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Environmental Regulatory Process Required to Amend and Consolidate the Mooikraal Colliery Environmental Management Programme Report, Sasolburg, Free State

Noise Impact Assessment Report

Project Number:

SAS5175

Prepared for:

Sasol Mining (Pty) Ltd

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EXECUTIVE SUMMARY

The Sasol Mining (Pty) Ltd (Sasol Mining), Sigma Colliery consists of two components, namely the operational complexes comprising Mooikraal Colliery (Mooikraal) and 3 Shaft Complex (3 Shaft), and the non-operational Sigma Defunct Colliery. This document only considers the Project as relevant to Mooikraal and 3 Shaft.

Mooikraal is an underground coal mine located in Sasolburg. It currently operates under a consolidated Mining Right and approved amended Environmental Management Programme (EMP) granted in April 2016. The authorisation permits the undertaking of various activities associated with the underground coal mining operation.

Mooikraal is now proposing to relocate the conveyor belt and associated crusher facility located at 3 Shaft. In addition, Mooikraal wish to amend and consolidate the approved Mooikraal EMPr. An environmental regulatory process is thus required to obtain the necessary Environmental Authorisation (EA) and associated approvals.

Digby Wells Environmental (Digby Wells) has been appointed by Sasol Mining to complete an integrated environmental regulatory applications process for authorisations required in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

This report assesses the potential noise impacts of the basic assessment activities, proposed amendment as well as installation of fogger cannons on the ambient noise climate of the area. The methodology used the Free State Noise Control Regulations to assess the baseline and potential impacts.

This environmental noise impact assessment report is compiled in support of the integrated environmental regulatory applications process for authorisations and entails:

- Identification of noise sources and potential noise sensitive receptors;
- Establish baseline noise climate at various locations around the proposed project area;
- Assess the anticipated noise impacts associated with the project activities during the construction (where applicable), operational, decommissioning and post-closure phases; and
- Provide relevant mitigation measures, a management plan and monitoring programme if applicable.

Based on the daytime measurements at the surrounding receptors, the existing ambient sound levels are above the SANS 10103:2008 guidelines for both districts (rural 45 dBA) and urban (55 dBA) standards. The average noise level (L_{Aeq}) measured, varied from 46 to 60 dBA where the main sources impacting on the measurements were produced by vehicles, workshops, socialising activities and sirens going off at 3 Shaft.

The results of the dispersion models indicate that the expected noise from the new components of the project will not measure above the existing ambient noise levels at the surrounding receptors. It is however established that the stockpiling area is currently impacting on the ambient noise levels at the neighbouring urban area of Zamdela as indicated by the measured levels at location N4. It is noted that no complaints from the community have been reported probably due to the community being desensitised by the noise from the coal handling activities having started during the 1950's (roughly the same time as the establishment of the neighbouring areas of Zamdela) and gradually increased in footprint.

It is recommended that if any noise related complaints are received from the existing infrastructure, Mooikraal investigate the complaint, and put into place actions to address excessive noise.

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Abbreviation	Description
L_{eq}	It is the Sound Pressure Level in dB, equivalent to the total Sound Energy over a given period of time.
A-weighting	the A-weighting filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at the lower levels
L_{AeqI}	A-frequency weighted, equivalent sound level value for a specific period measured using Impulse – time weighting.
Ambient Noise	Is the noise from all sources combined − mining noise, traffic noise, birdsong, running water, etc.
Residual Noise	It is ambient noise without specific noise. The residual noise is the noise remaining at a point under certain conditions when the noise from the specific source is suppressed.
Intermittent Noise	When machinery operates in cycles, or when single vehicles or aeroplanes pass by, the noise level increases and decreases rapidly. A single passing vehicle or aircraft is called an event.
Impulsive Noise	The noise from impacts or explosions, e.g., from blasting, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level.
Specific Noise	It is the noise from the source under investigation. The specific noise is a component of the ambient noise and can be identified and associated with the specific source.
Noise Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes, after such meter had been put into operation, and, if the alleged disturbing noise has a discernible pitch, to which 5 dab has been added.
Disturbing Noise	Means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in Table 2 of SANS 10103:2008
Water hammer	When a pipe is suddenly closed at the outlet (downstream), the mass of water/slurry before the closure is still moving, thereby building up high pressure and a resulting shock wave. This is experienced as a loud banging, resembling a hammering noise.

1 Introduction

The Sasol Mining (Pty) Ltd (Sasol Mining), Sigma Colliery, Mooikraal consists of two components, Mooikraal Colliery (Mooikraal) and 3 Shaft Complex (3 Shaft).

The Mooikraal is an operational underground coal mine located near Sasolburg. It currently operates under a consolidated Mining Right (Reference No. FS 30/5/1/2/2/2/1/221) and approved amended Environmental Management Programme (EMP) (Reference No. 30/5/1/2/3/2/1 (221) EM) granted in April 2016. The authorisation permits the undertaking of various activities associated with the underground coal mining operation.

Mooikraal also holds a separate approved EA (Reference No. EMB/28/14/43 dated 09 March 2015) for a 10 and 7Ml/day (Ml/day) water transfer pipelines. The 7 Ml/day pipeline authorises the transport of water from the Kleinvlei Ventilation Shaft and the 10 Ml/day pipeline is authorised to transport water from the Mooikraal pollution control dam to Sasolburg Operations.

Mooikraal is now proposing to reconfigure and relocate the conveyer belt series and existing crusher facility currently located at the 3 Shaft primary plant area. In addition Mooikraal also wishes to amend and consolidate the approved Mooikraal EMPr to include all activities and properties associated with the proposed operations. An environmental regulatory process is thus required to obtain the necessary EA and associated approvals.

As part of the dust management philosophy at 3 Shaft, Mooikraal envisages installing fogger cannons at the 3 Shaft area.

Through this environmental authorisation process, it is intended that the following will be undertaken:

- Listed Activities now triggered in terms of the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) (Government Notice No. R. 982 of 4 December 2014 as amended by Government Notice No. R.326 of 7 April 2017) referred to hereinafter as the EIA regulations, 2014 (as amended) promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) will be applied for; and
- Incorporate all activities at the Mooikraal and 3 Shaft operation into an amended EMPr so as to ensure that all activities are lawfully executed.

1.1 Project Description

Mooikraal is located approximately 18 kilometres (km) from the Sigma Defunct Colliery and 18 km southwest of Sasolburg in the Fezile Dabi District Municipality, Free State Province. The mine began operation in 2005 and has a Life of Mine (LoM) of 34 years until 2039.

Mooikraal is extracting coal utilising the underground bord and pillar mining method, however in some areas high extraction mining is taking place. The coal is transported via a conveyor belt underground and brought to surface via the same incline shaft which is used

to enter the mine. The coal is then stored in a silo. Subsequently the coal is conveyed via an 18 km conveyor belt (MK3 – KM8 Belt) from Mooikraal to 3 Shaft where the coal is crushed, screened and then stockpiled before it is transported to Sasolburg Operations for further use.

The following infrastructure is currently present at Mooikraal:

- Incline shaft, coal silo and emergency coal throw out area;
- Ventilation Shaft (Kleinvlei Shaft and various downcasts);
- Pollution Control Dams (PCDs);
- Three sumps (washbay, fuel storage, shaft);
- Clean and dirty water channels;
- Explosive magazine;
- Material and equipment storage area;
- Soil stockpiles;
- Waste Rock Dump (WRD);
- Sewage Treatment Plant (STP);
- Waste storage area / ISO Yard;
- Workshops, warehouses and wash bay;
- Bulk fuel and oil storage area;
- Chemical storage area;
- Electricity supply structures including pylons, transformers and bunds, cabling
- Boreholes (rescue and water monitoring)
- Access roads;
- Box-cut material storage area;
- Dust suppression storage area and bund;
- Borrow pits;
- Coal conveyor belt and associated infrastructure such as transfer stations;
- 10 Ml pipeline from Mooikraal to SSO;
- 7 Ml pipeline from Kleinvlei Shaft to SSO; and
- Administration buildings and change houses.

