BASELINE NOISE STUDY

FOR THE

KEBRAFIELD ROODEPOORT COLLIERY NATIONAL ENVIRONMENTAL MANAGEMENT ACT APPLICATION FOR AUTHORISATION REF:17/2/3N-289 & INTEGRATED WATER USE LICENSE APPLICATION

Department: Minerals Resources Ref: MP 30/5/1/2/2/479 MR

REPORT

2014

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Key Project Information	
Project Title:	Kebrafield Roodepoort Colliery
Farm Description:	Roodepoort 151 IS Portion 17
SG Code:	T0IS000000000115100017
Mining Right Reference Number:	MP30/5/1/2/2/479 MR
District Municipality:	Nkangala District
Local Authority:	Steve Tshwete Local Municipality
Nearest Town:	Pullenshope
Site Midpoint Coordinates:	26° 0'25.87"S 29°34'41.21"E

Project applicant:	Kebrafield (Pty) Ltd		
Trading name (if any):	Kebrafield		
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Qualifications & relevant experience	Masters Degree specializing in Environmental Management 10 Years' experience in Environmental Consultancy		
Professional affiliation(s) (if any)	Chartered Environmental Assessment Practitioner South Africa (CEAPSA)		
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Contact person:	Van Wyk Attorneys, 48 Mouton Street, Hendrina, 1095		
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1. INTRODUCTION

Eco Elementum (Pty) Ltd has been appointed by Eyethu on behalf of the applicant Kebrafield (Pty) Ltd to undertake the Scoping Environmental Impact Assessment and Water Use Licensing for all the relevant listed activities that will potentially be triggered during the opencast mining of the coal reserve. The mining right which has been awarded to Kebrafield (Pty) Ltd, MP30/5/1/2/2/479 MR, includes various farms and associated farm portions although for this specific project only the farm Roodepoort 151 IS portion 17 in the vicinity of the town of Pullenshope in Mpumalanga is being applied for. The project falls within the district municipality of the Nkangala District while the local authority is the Steve Tshwete Local Municipality. This report entails an application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010, and falls within the jurisdiction of the Department: Economic Development, Environment and Tourism, Mpumalanga Provincial Government.

As part of this authorisation process Eco Elementum (Pty) Ltd was commissioned to determine the baseline noise environment prior to the commencement of mining and to determine the potential noise impacts that might occur on the surrounding sound environment due to the establishment of the Kebrafield Roodepoort Colliery on the farm Roodepoort 151 IS Portion 17.

The proposed project relate to the opencast mining of approximately 800 000tons of high grade coal over a period of approximately three years. When coal seams are near the surface, it may be economical to extract the coal using open cut (also referred to as open cast, open pit, or strip) mining methods. Open cast coal mining recovers a greater proportion of the coal deposit than underground methods, as more of the coal seams in the strata may be exploited. The activity will cover approximately 50 hectares and is situated next to the town of Pullenshope downstream of the Eskom Hendrina Power Station.

2. SCOPE OF WORK

BASELINE NOISE STUDY

A baseline noise study was conducted by Eco Elementum (Pty) Ltd as part of the Kebrafield Roodepoort Colliery EIA.

The purpose was to:

- Study the available information relevant to the pre-development ambient noise levels in the environment;
- Identify the major existing noise sources in the environment;
- Identify the existing noise sensitive areas in the environment;

- Estimate by means of measurements and integration of the results with those of any relevant existing information the present ambient noise climate; and
- Identify the processes and equipment that will cause the major contribution to the future noise impact.

From the historical data that was presented during the mining right application is it not clear whether a baseline noise study for the area has ever been conducted, and therefore new measurements had to be taken in field to gather data for analysis.

3. STUDY AREA

3.1. LOCATION

Kebrafield Roodepoort Colliery is located on the farm Roodepoort 151IS Portion 17, which is situated on the western border of the town Pullenshope in Mpumalanga. Pullenshope is approximately 5 km west of the N11 between Middelburg and Hendrina. The propsed development is situated south of Optimum Colliery, which supplies coal to the Hendrina power station immediately southwest of Pullenshope. Pullenshope used to be the village of Hendrina powerstation which housed all the employees of the powerstation. Now the properties belong mostly to private owners although not all has been sold off by the powerstation. Coal mining operations forms an integrated part of the Hendrina power generation activities. Big scale coal mining operations occur in the local catchment area of the power station. The image below illustrates the relative position of the proposed project site to other towns in the vicinity of the operation. The farm Roodepoort 151IS Protion 17 of which only the northern section fo the property is proposed for the development is indicated by the reddish polygon to the west of the town Pullenshope.

The proposed activities are primarily surrounded by agricultural small holdings, power generation and neighbouring mining operations. Major residential areas in the region include Middelburg (~25km northwest), eMalahleni (~35km west-northwest), Bethal (~45 km southwest) and Ermelo (~60km southeast). Smaller residential areas in the region include Arnot (~20 km northeast), Pullen's Hope (~1 km east), Komati (~12 km southwest), KwaZamokuhle (~17 km southeast) and Hendrina (~17 km southeast) which may include schools and hospitals/clinics. Individual residences (i.e. farm houses) are also in the immediate vicinity of the proposed operations.

