9	-9.9	8.9	33.5	29.6	0.0	0.0
13	-10.0	5.0	-5.0	-10.0	8.8	33.5	29.6	0.0	0.0
14	-9.1	5.9	-4.1	-9.1	9.3	58.4	49.5	0.0	0.0

Table 8-11: Noise intrusion levels in dBA during the operational phase – Overland conveyor B and service road

Residential property	Overland Conveyor	Siren at overland conveyor	Service road	Maintenance work	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
1	2.8	17.8	7.8	2.8	18.7	60.6	49.5	0.0	0.0
2	1.1	16.1	6.1	1.1	17.1	60.6	49.5	0.0	0.0
3	0.6	15.6	5.6	0.6	16.6	60.6	49.5	0.0	0.0
4	1.4	16.4	6.4	1.4	17.4	60.6	49.5	0.0	0.0
5	12.0	27.0	17.0	12.0	27.7	60.6	49.5	0.0	0.0
6	10.3	25.3	15.3	10.3	26.0	60.6	49.5	0.0	0.0
7	1.1	16.1	6.1	1.1	17.1	38.9	41.0	0.0	0.0
8	-0.2	14.8	4.8	-0.2	15.9	38.9	41.0	0.0	0.0
9	-3.7	11.3	1.3	-3.7	12.9	33.5	29.7	0.0	0.1
10	-6.6	8.4	-1.6	-6.6	10.8	33.5	29.7	0.0	0.1
11	-4.1	10.9	0.9	-4.1	12.6	33.5	29.7	0.0	0.1
12	-9.9	5.1	-4.9	-9.9	9.2	33.5	29.6	0.0	0.0
13	-10.0	5.0	-5.0	-10.0	9.2	33.5	29.6	0.0	0.0
14	-9.1	5.9	-4.1	-9.1	10.2	58.4	49.5	0.0	0.0

Table 8-12: Noise intrusion levels in dBA during the operational phase – Activities at the expansion of existing discard dump

Residential property	Pump at discard dump	Access road, return water pipeline and slurry feed line	Maintenance activities	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
1	9.2	4.2	-0.8	12.3	60.6	49.5	0.0	0.0
2	10.1	5.1	0.1	12.9	60.6	49.5	0.0	0.0
3	9.9	4.9	-0.1	12.8	60.6	49.5	0.0	0.0
4	25.7	20.7	15.7	27.3	60.6	49.5	0.0	0.0
5	28.8	23.8	18.8	30.3	60.6	49.6	0.0	0.1
6	20.0	15.0	10.0	21.7	60.6	49.5	0.0	0.0
7	9.9	4.9	-0.1	12.7	38.9	41.0	0.0	0.0
8	8.5	3.5	-1.5	11.8	38.9	41.0	0.0	0.0
9	5.6	0.6	-4.4	10.1	33.5	29.6	0.0	0.0
10	2.7	-2.3	-7.3	8.8	33.5	29.6	0.0	0.0
11	4.7	-0.3	-5.3	9.6	33.5	29.6	0.0	0.0
12	0.0	-5.0	-10.0	8.1	33.5	29.6	0.0	0.0
13	-0.2	-5.2	-10.2	8.0	33.5	29.6	0.0	0.0
14	0.6	-4.4	-9.4	8.2	58.4	49.5	0.0	0.0

The impact assessment for the operational phase of the expansion activities is illustrated in Tables 8.13 to 8.15.

Table 8-13: Overland conveyor A and Service road activities

Issue	***Overland conveyor A and Service road activities***							
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-14: Overland conveyor B and Service road activities

Issue	***Overland conveyor B and Service road activities***							
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-15: Discard activities at the existing discard dump

Issue	***Discard activities at the existing discard dump***							
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

8.3 Decommissioning phase

The noise intrusion levels during the decommissioning phase will be insignificant and is illustrated in Table 8.16.

Table 8-16: Noise intrusion levels in dBA during the decommissioning phase

Residential	Demolition of all surface infrastructure	Rehabilitation of all disturbed areas	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Intrusion noise level - daytime	Intrusion noise level - night time
1	10.9	12.9	15.1	60.6	60.6	0.0	0.0
2	10.9	12.9	15.0	60.6	60.6	0.0	0.0
3	9.4	11.4	13.5	60.6	60.6	0.0	0.0
4	18.2	20.2	22.3	60.6	60.6	0.0	0.0
5	18.2	20.2	22.3	60.6	60.6	0.0	0.0
6	18.5	20.5	22.6	60.6	60.6	0.0	0.0
7	10.9	12.9	15.1	38.9	38.9	0.0	0.0
8	9.6	11.6	13.7	38.9	38.9	0.0	0.0
9	6.3	8.3	10.5	33.5	33.5	0.0	0.0
10	3.2	5.2	7.3	33.5	33.5	0.0	0.0
11	5.6	7.6	9.7	33.5	33.5	0.0	0.0
12	0.5	2.5	4.7	33.5	33.5	0.0	0.0
13	-1.3	0.7	2.8	33.5	33.5	0.0	0.0
14	1.1	3.1	5.2	58.4	58.4	0.0	0.0

The environmental noise impact of the activities during the decommissioning phase at the residential areas is illustrated in Table 8.17 and Table 8.18. The noise impact will be insignificant at the different noise receptors 1 to 14.