The following infrastructure is present at 3 Shaft:

- Primary plant area (including a crusher facility), stockpile area (including stacker reclaimer for ROM and imported coal)
- 4 Shaft coal bunker;
- Coal conveyor belt;
- Haul Roads for imported coal truck transport ;
- Bulk fuel and oil storage area and workshops;
- Waste storage area;
- Weighbridge
- Contractors storage yard;
- Workshops (diesel and boiler);
- Chemical storage area;
- Administration buildings and change houses.
- Pipelines
- Dirty water storage dam; and
- Old dams currently not in use and proposed to be demolished.

The following activities are proposed to be undertaken as part of this project:

- Demolition of the existing conveyor belt, crushing facility and coal bunker which is currently situated within a wetland at the 3 Shaft (primary plant);
- Relocation/reconstruction the primary plant (crusher facility) to the concreted stockpile area (to remain within the 3 Shaft footprint);
- Installing a conveyor belt from the MK8 transfer point to the stockpile area which will traverse a delineated wetland (within the 3 Shaft footprint);
- Proposed upgrade of the storm water management system at 3 Shaft;
- Rehabilitation of the existing wetland at 3 Shaft;
- Drilling of exploration, monitoring and rescue boreholes within the approved Mooikraal Mining Right area and 3 Shaft;
- Incorporate all activities at Mooikraal, Kleinvlei, 3 Shaft and along both servitudes into the EMPr;
- Incorporate the 7 and 10 Ml/day pipeline EA into the EMPr; and
- Incorporate all properties located within Mooikraal, Kleinvlei, 3 Shaft and along both servitudes into the EMPr.

1.2 Terms of Reference

This report relates specifically to the environmental noise impacts of the proposed amendments such as the proposed conveyor and proposed new plant location at 3 Shaft. In addition, Mooikraal requested Digby Wells to include the envisaged fogger cannon installation at 3 shaft into the noise impact assessment.

The approach used in investigating the noise impacts is based on the Free State Noise Control Regulations as published under GN24 (PG 35 of 24 April 1998) in terms of section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989).

The following additional legislation and standards were also considered during the assessment:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The South African National Standards SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication” (SANS 10103:2008).

The Environmental Noise Impact Assessment Report includes a baseline assessment and predicted noise impacts on the identified noise sensitive receptors by use of noise dispersion modelling as well as recommendations and mitigation measures for potential impacts.

2 Details of the Specialist

Lukas Sadler is an Affiliate Member of the Institute of Acoustics and has a B.Com degree in Geography and Environmental Management, including short courses in Environmental Noise Assessments, Environmental Noise Control and Air Quality Management as well as local and international work experience in the environmental acoustic sciences field. This includes experience working with projects in accordance with the International Finance Corporation (IFC) and World Bank Standards. Lukas has also gained experience working in Africa namely Mali, Senegal, Ghana, Sierra Leone, the Democratic Republic of Congo, Liberia, Mozambique and Namibia. As an independent contractor, Lukas’ core focus is working on environmental noise impact assessments, which includes baseline noise monitoring surveys, noise dispersion modelling and noise management programmes as well as carrying out compliance monitoring programmes. A Curriculum Vitae (CV) is attached in Appendix A.

3 Aim and Objectives

The aim of the study is to assess what the current ambient noise levels are in the area as well as what the significance of the noise impacts from the basic assessment activities and fogger cannons will be on the surrounding area. To achieve this, baseline noise measurements were conducted to establish the soundscape of the area surrounding the proposed Project, as well as assess, via predictive noise dispersion modelling, model predications were compared against regulatory standards to establish compliance.

4 Methodology

4.1 Literature Review and Desktop Assessment

The approach used in investigating noise impacts is based on the Free State Noise Regulations as well as guidelines provided by SANS 10103:2008 “The measurement and rating of environmental noise with respect to annoyance and to speech communication”. Based on the Noise Regulations it is prohibited to make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof. According to the Noise Regulations "disturbing noise" means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

According to the SANS 10103:2008, the sound pressure level is used as the measurement unit for noise levels. The acceptable rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non-residential) are presented in Table 4-1.

Table 4-1: Typical 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]
Residential 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						

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]
NOTE 3 In districts where outdoor LR,dn exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor LReq,T values in line with those given in table 1.						
NOTE 4 For industrial districts, the LR,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 background ambient rating levels are presented in Table 4-2, where $L_{Req,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels (dBA), determined over a specific time period. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. Thus, if the background ambient noise level is 50 dB, a 0 -10 dB increase in noise will elicit sporadic complaints, and an excess of 15 dB will elicit vigorous action.

Table 4-2: 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 ΔLReq,T should be calculated from the appropriate of the following:		
1) ΔLReq,T = LReq,T of ambient noise under investigation MINUS LReq,T of the residual noise (determined in the absence of the specific noise under investigation);		
2) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;		
3) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or		
4) ΔLReq,T = Expected increase in LReq,T of ambient noise in an area because of a proposed development under investigation.		

4.2 Field Work

The baseline noise soundscape of the project area is characterised through noise measurements taken at relevant locations surrounding the project footprint. The criteria used to site the measurement locations are:

- The noise sensitive receptors nearest to the project footprint; and
- The location served as suitable reference points for the measurement of ambient sound levels surrounding the proposed project area. The noise sensitive receptors selected nearest to the project area to the south west (N1 – N2), and east (N3 - N4), which represent the rural residential and urban areas.

A Cirrus, Optimus Green, precision integrating sound level meter was used for the measurements. The measurements were taken on the properties as per Table 4-3, with the instrument being set at a height of between 1.2 and 1.4 meters above the ground and 3.5 meters away from any reflective surfaces. The instrument was fitted with its associated windscreen and was field calibrated with a Cirrus, sound level calibrator and was still within its valid laboratory calibration period (calibration certificates available on request). The "ambient sound level" as defined by the Free State Noise Control regulations, means the "*reading taken at the end of a period of at least 10 minutes, uninterrupted by an alleged disturbing noise, or an integrating impulse sound level meter placed at a measuring point during which period the said meter has been in operation at all times*".

The measurements were taken for a 24-hr period at each location, taking into account the daytime as well as night time noise characteristics. According to the guidelines, daytime is between 06:00 and 22:00; and night time being between 22:00 and 06:00. The locations of the noise measurements are illustrated in Plan 1 (refer to Appendix B) and listed in Table 4-3 below. In addition, photographs of the sampling locations are provided in Figure 4-1 to Figure 4-4.