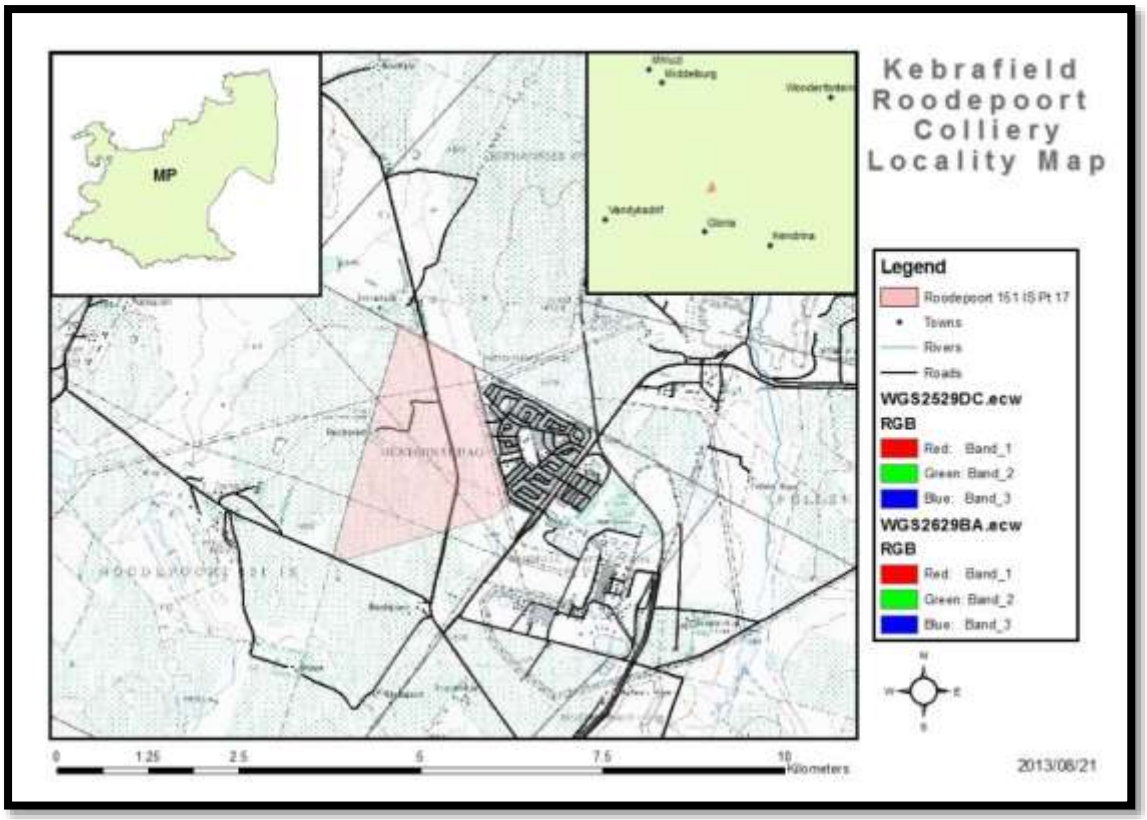

Figure 1: Kebrafield Roodepoort Colliery Locality Map – 1:50 000 Topographical Datasheets WGS2529DC & WGS2629BA

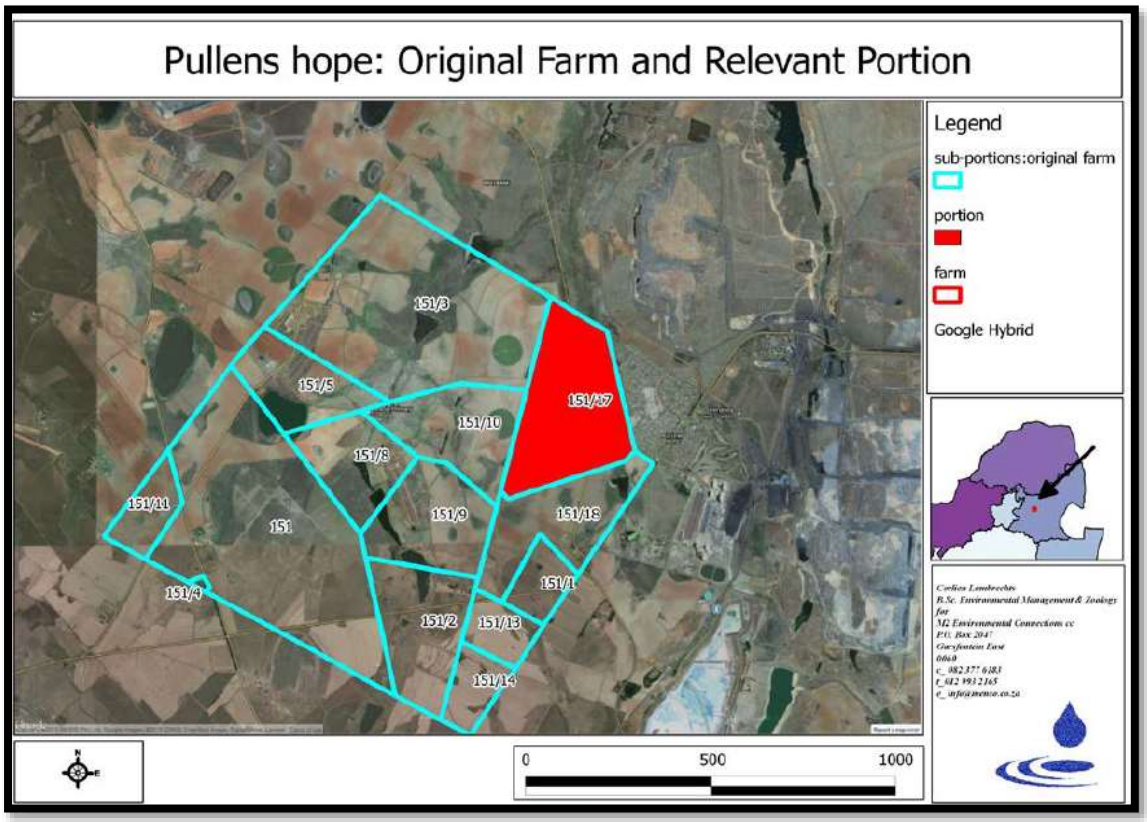

Figure 2: Roodepoort: Original Farm and Relevant Portion

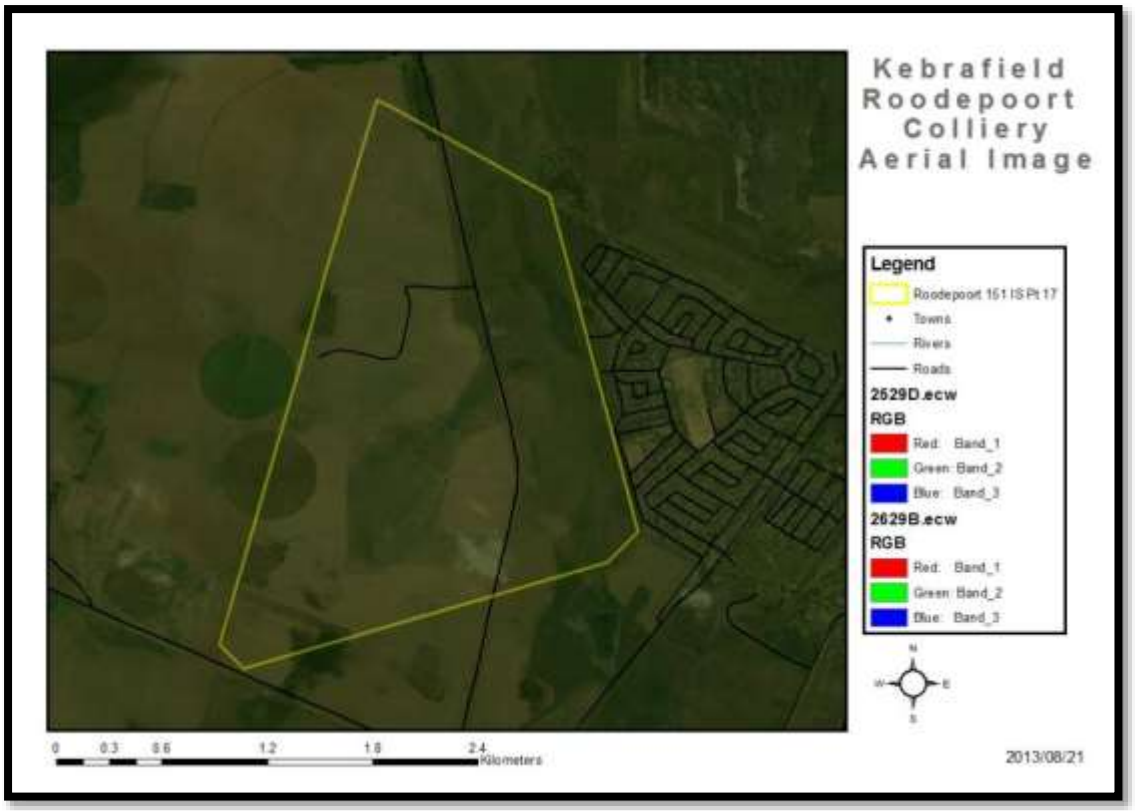

Figure 3: Aerial imagery (2010 Landsat Data) indicating the extent of the farm Roodepoort 151IS Portion 17

3.2. TOPOGRAPHY

The surface topography of the area is typical of the Mpumalanga Highveld, mainly a gently undulating plateau, varying between approximately 1680 mamsl underneath Ash Dam 4 to 1600 mamsl along the Woest-Alleen Spruit (East) and the lower reaches of the Woest-Alleen Spruit (West). The mining area is situated between the contour lines of the 1600 mamsl to 1610 mamsl. Several man-made features are also of significance at the site. Numerous dams have been constructed for a variety of purposes, the most obvious of which is the man made dam to the east of the study area, situtated right in the middle of a wetland. Various Eskom power lines transect the proposed mining area while there is a gravel road that runs straight through the middle of the mining footprint. These features are indicated in the figure below, 1:50 000 topographical map.