Table 8-17: Demolition of all infra-structure

Issue	***Demolition of all infra-structure***							
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

Table 8-18: Planting of grass on rehabilitated areas

Issue	***Planting of grass on rehabilitated areas***							
Impact Summary	*Noise increase at the boundary of the mine footprint and at the abutting residential areas*							
Potential Impact rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	No	**Negative**	**2**	**2**	**4**	**3**	**24**	**Low**
Management Measures	Implementation of the noise mitigatory measures and the noise management plan							
After Management Impact Rating	**Corrective measures**	**Nature**	**Extent**	**Duration**	**Magnitude**	**Probability**	**Significance**	**Significance rating**
	Yes	**Negative**	**2**	**2**	**2**	**3**	**18**	**Low**

9 Assumptions and Limitations

The following limitations forms part of the environmental noise impact assessment:

- This an existing mine with existing traffic along the R 544 and R547 roads during the day and night time period;
- Existing mine activities will change depending on the operational phase;
- No open cast blasting will be done at this mine;
- The prevailing ambient noise levels for the study area was created by far and near noise sources associated with traffic and mining activities with the result that the prevailing ambient noise level may change at times;
- Noise measurements in the presence of winds in excess of 3.0m/s may impact the outcome of the environmental noise results;
- Insect activities during the summer periods increase the prevailing ambient noise level during the day and night time periods accordingly;
- The influx of traffic into an area will have an influence on the prevailing ambient noise levels and should be considered during the noise impact assessment process.

10 Discussions

The proposed Dorstfontein West expansion will take place in the vicinity of existing mining activities (Dorstfontein West & Dorstfontein East) and the R544 and R 547 roads respectively. The potential environmental noise impact of the proposed discard facility extension and , overland conveyor/service road will be insignificant during the construction, operational and/or decommissioning phases of the expansion project.

There will be a difference between the summer and winter periods as the insect activities such as crickets increase the prevailing ambient noise levels accordingly during the summer period whereas the prevailing ambient noise levels will not be influenced as there are no insects during the winter period. The distances and topography between the proposed mining extensions and the residential

areas will play a role in the noise propagation and how the sound from the proposed mining activities will be perceived.

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which are intrusive such as traffic noise forms part of the ambient noise that people get accustomed to without noticing the higher sound levels. Any person in the workplace and at home is exposed to the following noise levels as given in Table 10-1. These are the average noise levels in the workplace and at home that will mask noise from a source introduced into an area:

Table 10-1 Different noise levels in and around the house and workplace

	Activity	**dBA**
Communication	Whisper	30.0
Communication	Normal Conversation	55.0-65.0
Communication	Shouted Conversation	90.0
Communication	Baby Crying	80.0
Communication	Computer	37.0-45.0
Home/Office	Refrigerator	40.0-43.0
Home/Office	Radio Playing in Background	45.0-50.0
Home/Office	Background Music	50.0
Home/Office	Washing Machine	50.0-75.0
Home/Office	Microwave	55.0-59.0
Home/Office	Clothes Dryer	56.0-58.0
Home/Office	Alarm Clock	60.0-80.0
Home/Office	Vacuum Cleaner	70.0
Home/Office	TV Audio	70.0
Home/Office	Flush Toilet	75.0-85.0
Industry	Industrial activities	85.0-95.0
Home/Office	Ringing Telephone	80.0
Home/Office	Hairdryer	80.0-95.0
Home/Office	Maximum Output of Stereo	100.0-110.0

11 Recommendations

The following three primary variables should be considered when designing acoustic screening measures for the control of sound and/or noise:

- The source – Reduction of noise at the source;
- The transmission path – Reduction of noise between the source and the receiver;
- The receiver – Reduction of the noise at the receiver.

The last option is not applicable as it was decided to control the noise levels at the source.