Table 4-3: Noise Measurement Locations

ID	Location	Coordinates		Category of receptor
N1	Wonderheuwel 417	26°56'56.1"S	27°49'55.02"E	Rural
N2	Saltberry Plain 422	26°51'34.62"S	27°49'40.62"E	urban/ rural
N3	Nkgopoleng High School	26°50'39.7"S	27°50'44.1"E	Urban
N4	Zion Christian Church	26°50'22.4"S	27°50'26.5"E	Urban

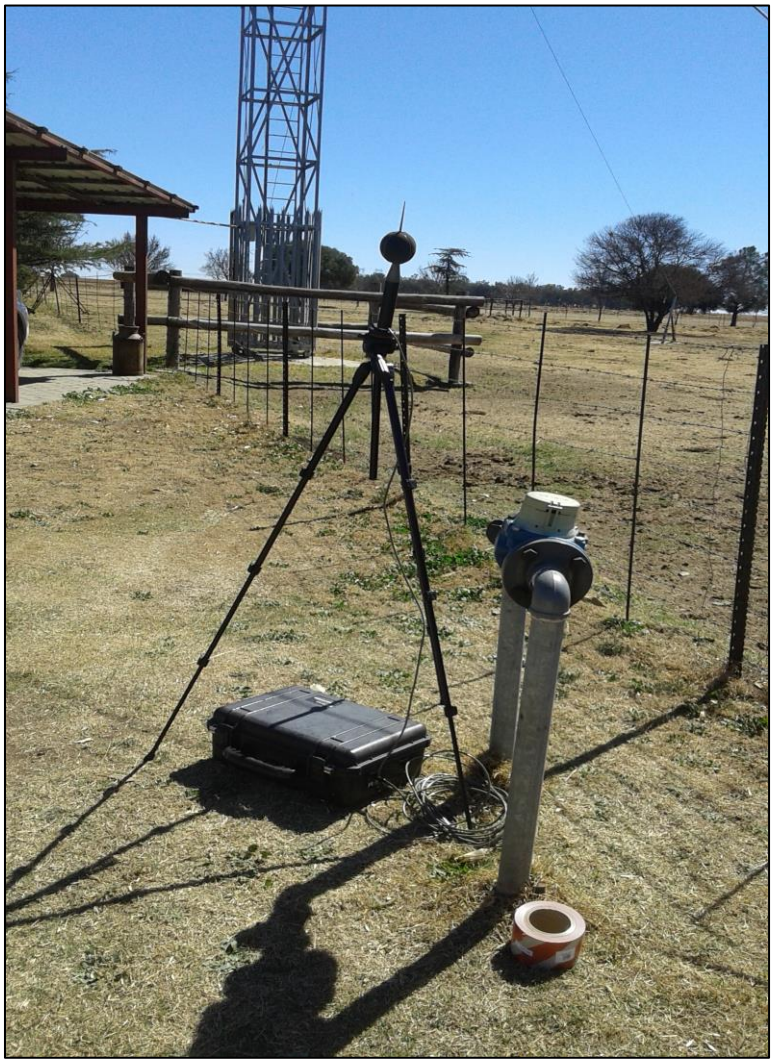

Figure 4-1: Noise measurement at N1

Figure 4-2: Noise measurement at N2

Figure 4-3: Noise measurement at N3

Figure 4-4: Noise measurement at N4

4.3 Noise Propagation Modelling and Impact Assessment

Predictive modelling was performed for the proposed activities using the modelling software SoundPLAN®. The software is internationally recognised specialises in computer simulations of noise pollution dispersion in accordance with ISO 9613-2:1996 "*Attenuation of sound during propagation outdoors*". The software uses atmospheric conditions such as temperature, humidity and air pressure as well as topography to calculate the noise

attenuation. The calculation also includes downwind conditions in every direction as a worst case scenario. the proposed project's noise levels were derived from the noise emissions from all the major noise-generating components and activities of the proposed project.

The following table indicates the sound power levels used in the model simulations. The sound power levels were sourced from SoundPLAN®'s database.

Table 4-4: Sound power levels from main noise causing sources

Noise source	**Sound power levels dB**						
Octave band frequencies, Hz	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**
Construction Phase							
Haul Truck	113	117	107	108	106	101	95
Front end Loader	108	116	107	108	105	99	95
Drilling activity	110	77	91	95	98	102	108
Diesel Generator	105	120	116	108	107	108	108
Pneumatic tools	82	75	73	68	63	67	80
Operational Phase							
New Conveyor Belt	60	64	71	68	71	71	76
Conveyor belt transfer points	69	79	86	92	95	96	96
Crusher	79	89	96	102	105	106	106
Water fog cannons	60 dBA Pressure level each						

The noise dispersion modelling software was used to assess whether the noise from the proposed project activities will impact on the relevant noise sensitive receivers, by comparing the predicted propagating noise levels with the current ambient baseline noise levels.

According to the Noise Regulations "disturbing noise" means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7dBA or more. The measured ambient sound level is described in Section 6 and the results of the noise dispersion modelling are presented in Section 8.

5 Assumptions and Limitations

The following assumptions and limitations are included as part of this assessment:

- Only the new proposed activities at 3 Shaft has been modelled. No noise modelling was undertaken at Mooikraal as it is an underground mine and therefore not likely to impact on the surrounding environment;

- It is assumed that during the relocation of the crushing facility, the stockpiling activities will temporarily be halted;
- The construction phase is assumed to be carried out during daytime hours (06:00-22:00), therefore only a daytime scenario was modelled for the construction phase and the subsequent impact of the construction phase refers only to the daytime;
- The resulting noise contours represent worst case LAeq at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the downwind conditions in all directions;
- In essence the modelling follows a conservative worst-case scenario approach assuming all activities for each phase are being carried out simultaneously; and
- The decommissioning phase was not modelled specifically as it is likely that it would produce similar results than that of the construction phase because of similar vehicle and machinery involved.

6 Baseline Environment

The area surrounding the site is covered with grassland during a wet season and includes cultivated lands. Few trees are planted around the farms, school and the church premises as wind barrier. A detailed description for each site and its weather condition during the noise measurement is portrayed in Table 6-1.

Table 6-1: Site enviromental description and weather conditions

ID	Location	Environmental description	Sensitive receptors	Weather conditions
N1	Wonderheuwel 417	Agriculture, grassland	Farmers	Clear Sky, wind speed <5m/s
N2	Saltberry Plain 422	Agriculture, grassland	Farmers	Clear Sky, wind speed <5m/s
N3	Nkgopoleng High School	Trees, buildings	Learners and teachers	Clear Sky, wind speed <5m/s
N4	Zion Christian Church	Trees, buildings	Christians attending church services	Clear Sky, wind speed <5m/s

The noise meter recordings for the sampled points as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 6-2. The noise level time history graphs are indicated in Figure 6-1 to Figure 6-4.

Table 6-2: Results of the Baseline Noise Measurements

Sample ID	SANS 10103:2008 Guidelines						
	Type of district	**Period**	**Distance from mine (m)**	**Acceptable rating level dBA**	**L_{Aeq} dBA**	**Maximum/Minimum dBA**	**Date**
N1	Urban	Daytime	2000m from Mooikraal Colliery	55	56	82/40	27/08/2018
		Night time		45	45	61/27	27/08/2018
N2	Rural	Daytime	1300 from 3 shaft	45	46	78/19	28/08/2018
		Night time		35	46	72/21	28/08/2018
N3	Urban	Daytime	760 from 3 shaft (stockpile handling area)	55	60	89/40	29/08/2018
		Night time		45	53	66/47	29/08/2018
N4	Urban	Daytime	160 from 3 shaft (stockpile handling area)	55	58	77/41	30/08/2018
		Night time		45	58	74/51	30/08/2018
	Indicates current L_{Aeq} levels above either the daytime rating limit or the night time rating limit						