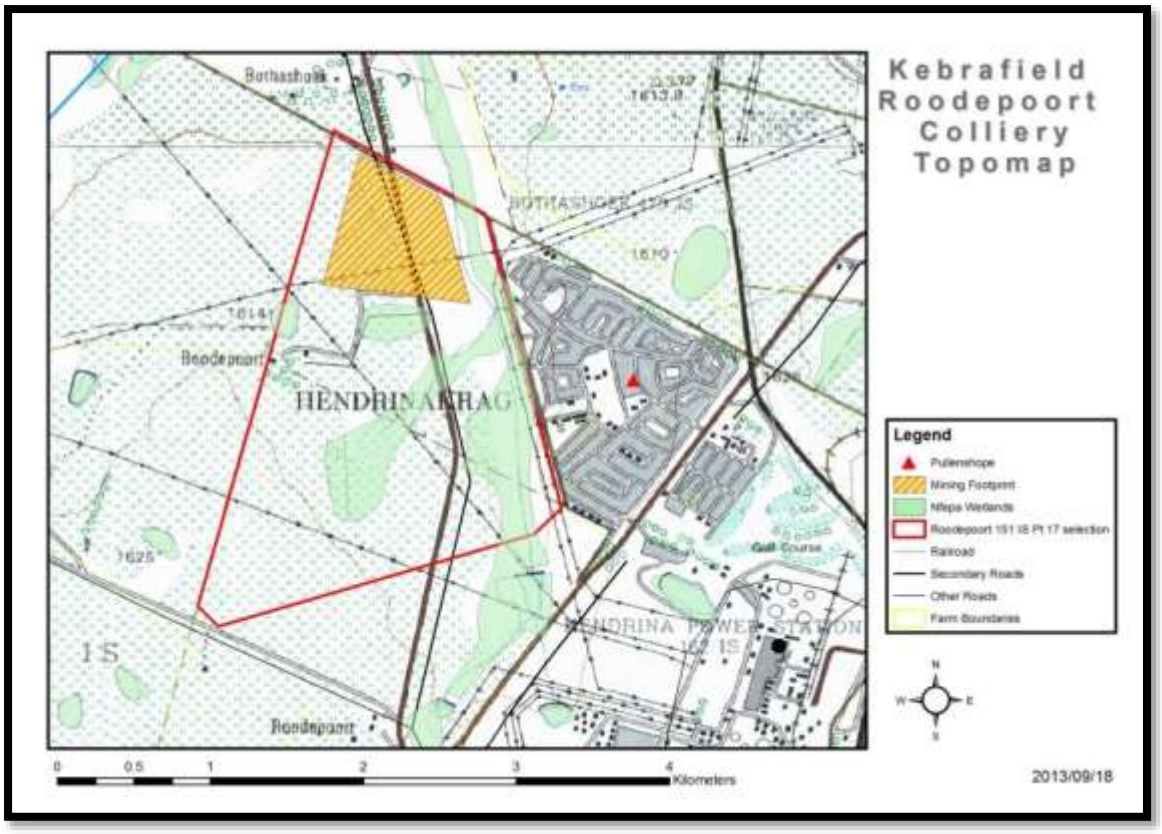

Figure 4: Topography according to the 1:50 000 topographical map

3.3. ROADS AND RAIL ROADS

A gravel road runs straight through the middle of the proposed operation, but an application to the Mpumalanga Department of Roads was successful in allowing the diversion of the road further to the West – therefore also further away from the community. From the image below the road has been indicated in yellow running thorugh the anticipated mining area in red, while there's also a railroad to the north of the study area. The rail road runs paralel to the north of the town Pullenshope before turning north and away from the study area.

Figure 5: Main road (yellow) and railway (white)

3.4. LANDUSE

The land cover of the proposed mining site as indicated in the figure below is mainly grasslands and cultivated commercial areas. The study area (yellow diagonal lines in the image below) covers only the northern portion of portion 17 of the Farm Roodepoort 151IS (indicated as a red polygon in the image below). A NFEPA wetland is situated to the east of the proposed study area and has been discussed under the previous section under the heading “Wetlands”. The large yellow polygon to the north and east of the study area has been classified according to the ENPAT data set as “Mining and Quarries”. Various previous studies conducted in the study region have acknowledged the fact that the catchment has already been largely transformed by mining activities. The proposed Kebrafield Roodepoort Colliery intends to keep clear of the wetland areas while adhering to a 100m buffer as proposed by the Wetland specialists during an initial prefeasibility study. The majority of the area to the east has been built up by the previous Hendrina Power Station Village, which today has become known as the town of Pullenshope as the majority of land ownership vest with private persons/entities.