11.1 Acoustic screening recommendations

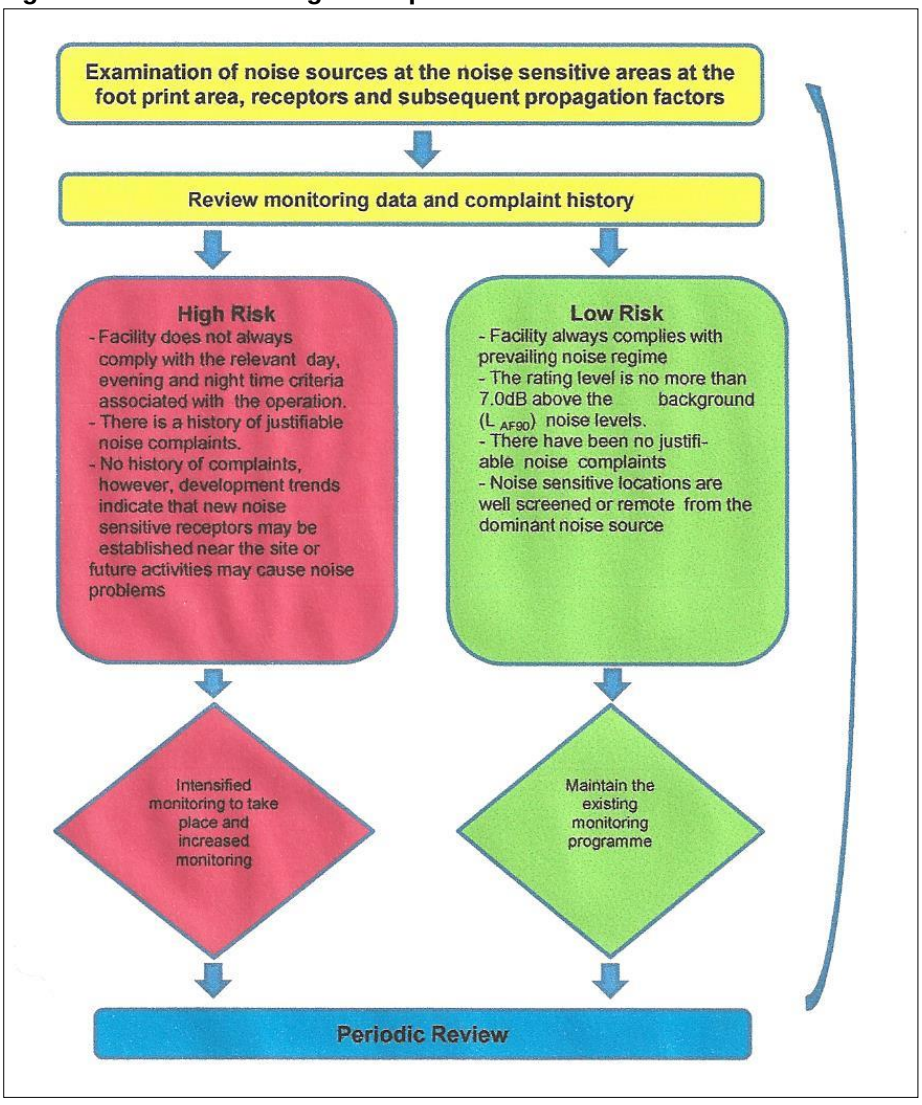
The acoustic screening measures for the project are given in Table 11.1. These are based on the best practicable methods, acoustic screening techniques and the IFC's Health and Safety Regulations.

Table 11-1: Recommended acoustic screening measures

Activity	Recommendations
Construction phase	• Machinery with low noise levels which complies with the manufacturer's specifications to be used. • Construction activities to take place during daytime period only. • Noise monitoring on a quarterly basis.
Operational phase	• Noise monitoring to be done at the abutting residential areas in the vicinity of the proposed discard extension, overland conveyor/service road and entrance to the S4L reserve on a quarterly basis after which it can change to an annual basis. • Actively manage the proposed mining extension activities and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. • The noise levels to be evaluated in terms of the baseline noise levels.
Decommissioning phase	• Machinery with low noise levels which complies with the manufacturer's specifications to be used. • Activities to take place during daytime period only. • Vehicles to comply with manufacturers' specifications and any activity which will exceed 85.0dBA to be done during daytime only.

The following are the Environmental, Health and Safety Guidelines of the IFC of the World Bank, which should be taken into consideration during the construction, operational and decommissioning phases of the project. The following noise management plan as illustrated in Figure 11.1 must be used to identify any new noise sources which may have an impact on the abutting noise sensitive areas.

Figure 11-1: Noise management plan



Noise monitoring will have to be carried out to determine the potential shift in the prevailing ambient noise levels on a quarterly basis. Noise readings to be carried out at the measuring points as illustrated in Figure 3.1.

12 Conclusion

The proposed project will be situated in an area where there are existing mining activities, feeder roads and residential areas. The noise impact assessment revealed that the noise increase at the proposed discard dumps, and any of the overland conveyor options will be insignificant and that the noise increase will not exceed the threshold value of 7.0dBA The recommended noise migratory measures will ensure that the proposed project will be environmentally sustainable.