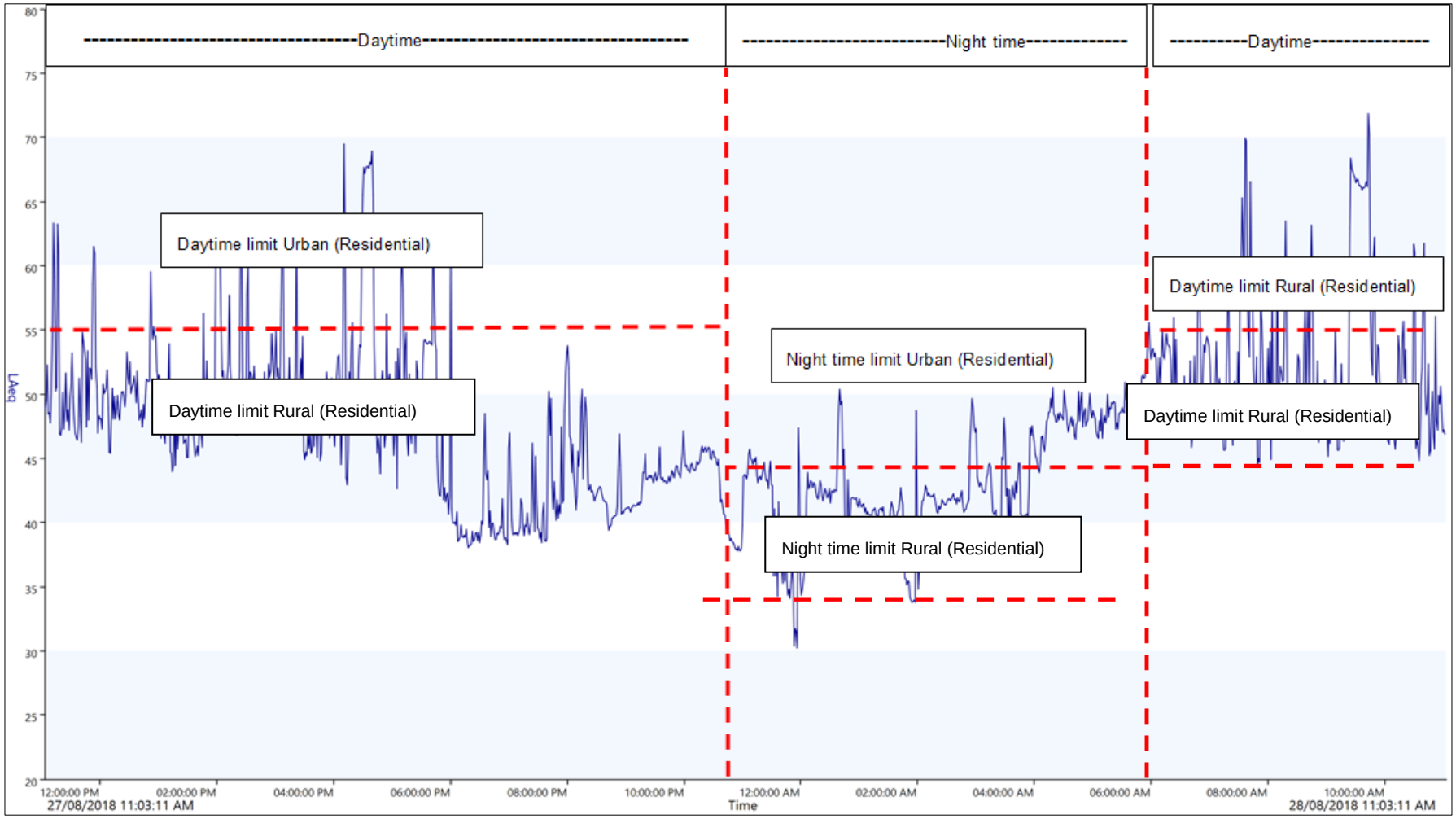

Figure 6-1: Noise time history graph for N1

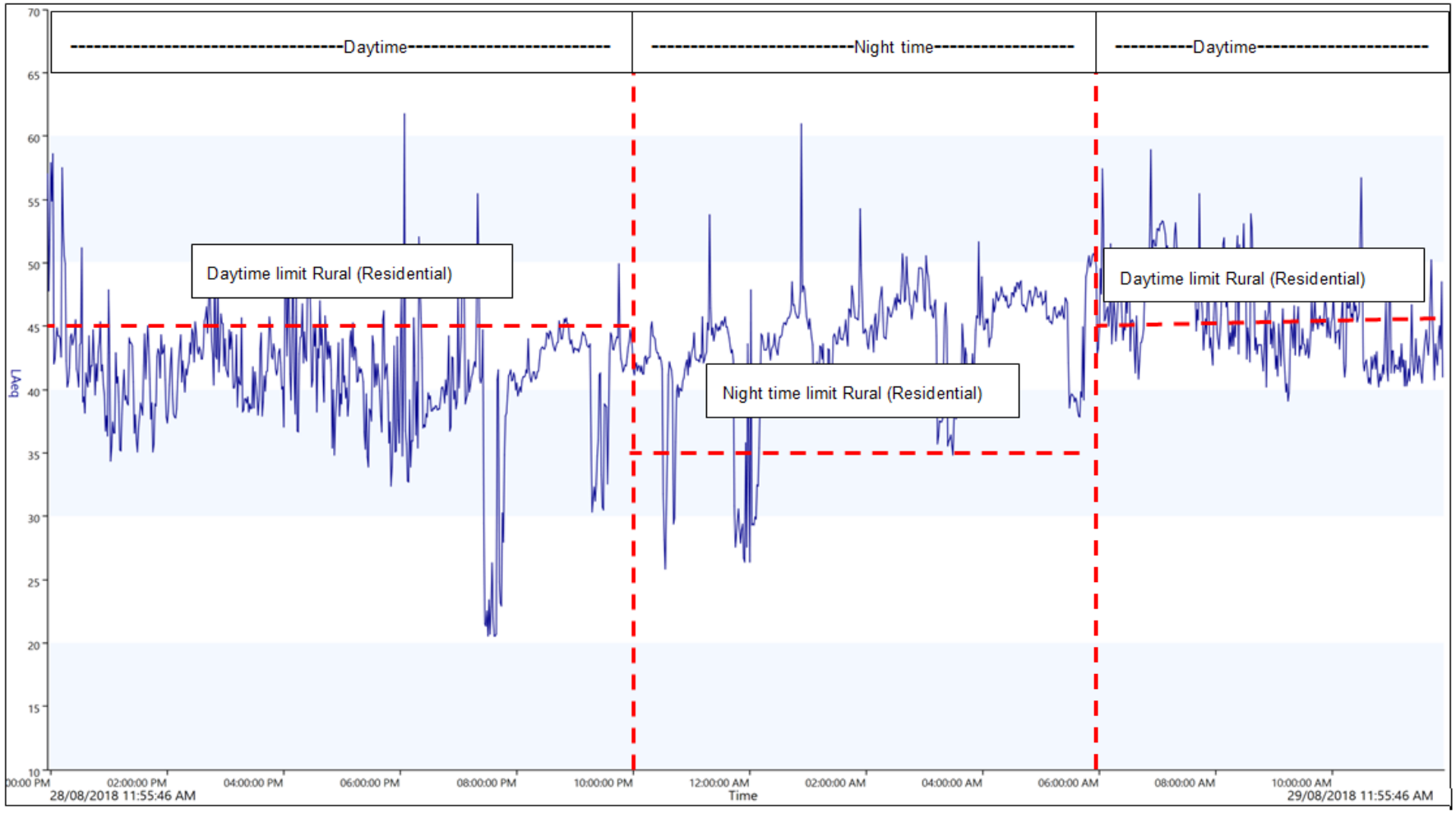

Figure 6-2: Noise time history graph for N2

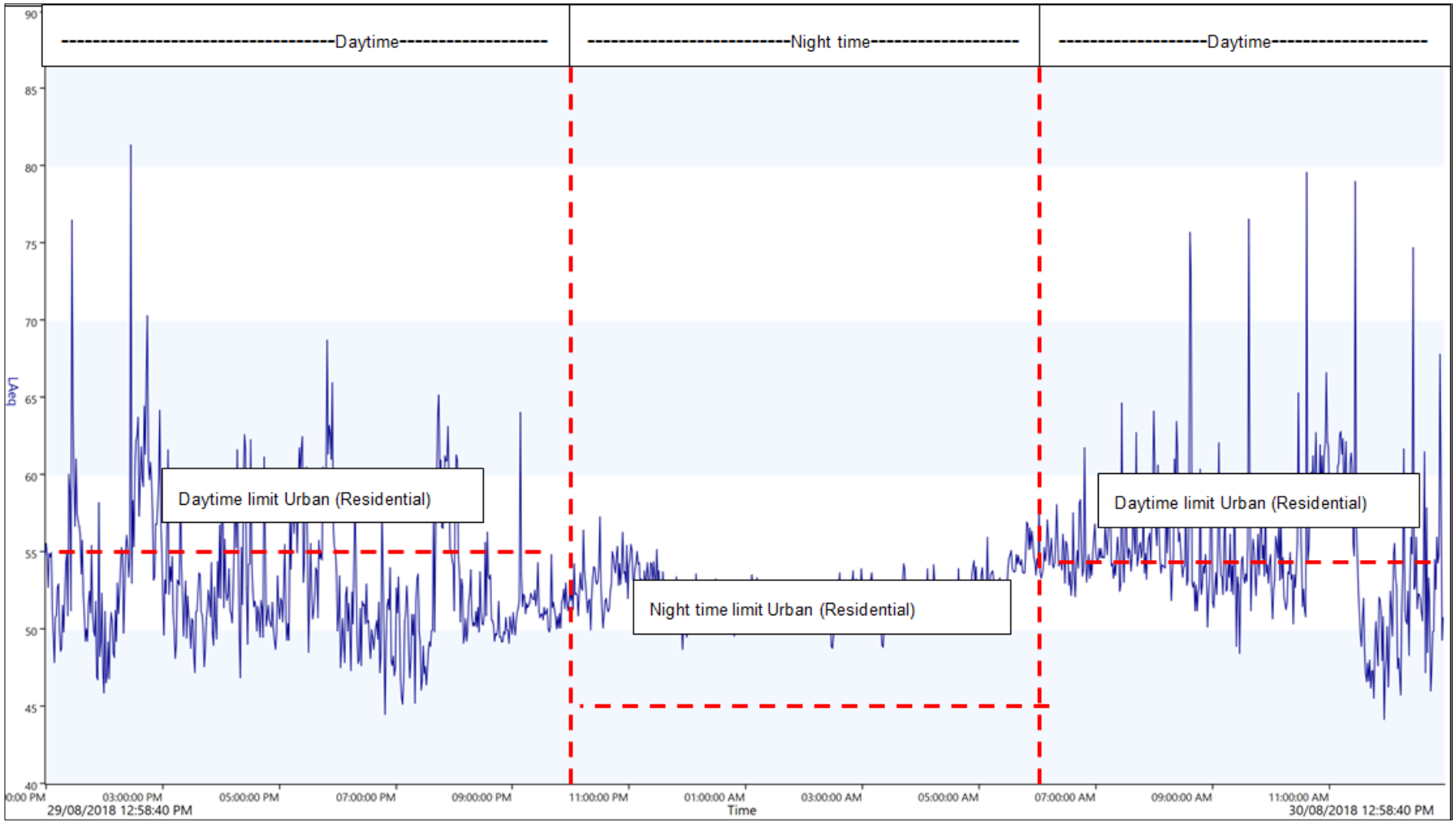

Figure 6-3: Noise time history graph for N3

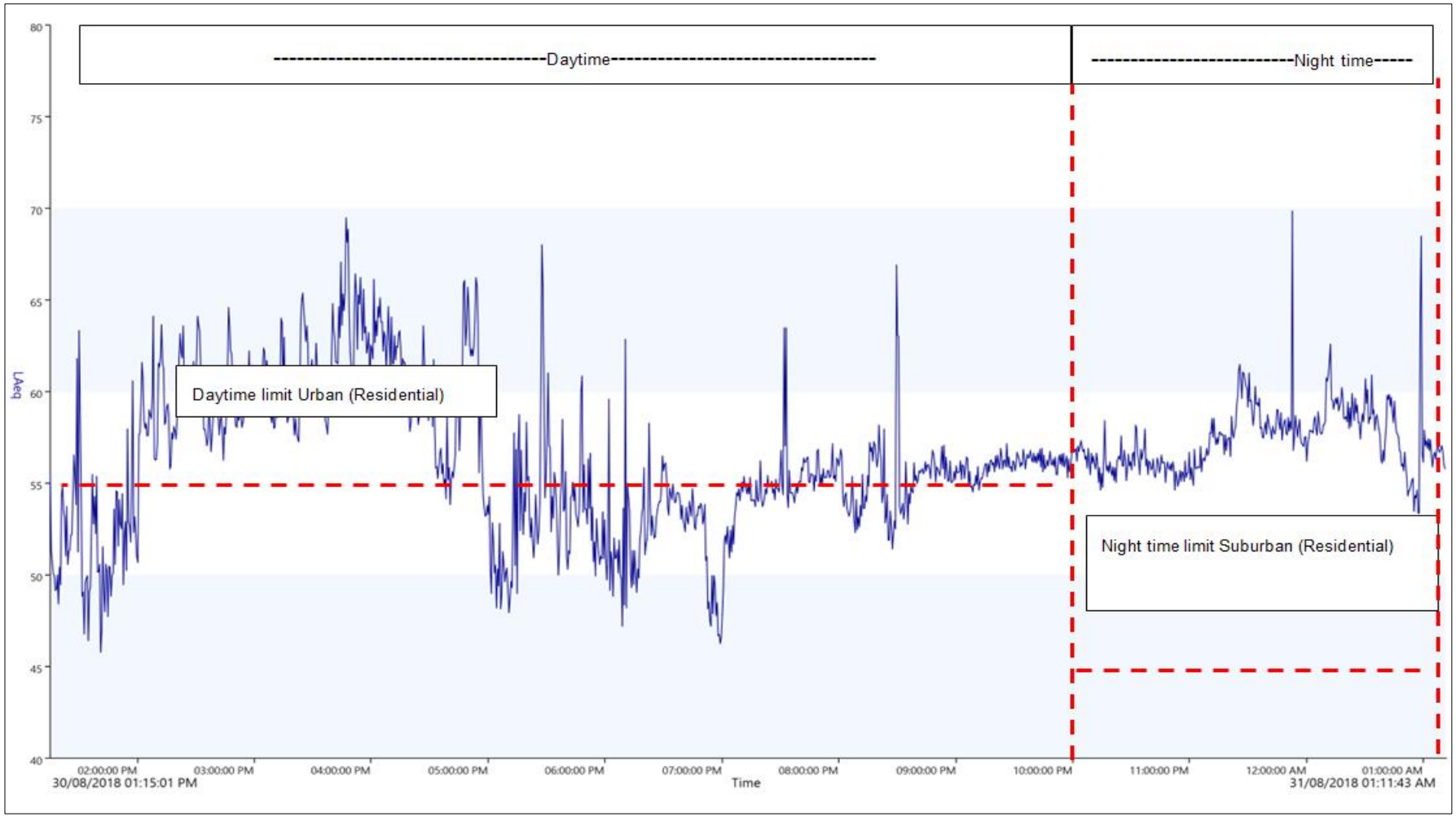

Figure 6-4: Noise time history graph for N4

6.1 Daytime Results

The measurements conducted monitoring locations N1 and N2 were taken at Wonderheuwel 417 and Saltberry Plain 422 farms respectively, while N3 and N4 were at Nkgopoleng High School and Zion Christian Church respectively, situated in Zamdela.

Based on the daytime results, the existing ambient sound levels are above the SANS 10103:2008 guidelines for both districts (rural 45 dBA) and urban (55 dBA). The average noise level (L_{Aeq}) measured at N1 and N2, varied from 46 dBA to 56 dBA where the main sources impacting on the measurements were produced by farm vehicles, mechanical workshop and cattle.

At N3, the average noise level was around 60 dBA and the main source of noise included vehicles and socialising activities.

At N4, the average noise level was around 58 dBA where the main source included vehicles and sirens operating at 3 Shaft.