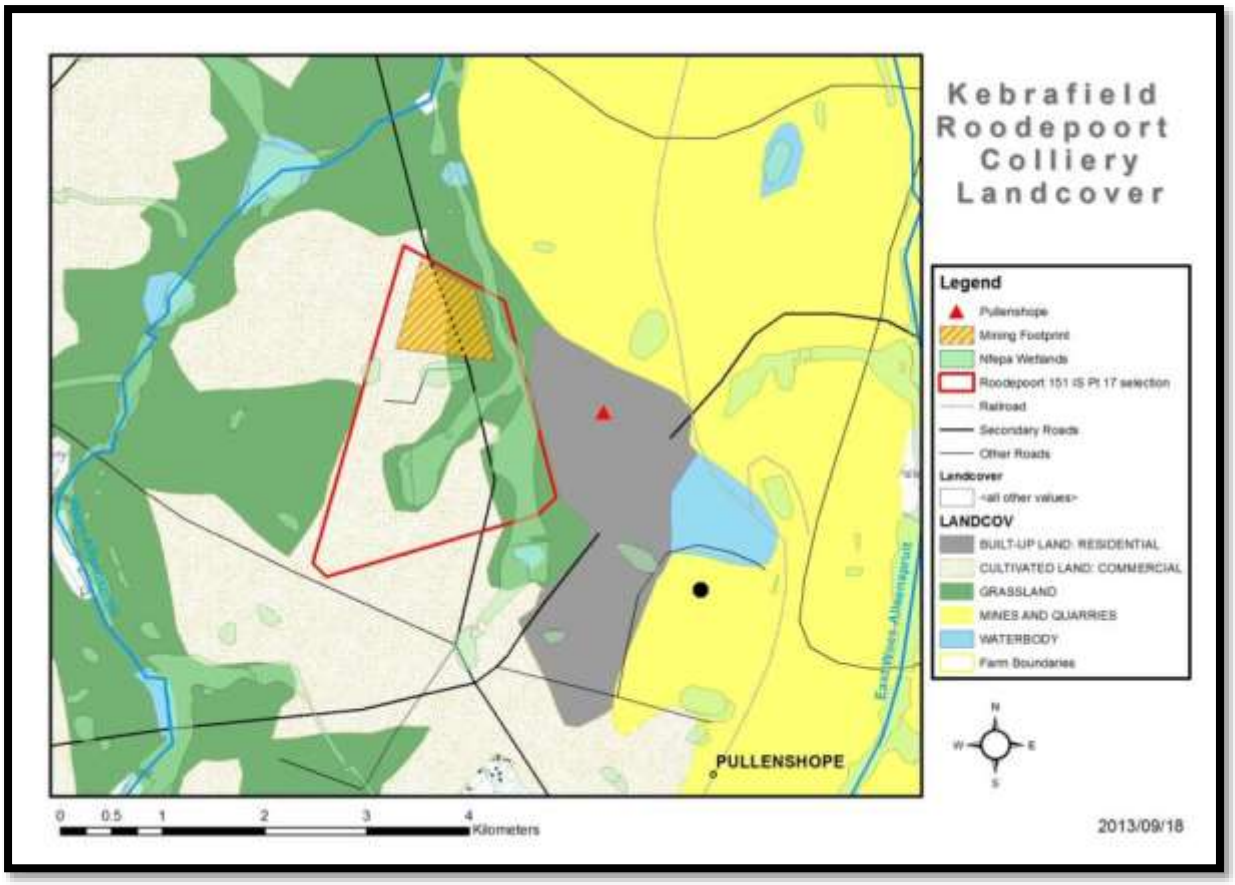

Figure 6: Land Cover map indicating overall land-cover of the study area (NFEPA and ENPAT data sets)

Land cover categories are presented in above. For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and land use categories that contribute to habitat degradation and transformation on a local or regional scale. Areas that are characterised by high levels of transformation and habitat degradation is generally accepted as being suitable for development purposes as it is unlikely that biodiversity attributes of sensitivities will be present or affected by development. Conversely, areas that are characterised by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

The status of natural habitat does however have bearing on the suitability of a site. The region comprises extensive transformed habitat that resulted from agriculture and mining, rendering remaining habitat fragmented and isolated and ultimately relatively sensitive. Little natural grassland habitat remains in the area, the majority being around streams and rivers where ploughing is not possible or soils are poor in nutrients. One of the shortfalls of the Environmental Potential Atlas database (ENPAT) is that it does not reflect the current status of natural habitat within the study area. At this stage of the process it is therefore assumed that all areas indicated to comprise of natural grassland is representative of the regional vegetation types and are in a good condition. While this assumption is unlikely to hold true for most of the study area, an assessment of the actual ecological

status of grasslands within the study area is beyond the scope of this report and will only be compiled during the EIA phase.

Surrounding land uses in the vicinity of the proposed mining site are farming with agricultural as the predominantly activity as well as Power generation and the residential areas of Pullens Hope to the right. Agricultural activities include cultivated crops with clear irrigation practices and livestock farming. Optimum Colliery is an active colliery located to the right of Portion 17.