Animals depend on acoustic signals for essential functions. Some species have become threatened or endangered because of loss of habitat and further relocation as a result of noise disturbance is not possible. There is still an absence of understanding how observed behavioral and physiological

effects translate into ecological consequences for wildlife. There are examples where mining activities did not impact on the breeding and well-fare of wild life inside mining areas and this was successfully introduced in mines in the Limpopo (IEMR, 2000). Integrated Environmental Management (IEM) is a continuous process that ensures that the environmental impacts which can be introduced by mechanised activities during the construction, operational and decommissioning phases are avoided or mitigated throughout the project life cycle from design to the operational phase of the project (DEAT, 2004).

The Environmental management Plan (EMP) for the proposed mine extensions will consist of the following as illustrated in Table 12.1. Regular environmental monitoring will provide the data for reviewing, checking and revising the EMP.

Table 12-1: Environmental noise management plan

Action	Description	Frequency	Responsible person
Management objective	To ensure that the legislated noise levels will be adhered to at all times.	Quarterly basis	The engineer during the construction phase and the responsible person (Dorstfontein West Environmental Department) during the construction and operational phases of the project. A quarterly audit to be done by an approved environmental noise specialist.
Monitoring objective	Measure the environmental noise levels during the construction, operational and decommissioning phases of the project to ensure compliance to the recommended and threshold noise levels.	Quarterly basis	Dorstfontein West Environmental Department
Monitoring technology	The environmental noise monitoring must be done with a calibrated Class 1 noise monitoring equipment.	Quarterly basis	Dorstfontein West Environmental Department
Specify how the collected information will be used	The data must be collated and discussed on a quarterly basis during the construction and operational phases	Quarterly basis	Dorstfontein West Environmental Department
Spatial boundaries	At the boundaries of the identified residential areas as well as at the rail yard boundaries.	Quarterly basis	Dorstfontein West Environmental Department
Define how the data will be analysed and interpreted and how it should be presented in monitoring reports	Reports must be compiled for each monitoring cycle and the results must be compared to the previous set of results to determine if there was a shift in the prevailing ambient noise levels.	Quarterly basis	Dorstfontein West Environmental Department
Accuracy and precision of the data	The noise survey will have to be conducted in terms of the recommendations of the Noise Control regulations, 1994 and SANS 10103 of 2008.	Calibrated equipment which complies with the recommendations of SANS 10103 of 2008 must be used at all times.	Environmental noise specialist

The activities during the construction, operational, decommissioning phases of the proposed Dorstfontein West expansion project will comply with the relevant Noise Control Regulations, 1994 and SANS 10103 of 2008 provided that the noise mitigatory measures are in place and that the noise management plan be adhered to at all times.

Barend van der Merwe – MSc UJ
Environmental noise and vibration specialist

13 List of Definitions and Abbreviations

13.1 Definitions

Ambient noise
The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far

A-weighted sound pressure level (sound level) (L_{pA}), in decibels
The A-weighted sound pressure level is given by the equation:

$L_{pA} = 10 \log (p_A/p_o)^2$

Where

p_A is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and

p_o is the reference sound pressure (p_o = 20 μPa).

NOTE The internationally accepted symbol for sound level is dBA.

Distant source
A sound source that is situated more than 500 m from the point of observation

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$), in decibels
The value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T, has the same mean-square sound pressure as a sound under consideration whose level varies with time. It is given by the equation

$$L_{Aeq,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2(t)}{p_o^2} dt \right]$$

Where
$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T that starts at t_1 and ends at t_2;

p_o is the reference sound pressure (p_o = 20 μPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal, in pascals.

Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise

Initial noise
The component of the ambient noise present in an initial situation before any change to the existing situation occurs

Intelligible speech
Speech that can be understood without undue effort

Low frequency noise
Sound, which predominantly contains frequencies below 100 Hz

Nearby source
A sound source that is situated at a distance of 500 m or less from the point of observation

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises are suppressed

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source
NOTE Complaints about noise usually arise as a result of one or more specific noises.

Ambient sound level
Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Disturbing noise
Means a noise that causes the ambient noise level to rise above the designated zone level by 7.0dBA or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

Noise nuisance
Means any sound which disturbs or impairs the convenience or peace of any person

13.2 Abbreviations

dBA – A-weighted sound pressure level;

EMP – Environmental Management Plan;

IBR – Angular trapezoidal fluted profile sheet;

IFC – International Finance Corporation;

Km/h - Kilometers per hour;

Kg/m^3 – Kilogram per cubic meter;

m/s – meters per second;

NSA – Noise sensitive areas;

L_{Basic} – Basic noise level in dBA;

SANS – South African National Standards;

TLB – Tractor-loader-backhoe

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Appendix A

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MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	831, PRM 831 and 377B02
SERIAL NUMBERS	0001072, 0206 and 102184
DATE OF CALIBRATION	15 AUGUST 2018
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