6.2 Night time Results

Based on the night time results, the existing ambient sound levels are above SANS 10103:2008 guidelines for rural district (35 dBA) and urban district (45 dBA) respectively. The average noise level (L_{Aeq}) measured at N1 was 45 dBA. The main continuous noise sources were vehicles and cattle.

At N2, the average noise level (LAeq) was 46 dBA and the peaks in the graphs caused by intermittent noise source mainly coming from 3 Shaft activities and wind gusts.

At N3, the average noise level (LAeq) was 52 dBA, the peaks measured were caused by socialising activities from people living near the school.

At N4, the average noise level (L_{Aeq}) measured was 58 dBA with vehicles and siren noise coming from 3 Shaft operations.

7 Sensitivity Analyses and No-go Areas

In terms of the current location and infrastructure layout of the proposed amendments, it is not expected that there is any noise sensitive or ‘No-Go’ areas that would affect the chosen location and layout. The reason for this is that the likely quantified noise levels from the area and linear (conveyor infrastructure) developments of the project will not increase the current measured soundscape due to the decibel scale being logarithmic and cannot just be added as normal arithmetic.

8 Impact Assessment and Evaluation

8.1 Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Noise Impacts and Risks

Details of the noise impact assessment methodology used to determine the significance of physical impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = CONSEQUENCE X PROBABILITY X NATURE

Where

Consequence = intensity + extent + duration

And

Probability = likelihood of an impact occurring

And

Nature = positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this environmental noise impact assessment report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 8-2, which is extracted from Table 8-1. The description of the significance ratings is discussed in Table 8-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 8-1: Impact Assessment Parameter Ratings

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 8-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

Table 8-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

8.2 Potential Environmental Noise Impacts

This section discusses the significance of the noise impact on the surrounding noise sensitive receptors by comparing the results of the noise dispersion modelling with the existing ambient levels (as referred to by the Noise Control regulations for defining 'disturbing noise'). The noise impact assessment has only been undertaken for the 3 Shaft area as this is the area where the most amount of noise will be generated and where the significant noise impacts will occur.

The results of the predictive modelling are indicated on graphic plots (refer to Plan 2 to Plan 4 in Appendix B) for the construction and operational phases. The decommissioning phase was not modelled specifically as it is likely that it would have a similar or lesser impact than the construction phase. A summary of the impacts are indicated in Table 8-4 below.

Table 8-4: Summary of Impacts

Surrounding area of monitoring locations	Baseline Ambient Noise Levels (refer to table 6-1)		Construction Phase Predicted Ambient Noise Levels (refer to plan 2)	Construction noise impacts	Operational Phase predicted ambient noise levels refer to plan 3 and 4)		Operational noise impacts
	Day (dBA)	Night (dBA)	Assume only during daytime as assumed to take place (dBA)		Day (dBA)	Night (dBA)	
N1	56	45	<35	▪ Groundwork's (machinery such as haul trucks, front end loaders with reverse sirens) ▪ Civil construction activities ▪ Material hauling from one area to another for infill and removal ▪ Increase in traffic to area ▪ Building activities including cement trucks and mixing ▪ Demolishing activities	<35	<35	▪ The current activities occurring at 3 shaft (ambient noise) including trucks for import coal along the haul road (perimeter fence) ▪ Drilling activities (for boreholes and piles) ▪ Crushing activities located closer to receptors at N4 (Zamdela) ▪ Conveyor belt located closer to receptors (N4 Zamdela) ▪ Fogger cannons erected on the perimeter fence
N2	45	35	<35		<30	35	
N3	60	53	40 – 45		35 – 40	45 – 50	
N4	58	58	50 – 52		45 – 47	55 – 57	

It can be seen when comparing the predicted ambient noise levels during construction phase and operational phase that there will not be any “disturbing noise”, i.e. the ambient sound level was not increased by 7dB.

8.2.1 Construction Phase

8.2.1.1 Project activities assessed

The Construction Phase noise was assessed in terms of the activities in Table 8-5.

Table 8-5: Interactions and Impacts of the relevant construction activities

Interaction	Impact
Relocation/reconstruction of the crusher facility (to remain within the 3 Shaft footprint)	Noise disturbance from the construction vehicles and machinery
Relocation of the MK9 Belt which links to the coal handling plant (within the 3 Shaft footprint)	Noise disturbance from the construction vehicles and machinery

8.2.1.2 Impact description

The noise dispersion model that was run for the construction phase (refer to Plan 2 in Appendix B) indicates that the expected noise from the relocation of the crusher and conveyer belt will not measure above the existing ambient levels at the urban and rural receptors and therefore not impact on the surrounding receptors.

8.2.1.3 Management objectives

To minimise/prevent the noise impact from causing a noise disturbance at the surrounding receptors due to the construction activities. Ensure complies with the Free State Noise Control Regulations.

8.2.1.4 Management actions and targets

No management actions and targets are recommended for the construction phase due to the nature of this activity not likely to cause a noise impact.

8.2.1.5 Construction phase impact ratings

The table below summarises the rating of the impact significance for the construction phase.

Table 8-6: Pre-mitigation and post-mitigation significance ratings for impacts on noise during the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction (Site clearance and construction of conveyor and crushing facility)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the construction activities, however will not impact on any receptors as the noise levels in this area are already high.			
Prior and Post mitigation/ management			
Duration	Short term (2)	Noise will be produced for the duration of construction phase	Negligible (negative) – 21
Extent	Local (3)	It is expected that during construction, noise will extend as far as development site area.	
Intensity x type of impact	Minor - negative (-2)	It is expected that during construction phase noise will have a minor impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding communities.	
Nature	Negative		
Mitigation/ Management action			
▪ No mitigation recommended due to negligible impact			

8.2.2 Operational Phase

8.2.2.1 Project activities assessed

The Operational Phase noise was assessed in terms of the activities in Table 8-7.

Table 8-7: Interactions and Impacts of the relevant operational activities

Interaction	Impact
Operation of crushing facility	Noise disturbance from the crushing activities
Operation of associated conveyor belt	Noise disturbance from the idlers, siren and rollers
Operation of the stockpiling area	Noise disturbance from the stacker/reclaimers (sirens) and other machinery (front end loaders etc) and vehicles as well as fogger cannons

8.2.2.2 Impact description

The operational modelling scenarios that were run for the day and night time (refer to Plan 3 and Plan 4 in Appendix B), which include the relocated crushing facility and conveyor belt,

indicate that the expected noise will not measure above the current ambient noise levels at the surrounding urban and rural receptors. Furthermore, the relocation of the crusher facility away from the rural receptors towards the south west will likely experience less audible noise from the 3 Shaft complex.

However, stockpiling activities are currently impacting on the neighbouring urban areas of Zamdela during the day and especially the night time as indicated by the levels measured at N4. It is noted that no complaints from the community have been reported probably due to the community being desensitised by the noise from the coal handling activities having started during the 1950's (roughly the same time as the establishment of the neighbouring areas of Zamdela) and gradually increased in footprint.

8.2.2.3 Management objectives

To minimise/prevent the noise impact of causing a noise disturbance at the surrounding receptors because of the operational activities and subsequently comply with the Free State Noise Regulations.

8.2.2.4 Management actions and targets

The main component influencing the soundscape in the neighbouring urban area of Zamdela is the vehicles and machinery within the stockpiling area. This is however, existing operational activities and it is recommended that excessive noise be managed on a case by case basis.

8.2.2.5 Operational phase impact ratings

The table below summarises the rating of the impact significance for the operational phase.