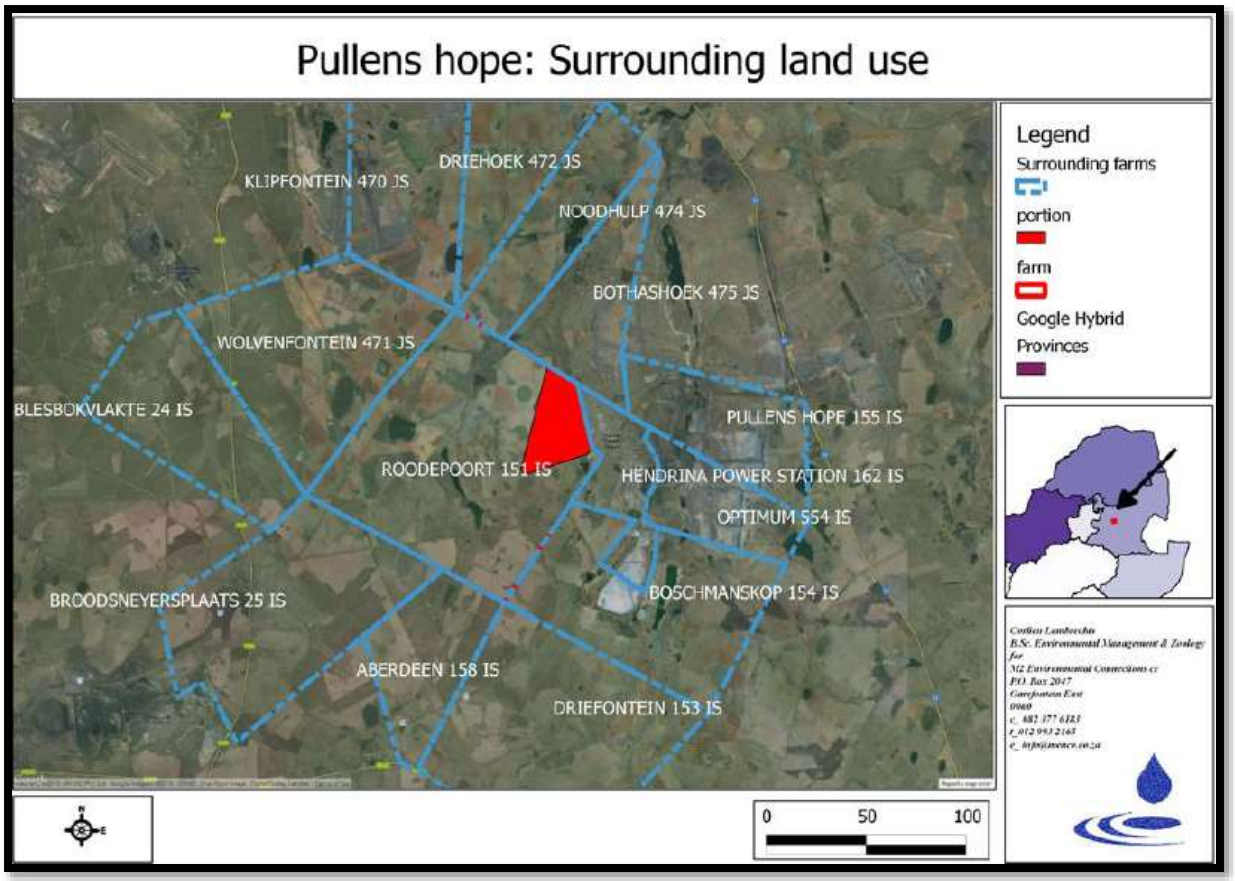

Figure 7: Surrounding land use description

Table 1: Zoning information for surrounding land uses

Title name	SG Code of Original	Zoning information
Roodepoort 151 IS	T0IS00000000015100000	Agricultural Holding (All Portions)
Bothashoek 475 JS	T0JS00000000047500000	Mining: Optimum Coal Mine
Pullens hope 155 IS	T0IS00000000015500000	Mining: Optimum Coal Mine (Portion 0 – 3, 9 - 12) Other Purposes: RSA Government Property (Portion 5) Mining: Privately Owned (Portion 6) Mining: Billiton Energy Coal (Portion 8)
Optimum 554 IS	T0IS00000000055400000	Open Cast Colliery: Mining Right
Hendrina Power Station 162 IS	T0IS00000000016200000	Other Purposes: Eskom (Portion 0) Government: Schools (Portion 1) Government: Business (Portion 2) Residential Area (Portion 4) Commercial / Industrial Purposes (Portion 6)
Boschmanskop 154 IS	T0IS00000000015400000	Agricultural Holding (All other)
		Other Purposes: Eskom (Portion 5) Commercial / Industrial Purposes (Portion 8) Mining: Optimum Coal Mine (Portion 11, 21)
Driefontein 153 IS	T0IS00000000015300000	Agricultural Holding (All other) Commercial / Industrial (Portion 38 – 41)
Aberdeen 158 IS	T0IS00000000015800000	Agricultural Holding (All)
Broodsneyersplaats 25 IS	T0IS00000000002500000	Agricultural Holding (All other) Public Service Infrastructure (Portion 14, 20, 21, 23-35) Mining: Billiton Energy Coal (Portion 9) Other Purposes: RSA Government Property (Portion 22)
Blesbokvlakte 24 IS	T0IS00000000002400000	Agricultural Holding (All other) Public Service Infrastructure (Portion 11-13)
Wolvenfontein 471 JS	T0JS00000000047100000	Agricultural Holding (All other) Mining: Anglo Operations (Portion 8) Commercial / Industrial Purposes (Portion 14) Other Purposes: RSA Government Property (Portion 15) Public Worship (Portion 23)
Klipfontein 470 JS	T0JS00000000047000000	Mining: Ingwe Surface Holdings (Portion 0-2)
Driehoek 472 JS	T0JS00000000047200000	Agricultural Holding (All)

		Other Purposes: Eskom (Portion 5) Commercial / Industrial Purposes (Portion 8) Mining: Optimum Coal Mine (Portion 11, 21)
Driefontein 153 IS	T0IS00000000015300000	Agricultural Holding (All other) Commercial / Industrial (Portion 38 – 41)
Aberdeen 158 IS	T0IS00000000015800000	Agricultural Holding (All)
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Klipfontein 470 JS	T0JS00000000047000000	Mining: Ingwe Surface Holdings (Portion 0-2)
Driehoek 472 JS	T0JS00000000047200000	Agricultural Holding (All)

4. OVERVIEW

Sound is created when an object vibrates and radiates part of that energy as acoustic pressure or waves through a medium, such as air, water or a solid. Sound and noise are measured in units of decibels (dB). The dB scale is not linear but logarithmic. This means, for example, that if two identical noise sources, each producing 60 dB, operate simultaneously they will generate 63 dB. Similarly, a 10-decibel increase in sound levels represents ten times as much sound energy.

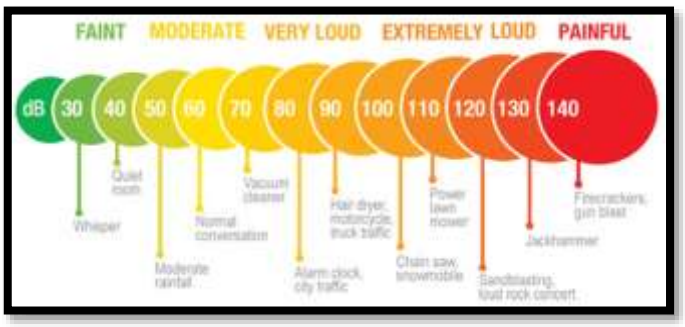
The human ear can accommodate a wide range of sound energy levels, including pressure fluctuations that increase by more than a million times. The human ear is not equally receptive to all frequencies of sound. The A-weighting of sound levels is a method used to approximate how the human ear would perceive a sound, mostly by reducing the contribution from lower frequencies by a specified amount. The unit for the A-weighted sound levels is dB(A).

Small changes in ambient sound levels will not be able to be detected by the human ear. Most people will not notice a difference in loudness of sound levels of less than 3 dB(A), which is a two-fold change in the sound energy. A 10-dB(A) change in sound levels would be perceived as doubling of sound loudness.

The level of ambient sound usually varies continuously with time. A human's subjective response to varying sounds is primarily governed by the total sound energy received. The total sound energy is the average level of the fluctuating sound, occurring over a period of time, multiplied by the total time period.

In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, nonvarying sound that will produce the same energy during the same time period. The average of the fluctuating noise levels over the time period is termed Leq, and it represents the constant noise level that would produce the same sound energy over the time period as the fluctuating noise level.

The atmospheric conditions, interference from other objects and ground effects also play an important role in the resulting noise levels. For example, "hard" ground, such as asphalt or cement transmits sound differently than "soft" ground, such as grass. The first ground type promotes transmission of sound, thus producing louder sound levels farther from the source. In general terms, the above effects increase with distance, and the magnitude of the effect depends upon the frequency of the sound. The effects tend to be greater at high frequencies and less at low frequencies.



Examples	Sound Pressure Level L_p dBSPL
Jet aircraft, 50 m away	140
Threshold of pain	130
Threshold of discomfort	120
Chainsaw, 1m distance	110
Disco, 1 m from speaker	100
Diesel truck, 10 m away	90
Kerbside of busy road, 5 m	80
Vacuum cleaner, distance 1 m	70
Rough Pump without Whisper 9000	60
Conversational speech, 1m	60
Rough Pump in Whisper 9000	50
Average home	50
Quiet library	40
Quiet bedroom at night	30
Background in TV studio	20
Rustling leaf	10
Threshold of hearing	0

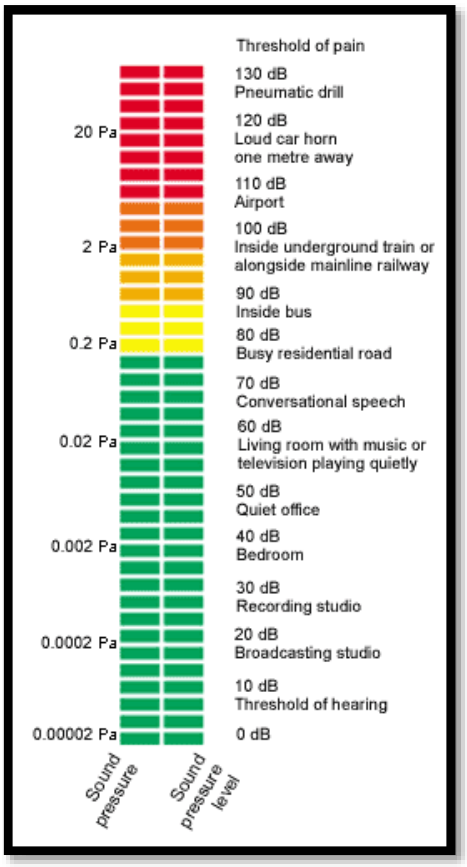


Figure 8: Typical noise levels for various environments

5. RELEVANT LEGISLATION, GUIDELINES AND STANDARDS

5.1. INTERNATIONAL GUIDELINES AND STANDARDS

In general, the standards applied by the international community are similar for different countries. Internationally, the current trends are to apply more stringent criteria due to the deteriorating noise climate. The noise impacts due to a proposed project are generally based on the difference between the expected noise level increase and the existing noise levels in the area, as well as on comparisons against area-specific noise guidelines.