Table 8-8: Pre-mitigation and post-mitigation significance ratings for impacts on noise during the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction (Operation of the plant and associated infrastructure as well as stockpiling area at 3 Shaft)			
Impact Description: Noise will emanate from the plant and associated infrastructure as well as stockpiling area. The current noise from the stockpiling area is already impacting on the neighbouring urban area of Zamdela.			
Prior mitigation/ management			
Duration	Project life (5)	The existing noise of the stockpiling area is impacting the neighbouring urban areas of Zamdela	Moderate (negative) – 84

Dimension	Rating	Motivation	Significance
Extent	Municipal (4)	The existing noise of the stockpiling area is extending to the neighbouring urban area of Zamdela, but not entire municipal area.	
Intensity x type of impact	Moderate - negative (-3)	The existing noise of the stockpiling area has a moderate impact on the neighbouring urban area of Zamdela	
Probability	Definite (7)	It is highly likely that noise is impacting on the neighbouring urban area of Zamdela.	
Nature	Negative		
Mitigation/ Management action			
The infrastructure at 3 Shaft has been in operation since 1952 therefore this impact is existing. The following measures are proposed: ▪ If any noise related complaints are received from the existing infrastructure, Mooikraal will investigate the complaint, and put into place actions to address the complaint; and ▪ Should any new structures with noise generating potential be erected, Mooikraal must conduct a noise assessment. If it is predicted that new structures will increase noise levels (from the baseline noise level), Mooikraal must investigate noise controls/ abatement to not increase ambient noise levels beyond threshold as per Free State Noise Control Regulations.			

8.2.3 Decommissioning Phase

8.2.3.1 Project activities assessed

The Decommissioning Phase noise was assessed in terms of the activities in Table 8-9.

Table 8-9: Interactions and Impacts of the relevant decommissioning activities

Interaction	Impact
Demolition of the existing conveyor belting, crushing facility and coal bunker which is currently situated within a wetland at the 3 Shaft	Noise disturbance from the demolition
Decommissioning of all linear structures including roads, pipelines and conveyor belts;	Noise disturbance from the decommissioning activities

8.2.3.2 Impact description

Due to the decommissioning activities using similar or fewer machinery and vehicles than the construction phase, it is expected that the significance of the noise impact during this phase will be similar.

8.2.3.3 Management objectives

To minimise/prevent the noise impact of causing a noise disturbance at the surrounding receptors because of the decommissioning activities and subsequently comply with the Noise Regulations.

8.2.3.4 Management actions and targets

No management actions and targets are recommended due to the nature of this project not likely causing a noise impact.

8.2.3.5 Decommissioning phase impact ratings

The table below summarises the rating of the impact significance for the decommissioning phase.

Table 8-10: Pre-mitigation and post-mitigation significance ratings for impacts on noise during the Decommissioning Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction (Dismantling and removal of the pump stations and pipeline infrastructure)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the decommissioning activities.			
Prior and Post mitigation/ management			
Duration	Medium term (3)	Noise will be produced for the duration of the decommissioning phase	Negligible (negative) – 21
Extent	Local (3)	It is expected that during decommissioning noise will extend as far as development site area.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors.	
Nature	Negative		
Mitigation/ Management action			

Dimension	Rating	Motivation	Significance
▪ No mitigation recommended due to negligible impact			

8.2.3.6 Post-closure phase

The construction, operational and decommissioning activities will have ceased and the subsequent noise levels from the activities will have ceased, therefore no post closure impacts expected, and no post closure monitoring programme is recommended.

9 Cumulative Impacts

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The project is considered a causative source of noise pollution of moderate significance due to the current noise from the stockpiling area impacting on the neighbouring urban area of Zamdela. The new amendments to the project are not expected to have a significant cumulative impact or exacerbate current noise levels. .

10 Unplanned Events and Low Risks

Low risks can be monitored to gauge if the baseline changes and mitigation is required, but unplanned events may happen at any moment. However, considering the nature and location of the project, it is highly unlikely that any unplanned events may results in increased impact significance.

11 Environmental Management Plan

The objective of an EMP is to present mitigation to (a) manage undue or reasonably avoidable adverse impacts associated with the development of a project and (b) to enhance potential positives.

The EMP must consider each activity and its potential (significant) impacts during the construction, operational and decommissioning phases. The EMP should be structured as described in Section 11.2.

11.1 Project Activities with Potentially Significant Impacts

The noise dispersion models were run as a conservative worst-case scenario approach, as previously mentioned. The activities per phase were accounted for simultaneously and therefore cumulatively contribute to the significance of the noise impact. With the overall negligible calculated significance for the construction, operational and decommissioning phase, no specific activity is expected to have a potential significant noise impact.

11.2 Mitigation and Management Plan

The mitigation and/or management measures are presented in Table 11-1.

Table 11-1: Information pertaining to the recommended mitigation measures

Activity	Objectives	Mitigation/Management measure	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person
Stockpiling area	To prevent increased noise levels at 3 Shaft. It is noted that the current operation is impacting on the neighbouring urban areas of Zamdela and the new amendments to the project are not expected to have a significant cumulative impact or exacerbate current noise levels.	■ If any noise related complaints are received from the existing infrastructure, Mooikraal will investigate the complaint, and put into place actions to address the complaint; and ■ Should any new structures with noise generating potential be erected, Mooikraal must conduct a noise assessment. If it is predicted that new structures will increase noise levels (from the baseline noise level), Mooikraal must investigate noise controls/ abatement to not increase ambient noise levels beyond threshold as per Free State Noise Control Regulations.	Free State Noise Control Regulations	Noise monitoring to be undertake should complaints be received and action plans must be developed accordingly.	Construction	Environmental Manager

12 Consultation Undertaken

Discussions were held with the relevant landowners and occupiers on whose property the noise measurements were taken. This was to obtain the required permission to enter the property and explain the purpose of the study. No concerns were raised at the time.

13 Conclusion and Recommendations

Sasol Mining are proposing amendments to surface components of their Mooikraal Colliery and 3 Shaft Complex, which include mainly the relocation of the crushing facility and associate conveyor system at 3 Shaft.

The environmental noise impact assessment assessed whether the proposed project will impact on the surrounding receptors by causing disturbing noise, as defined by the Noise Regulations. The current ambient baseline noise soundscape level was established and the expected noise contribution from the project was quantified by use of dispersion modelling.

The results of the dispersion models indicate that the expected noise from the new components of the project will not measure above the existing ambient noise levels at the surrounding receptors. It is however established that the stockpiling area is currently impacting on the ambient noise levels at the neighbouring urban area of Zamdela as indicated by the measured levels at location N4. It is noted that no complaints from the community have been reported probably due to the community being desensitised by the noise from the coal handling activities having started during the 1950's (roughly the same time as the establishment of the neighbouring areas of Zamdela) and gradually increased in footprint.

It is recommended that if any noise related complaints are received from the existing infrastructure, Mooikraal investigate the complaint, and put into place actions to address excessive noise.

14 References

Free State Noise Control Regulations as published under GN24 (PG 35 of 24 April 1998) in terms of section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989).

The Minister of Environmental Affairs. (1998). *Noise Control Regulations*. Government Notice 24, Gazette extraordinary, 24 April 1998.

South African National Standard - Code of practice, SANS 10103:2008, Edition Six, *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. Available [online] http://www.sabs.co.za.

Appendix A: Curiculum Vitae

LUKAS SADLER

Mr. Lukas Sadler

Senior Environmental Noise Consultant

Atmospheric Sciences Department

Digby Wells Environmental (Pty) Ltd

1 EDUCATION

Institution	Dates	Degree(s) or Diploma(s) obtained:
Global Prospectus	2014	Noise and Vibration Fundamentals Assessment
Mackenzie Hoy Consulting Acoustic Engineers	2013	Environmental Noise Control
University of Johannesburg	2010	Air Quality Management
Open Access Industrial Training College (OAITC)	2009	Occupational and Environmental Noise
North West University	2002	B.Com Environmental Management
Randburg High School	2001	Matric

2 EMPLOYMENT

November 2007 - Present: Digby Wells Environmental

May 2006 – July 2007: West View Rail (Pty) Ltd (London)

3 EXPERIENCE

During my two year stay in London from September 2005 – September 2007, I worked for West View Rail (Pty) Ltd on the London Underground Railway doing reconstruction of the underground railway.