The available international guidelines are presented in the sections below and have taken into consideration the following adverse effects of noise:

- Annoyance.
- Speech intelligibility and communication interference.
- Disturbance of information extraction.
- Sleep disturbance.

- Hearing impairment.

The World Health Organisation (WHO) together with the Organisation for Economic Co-ordination and Development (OECD) have developed their own guidelines based on the effects of the exposure to environmental noise. These provide recommended noise levels for different area types and time periods.

The World Health Organisation has recommended that a standard guideline value for average outdoor noise levels of 55 dB(A) be applied during normal daytime, in order to prevent significant interference with the normal activities of local communities. The relevant night-time noise level is 45 dB(A). The WHO further recommends that, during the night, the maximum level of any single event should not exceed 60 dB(A). This limit is to protect against sleep disruption. In addition, ambient noise levels have been specified for various environments. These levels are presented in the table below.

Table 2: Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	Leq [dBA]	Time base [hours]	Lmax, fast [dBA]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech comprehension and moderate annoyance, daytime and evening	35	16	45
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	sleeping-time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110

Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 #2
	Hearing impairment (children)	-	-	120 #2
Outdoors in parkland and conservation areas	Disruption of tranquillity	#3		

#1: as low as possible

#2: peak sound pressure (not Lmax, fast), measured 100 mm from the ear

#3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low

#4: under headphones, adapted to free-field values

The WHO specifies that an environmental noise impact analysis is required before implementing any project that would significantly increase the level of environmental noise in a community (WHO, 1999). Significant increase is considered a noise level increase of greater than 5 dB.

The World Bank Group (WBG, 1998) has developed a program in pollution management so as to ensure that the projects they finance in developing countries are environmentally sound. Noise is one of the pollutants covered by their policy. It specifies that noise levels measured at noise receptors, located outside the project's property boundary, should not be 3 dB(A) greater than the background noise levels, or exceed the noise levels depicted in the below table.

The International Finance Corporation (IFC) has recently revised and published Performance Standards on Social & Environmental Sustainability (April 2006). Performance Standard 3 regarding "Pollution Prevention and Abatement" deals with forms of pollution such as noise, and adopts the WBG guidelines presented in the table above. The Standard also refers to the WHO Guidelines for Community Noise (WHO, 1999) for the provision of guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Table 3: IFC/WBG Recommended noise limits

Receptor	Maximum Allowable Ambient Noise Levels 1-hour LAeq (dB(A))	
	Daytime 07:00 – 22:00	Night-time 22:00 – 07:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70
Note: No LAeq values are stipulated for rural areas.		

5.2. SOUTH AFRICAN LEGISLATION AND STANDARDS

The original noise regulations pertaining to noise were published in 1990 under the Environment Conservation Act, 1989. At first they were not compulsory and local authorities were required to apply for permission to make them legally applicable in its area of jurisdiction. Since this lead to an unsatisfactory number of applications, the noise regulations were made compulsory in 1992. However, the arrival of the new Constitution in 1994 voided the legal driving force behind these regulations, since the issue of environmental noise was handed down from national to provincial level. The Minister of the Environment did circulate sample noise regulations to the provinces in 1997, which they could adopt unchanged or adapt to their own requirements. To date this has happened in only three provinces, i.e. the Free State, Gauteng and Western Cape.

The original sample noise regulations contain a number of serious flaws and a thorough revision has been undertaken. These revised national noise regulations have been circulated for comments. They will be published under the Air Quality Act, 2005. However, it is not clear when this will actually happen and until then the regulatory situation in most of the provinces will remain uncertain.

In terms of the setting of standards the new regulations will make direct and extensive reference to South African National Standard (SANS) 10103. This is a very successful document addressing the technical requirements for environmental noise measurements and the assessment of the results in the South African context. It is in line with the guidelines provided by the World Health Organisation (WHO) as mentioned in the previous section and conforms to the requirements of standards ISO 1996 Parts 1 and 2 issued by the International Standards Organisation (ISO).

In the table below of SANS 10103 typical ambient noise levels in different types of districts are listed.

Table 4: Typical ambient noise levels (as per SANS 10103 Table 2)

Type of district	Noise level, dBA		
	$L_{R,dn}$	$L_{Req,d}$	$L_{Req,n}$
a) Rural districts	45	45	35
b) Suburban districts with little road traffic	50	50	40
c) Urban districts	55	55	45
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50

e) Central business districts	65	65	55
f) Industrial districts	70	70	60

5.3. COMPARISON OF DIFFERENT SEPCIFIED AMBIENT NOISE LEVELS

The different noise levels presented in the previous paragraphs, including South African and International, has been presented in a comparative manner in the table below.

Table 5: Comparison of specified ambient noise levels

Document	Type	Description of the environment	L_{Aeq} dBA	
			Day	Night
SANS 10103	A	Rural districts	45	35
	B	Suburban districts with little road traffic	50	40
	C	Urban districts	55	45
	D	Urban districts with one or more of the following: workshops; business premises; and main roads	60	50
	E	Central business districts	65	55
	F	Industrial districts	70	60
WHO, WB, IFC	1	Residential; institutional; educational	55	45
	2	Industrial; commercial	70	70

It is clear that SANS 10103 provides a considerably more differentiated set of districts and associated ambient noise levels than each of the WHO, WB or IFC guidelines. Although there is agreement between the ambient noise levels of types (c) '*Urban districts'* and (1) '*Residential; institutional; educational'* those associated with type (a) *'Rural districts'* are more than likely applicable to the environment of the Project.

6. METHODOLOGY

The approach that was used during investigating noise impacts is based on guidelines provided by SANS 10103:2008. According to the SANS 10103:2008 the sound pressure level is used as the measurement unit for noise guidelines. The acceptab le rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non-residential) are presented in the tables below.

Table 6: Acceptable rating levels for noise in districts (SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg,T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
RESIDENTAIL DISTRICTS						
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
NON-RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) 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 the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7

NOTE 3 In districts where outdoor $L_{R,dn}$ exceeds 55 dBA, 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.

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 24 h day/night cycle, LReq,d = LReq,n =70 dBA can be considered as typical and normal.

NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous 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 Weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.

a The values given in columns 2 and 5 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 in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.

The probable community/group response to levels in excess of the acceptable rating levels are presented in the table below, where LReq,T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time period of not less than 30 minutes. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 7: Categories of community/group response (SANS 10103, 2008)

Excess ($\Delta L_{Req,T}$)[a]dBA	Estimated community/group response	
	Category	Description
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of action
>15	Very strong	Vigorous 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) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS LReq,T of the residual noise (determined in the absence of the specific noise under investigation);		
2) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;		
3) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or		
4) $\Delta L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.		

For our study baseline noise measurements were taken at some sensitive noise sensitive receivers surrounding the proposed Kebrafield Roodepoort Colliery. The baseline noise measurements were carried out to assess the current ambient noise levels in the area. According to the SANS 10103:2008 guidelines 'daytime' is defined as anytime between 06:00 to 22:00, and 'night time' between 22:00 to 06:00. As a result of these guidelines, most measurements were taken for an 8 hour period to incorporate day and night time levels. Predictive modelling was not performed for the proposed mining activities but could be done in the future through the use of the modelling software SoundPlan.

A Sauter SU 130 Professional sound level meter, class II was used during the baseline assessment. The image below depicts the instrumentation that was used.

Features of the Sauter SU 130 Professional instrument includes;

- Professional sound level meter for measuring noise in areas such as, for example, the environment, mechanical applications, car industry and much more
- Measures the sound intensity in the work-place
- Helps in differentiating between normal noise influences, and excessive noise, e.g. in a production hall
- Multi measuring functions:
  - Lp: Standard sound level measuring function
  - Leq: Energy equivalent sound level measuring mode (type A)
  - Ln: Shows the deviation from a predefined limit in %
- Selectable methods of evaluation:
  - A: As sensitive as the human ear
  - C: Sensitive for noisier environmental conditions, where there are machines, plant, motors etc.
  - F: For areas where sound intensity does not vary

Table 8: Sauter SU 130 Professional sound level meter, class II specifications

Model SAUTER	Type	Measuring range dB	Readout dB
SU 130.	Lp A	30 - 130	0,1
	Lp C	35 - 130	
	Lp F	35 - 130	

Figure 9: Sauter SU 130 Professional sound level meter, class II

Table 9: Noise measurements locality descriptions

Site Reference	Location Description	GPS Coordinates
N 001	North-East of the proposed activity	26° 0'13.12"S 29°34'58.96"E

N 002	South-East of the proposed activity	26° 0'29.70"S 29°35'5.89"E
N 003	West of the proposed activity	26° 0'19.24"S 29°34'36.52"E

Figure 10: Noise measurement locations

7. BASELINE NOISE MEASUREING RESULTS

The results from the noise meter recordings which was taken between 14-15 May 2014 for all the sampled points as well as the rating limits according to the SANS 10103:2008 guidelines are presented in the table below.

Table 10: Noise measurement results

Sample Ref	Type of District	Period	Acceptable rating level dBA	L_{AreqT} dBA	Maximum dBA	Minimum dBA
N 001	Rural	Daytime	45	61	92	46
		Night Time	35	42	71	42
N 002	Suburban	Daytime	50	57	82	43
		Night Time	40	43	72	40

N 003	Rural	Daytime	45	44	73	38
		Night Time	35	34	69	37

The figure indicated in red in the above table indicates areas where the current L_{AeqT} levels were above the daytime and/or night time rating limits according to SANS 10103:2008 Rating Limits.

8. DISCUSSION OF THE BASELINE NOISE MEASUREING RESULTS

Based on the daytime results from the baseline environmental noise measurements it is noted that the LAeq levels at most locations measured above the SANS guidelines for the maximum allowable outdoor daytime limit for ambient noise in rural districts. When considering the image depicted earlier on indicating the sampling point localities could the following conclusions be drawn for the individual sampling points.

N 001 is situated to the North East of the proposed activity and approximately 200m from the railway line but also approximately 600m from the Optimum colliery operations. Noise from both these sources could be heard during the measurement period. The highest measurement was at N001 at 92dBA during the daytime when commercial activities such as mining and use of the railroad was being undertaken.

N 002 which is situated to the South East of the proposed activity is in very close proximity on the boundary of the town Pullenshope. Noise sources that were identified during the measurements were similar as for N 002 but in addition includes vehicle movement, dogs and chickens that were being kept inside inside the properties at this monitoring location.

N 003 was the only sampling point that actually fell within the limits of SANS and was situated between the maize fields and truly represents a rural setting. Vehicle movement on the main gravel road transgressing the study area was very low and less than 30 vehicles used this road during the study period. The lowet measurement both daytime and night time was recorded at this sampling point.

The noise sources that were audible during the base line measurements at the time of the noise survey and that were responsible for the day/night time level are summarised in the table below.

Table 11: Summary of noise sources influencing ambient noise levels at noise sensitive receivers around the proposed site.

Noise Source Descriptions			
Daytime	**Exposure**	**Night Time**	**Exposure**
Mining Activities North	Continuous	Mining activities North	Intermittent

East of proposed activity		East of proposed activity	
Domestic animals - dogs	Intermittent	Domestic animals - dogs	Intermittent
Vehicle movement on main gravel road transecting study area	Intermitted	Vehicle movement on main gravel road transecting study area	Intermittent
Birdsong	Continuous	Birdsong	Limited to dusk and dawn
Vehicle movement inside the town of Pullenshope	Continuous	Vehicle movement inside the town of Pullenshope	Intermittent

9. FINDINGS

9.1. PREDICTED IMPACTS

Mining activities are associated with the generation of noise and therefore the proposed activity will also contribute to the generation of noise. The table below gives a general prediction of the noise levels that could be expected due to the mining activities. Although very difficult to determine exactly the intensity of the noise impacts, from past studies it could be gathered that impacts would most probably be in the range of the table below.

Anticipated noise source	Expected noise level at source measured in dBA
Front end loaders	+- 95
Dozers	+- 95
Haul trucks	+- 90
Blasting	+- 130

Earth moving equipment such as the front end loaders and dozers will be the primary source of continuous noise impact. Haul trucks will also be a continuous noise source although the predicted impact will be less than for the earth moving equipment. The loudest noise will be from the blasting although this noise source will only be intermittent.

9.2. FINDINGS PER MINING PHASE

9.2.1. CONSTRUCTION PHASE

It is assumed that the construction activities will only take place during daylight hours. The following activities during the construction phase are identified as possible noise sources and may impact on the ambient noise level of the area:

- Site Clearing: Stripping and removal of topsoil & vegetation;
- Construction of any surface infrastructure e.g. haul roads, pipes, stormwater diversion berms (including transportation of materials & stockpiling); and
- Blasting and development of initial boxcut for mining (incl. stockpiling from initial cuts)

Potential impact: The construction machinery will be a source of continuous noise throughout the construction phase. The blasting activities during the construction phase are identified as the highest noise producing source, the noise from blasting is called impulsive noise, it is brief and abrupt, and its startling effect causes greater annoyance than would be expected from continuous noise sources.

9.2.2. OPERTIONAL PHASE

The following activities during the operational phase are identified as possible noise sources and may impact on the ambient noise level at the relevant noise sensitive receivers:

- Removal of overburden and backfilling when possible (including drilling/blasting hard overburden & stockpiling);
- Use and maintenance of haul roads (incl. transportation of coal to washing plant off site);
- Removal of coal (mining process) and ROM coal Stockpile; and
- Concurrent roll-over bacfill rehabilitation and replacement of overburden, topsoil and revegetation.

Potential impact:

The machinery involved with the above mentioned activities will be a source of continuous noise throughout the operational phase. The blasting activities during the operational phase are identified as the highest noise producing source, the noise from blasting is called impulsive noise, it is brief and abrupt, and its startling effect causes greater annoyance than would be expected from continuous noise sources.

9.2.3. DECOMMISSIONING/CLOSURE PHASE

It is assumed that the decommissioning activities will only take place during daylight hours. The following activities during the decommissioning phase are identified as possible noise sources and may impact on the ambient noise level at the relevant noise sensitive receivers:

- Demolition & Removal of all infrastructure (incl. transportation off site); and
- Rehabilitation (spreading of soil, revegetation & profiling/contouring);

Potential impact:

The machinery involved with the above mentioned activities will be a source of continuous noise throughout the decommissioning phase. The results will be similar to that of the construction phase with regards to the expected noise levels, therefore it is probable that the noise from the proposed mining activities will be similar or lower to that of the current ambient noise levels at the indicated noise sensitive receivers.

10. PROPOSED MITIGATION MEASURES

The objectives described for the recommended mitigation and/or management measures for each identified impact associated with each activity are presented in the section below. This section list the relevant activities for each phase of the mining operation and provides information pertaining to the legal requirements, recommended actions plans, timing, responsible person and significance after mitigation.

10.1. CONSTRUCTION PHASE

Activities;

- Site Clearing: Stripping and removal of topsoil & vegetation;
- Construction of any surface infrastructure e.g. haul roads, pipes, stormwater diversion berms (including transportation of materials & stockpiling); and
- Blasting and development of initial boxcut for mining (incl. stockpiling from initial cuts)

Objectives;

To prevent the noise emanating from the construction machinery from impacting on the sensitive noise sensitive receivers

Management and mitigation measures;

A noise barrier in the form of a berm should be constructed on the eastern boundary of the proposed opencast area as soon as possible, so that it is situated between the main noise source noise sensitive receivers which is

mainly the town of Pullenshope. The berm will help with the attenuation of noise produced by the mining activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.

Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; Switching off equipment when not in use; and fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. The barriers should be installed between the noise source and sensitive noise receptor, as close to the noise source as possible.

All project employees and contractors will be instructed to avoid the use of engine compression brakes when approaching the Mine entrance or driving through or in the vicinity of the town of Pullenshope. All access roads will be signposted and speed limited to minimise transport noise. Equipment with lower sound power levels would be used in preference to more noisy equipment. All equipment used onsite will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling to assess generated noise levels and compliance with the criteria. The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.

As for the blasting operations it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. The following with regards to blasting operations is recommended: The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended. Reduction of the powder factor, that is, use of less explosive per cubic meter of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed; and maintaining good public relations with the surrounding communities i.e warning the local communities in advance before blasts.

Monitoring;

Regular vehicle inspections are required while a noise monitoring programme must be developed. Noise and vibrations should be measured during blasting.

10.2. OPERATIONAL PHASE

Activities;

- Removal of overburden and backfilling when possible (including drilling/blasting hard overburden & stockpiling);

- Use and maintenance of haul roads (incl. transportation of coal to washing plant off site);
- Removal of coal (mining process) and ROM coal Stockpile; and
- Concurrent roll-over bacfill rehabilitation and replacement of overburden, topsoil and revegetation.

Objectives;

To prevent the noise emanating from the mining machinery from impacting on the sensitive noise sensitive receivers

Management and mitigation measures;

A noise barrier in the form of a berm should be constructed on the eastern boundary of the proposed opencast area as soon as possible, so that it is situated between the main noise source noise sensitive receivers which is mainly the town of Pullenshope. The berm will help with the attenuation of noise produced by the mining activities. A basic rule of thumb for barrier height is: Any noise barrier should be at least as tall as the line-of-sight between the noise source and the receiver, plus 30%. So if the line-of-sight is 10m high, then the barrier should be at least 13m tall for best performance.

Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; Switching off equipment when not in use; and fixed noise producing sources such as generators, pump stations and crushers to be to be either housed in enclosures or barriers put up around the noise source. The barriers should be installed between the noise source and sensitive noise receptor, as close to the noise source as possible.

All project employees and contractors will be instructed to avoid the use of engine compression brakes when approaching the Mine entrance or driving through or in the vicinity of the town of Pullenshope. All access roads will be signposted and speed limited to minimise transport noise. Equipment with lower sound power levels would be used in preference to more noisy equipment. All equipment used onsite will be regularly serviced to ensure the sound power levels remain at or below the levels used in the modelling to assess generated noise levels and compliance with the criteria. The on-site road network will be well maintained to limit body noise from empty trucks travelling on internal roads.

As for the blasting operations it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. The following with regards to blasting operations is recommended: The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended. Reduction of the powder factor, that is, use of less explosive per cubic meter of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed; and maintaining good public relations with the surrounding communities i.e warning the local communities in advance before blasts.

Monitoring;

Regular vehicle inspections are required while a noise monitoring programme must be developed. Noise and vibrations should be measured during blasting.

10.3. DECOMMISSIONING/CLOSURE PHASE

Activities;

- Demolition & Removal of all infrastructure (incl. transportation off site); and
- Rehabilitation (spreading of soil, revegetation & profiling/contouring);

Objectives;

To prevent the noise emanating from the mining machinery from impacting on the sensitive noise sensitive receivers

Management and mitigation measures;

Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers and switching off equipment when not in use.

Limiting decommissioning/closure and rehabilitation activities to daylight hours.

Monitoring;

Regular vehicle inspections are required while a noise monitoring programme must be developed.

11. MONITORING PROGRAMME

It is recommended that the monitoring plan be implemented to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required.

Components to be included in the proposed monitoring plan are discussed below.

Noise monitoring is to be conducted on a quarterly basis throughout the life of mine to determine the impact of the noise levels on the relevant noise sensitive receivers as well as determine the level of mitigation.

The noise measurements should be taken as per the baseline noise measurement locations of this report although additional noise monitoring points should be identified should other sensitive receptors become known during the physical implementation of the activity. A report must be compiled quarterly and submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. At each measurement point the ambient noise level will be sampled in terms of the following parameters:

- The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.
- Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

12. CONCLUSION

Through the baseline noise investigation has measurements been taken which can be used in the future once the proposed activity commence as a basis or reference points. The noise measurements will serve as part of the management tool during continuous monitoring during the life of mine to determine whther significant increases has occurred that require management and mitigation measures that might be more stringent than what have been listed in this particular report. Should the need arise would specialised noise practitioners be approached to assist with noise modelling in order to determine the exact location and design of specialised noise barriers in between the proposed activity and the sensitive receptors, although currently the management and mitigation measure of constructing berms around the entire facility should suffice.

Due to the short duration of the operation and small scale in relation to other coal mining operations is the expected impact minimal, although the close proximity of the town of Pullenshope might become a concern. Taking into account the fact that the town already receive noise from the Eskom Poser Station activities, the railroad, main road which has a lot of haulage vehicles on and the current proximity to existing coal mines, would the proposed activity not be unique in any sense and would the community already be aware of the anticipated impacts that mining has on their livelihood. Through thorough implementation of the proposed management and mitigation measures as well as adhering to the proposed monitoring programme can the impacts be minimised to an extent that the proposed activity can be carried out without significant harm to the receiving environment.