I am currently working at Digby Wells Environmental in the Environmental Noise Unit, where I am responsible for the Noise Impact Assessments relating to EIA/EMP's, as well as undertaking compliance monitoring. This includes experience working with projects in accordance with the International Finance Corporation (IFC) and World Bank standards, in countries such as Namibia, Mali, Senegal, Ghana, Mozambique Liberia, DRC, Sierra Leone, Cameroon, Botswana and Zambia.

My core focus is working on Environmental Noise Impact Assessments, which includes the assessment, remediation and management of impacts related to noise disturbance for the construction, mining and petrochemical industry.

4 PROJECT EXPERIENCE

DATE		DETAILS
FROM	TO	
2009	2009	**Project**: Knights and City Deep Tailings Reclamation Noise Assessment **Country**: South Africa **Client:** Crown Gold Recoveries **Nature of Work:** To conduct an environmental noise impact assessment of the proposed reclamation of Tailings Storage Facilities in and around Johannesburg. I was responsible for assessing the significance of the noise impact from the proposed reclamation activities on the surrounding urban and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Gauteng Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2009	2009	**Project**: Environmental Noise Impact Assessment for Gold Mining activities in the Free State **Country**: South Africa **Client:** Pamodzi Gold **Nature of Work:** To conduct an environmental noise impact assessment of the proposed gold mining activities. I was responsible for assessing the significance of the noise impact from the proposed gold mining activities on the surrounding rural and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Free State Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2009	2009	**Project**: Environmental Noise Impact Assessment for Boikarabelo Colliery, Waterberg **Country**: South Africa **Client:** Resource Generation **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2010	2010	**Project**: Baseline Noise Survey for proposed Coal Mine in Mpumalanga Province

2010	2010	**Country**: South Africa **Client:** BHP Billiton Energy South Africa **Nature of Work:** To conduct baseline noise measurements in order to assess the pre-mining soundscape as well as identify the current noise sources **Project**: Environmental Noise Impact Assessment for the Lesedi Power Generation Project **Country**: South Africa **Client:** Xstrata Alloys **Nature of Work:** To conduct an environmental noise impact assessment of the proposed power generating activities. I was responsible for assessing the significance of the noise impact from the proposed coal fired power station on the surrounding rural and suburban sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2011	2011	**Project**: ESIA for Gold Mine in Armenia **Country**: Armenia **Client:** GeoPro Mining Limited **Nature of Work:** To conduct an environmental noise impact assessment in support of an ESIA for a gold mining project. I was responsible for assessing the significance of the noise impact from the proposed project on the surrounding noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the International Finance Corporations' (IFC) Environmental Health and Safety's (EHS) Noise Management Guidelines. SoundPlan was used to quantify the expected noise sources then compared to the baseline noise measurements to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2011	2011	**Project**: Environmental Noise Impact Assessment for Extension of Koidu Diamond Mine **Country**: Sierra Leone **Client:** Koidu **Nature of Work:** To conduct an environmental noise impact assessment of the proposed extension of the diamond mine. I was responsible for assessing the significance of the noise impact from the extension of the kimberlite pipe on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the IFC EHS guidelines. The Concawe noise quantification method was used to quantify the expected noise sources then compared to background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.

2011	2011	**Project**: Environmental Noise Impact Assessment for Roodekop Colliery **Country**: South Africa **Client:** Universal Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2012	**Project**: Environmental Noise Impact Assessment for Kibali's Hydropower Plants **Country**: DRC **Client:** Randgold Resources **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Hydropower Plants along the Kibali river. I was responsible for assessing the significance of the noise impact from the Hydropower Plnats on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the IFC EHS guidelines. The Concawe noise quantification method was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2012	**Project**: Environmental Noise Impact Assessment for Brakfontein Colliery **Country**: South Africa **Client:** Universal Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2016	**Project**: Environmental Noise Impact Assessment for Klipspruit South **Country**: South Africa **Client:** South 32 **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control

		regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2012	2014	**Project**: Environmental Noise Impact Assessment for Platreef Platinum Mine **Country**: South Africa **Client:** Ivanplats **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Platinum Mine. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2016	**Project**: Compliance Monitoring for Platreef **Country**: South Africa **Client:** Ivanplats **Nature of Work:** To conduct compliance monitoring at the operational Platreef Mine to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.
2013	2013	**Project**: Environmental Noise Impact Assessment for Balama Graphite Mine **Country**: Mozambique **Client:** Syrah Resources **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Graphite Mine. I was responsible for assessing the significance of the noise impact from the proposed mine on the surrounding villages. The environmental noise impact assessment was undertaken in accordance with the EHS IFS guidelines. SoundPlan was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2013	2013	**Project**: Environmental Noise Impact Assessment for Ash Backfilling at Sasolburg **Country**: South Africa **Client:** Sasol **Nature of Work:** To conduct an environmental noise impact assessment of the proposed ash backfilling activities. I was responsible for assessing the significance of the noise impact from the proposed ash backfilling activities on the surrounding rural and suburban noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the Free State Noise Control Regulations. SoundPlan was used to quantify the expected noise

		sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2014	**Project**: Environmental Noise Impact Assessment for Weltevreden Colliery, Belfast **Country**: South Africa **Client:** Northern Coal **Nature of Work:** To conduct an environmental noise impact assessment of the proposed colliery. I was responsible for assessing the significance of the noise impact from the proposed colliery on the surrounding rural noise sensitive receptors. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2014	2014	**Project**: Environmental Noise Impact Assessment for Water Treatment Facility **Country**: South Africa **Client:** TCTA **Nature of Work:** To conduct an environmental noise impact assessment of the proposed water treatment and sludge disposal for the short term intervention for acid mine drainage treatment. I was responsible for assessing the significance of the noise impact from the proposed water treatment and sludge disposal on the surrounding urban noise sensitive receptors on the east rand of Johannesburg. The environmental noise impact assessment was undertaken in accordance with the Gauteng Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2013	2016	**Project**: Compliance Monitoring for Kalgold **Country**: South Africa **Client:** Harmony Gold **Nature of Work:** To conduct compliance monitoring at the operational Kalgold Mine to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.
2015	2015	**Project**: Environmental Noise Impact Assessment for Thabametsi Colliery **Country**: South Africa **Client:** EXXARO **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Thabametsi Colliery. I was responsible for assessing the significance of the noise impact from the proposed coal mining activities on the surrounding rural noise sensitive receptors. The

		environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the noise control regulations to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2015	2015	**Project**: Environmental Noise Impact Assessment for a Vanadium Mine **Country**: South Africa **Client:** VMIC **Nature of Work:** To conduct an environmental noise impact assessment of the proposed Vanadium Mine. I was responsible for assessing the significance of the noise impact from the proposed mine on the surrounding communities. The environmental noise impact assessment was undertaken in accordance with the National Noise Control Regulations. SoundPlan was used to quantify the expected noise sources then compared to the background noise levels to establish the significance of the impact. Mitigation and management measures in terms of noise control were recommended in accordance with the significance of the impact.
2015	2016	**Project**: Compliance Noise Monitoring for the Kazungula Bridge Construction Project **Country**: Botswana/Zambia **Client:** Daewoo Construction **Nature of Work:** To conduct compliance monitoring at surrounding noise sensitive receptors to the bridge construction site to assess compliance with the relevant regulations as well as recommend noise control measures in the event of non-compliance.

5 PROFESSIONAL AFFILIATIONS

Affiliate Member of the Institute of Acoustics

Appendix B: Plans

Plan 1: Noise Measurement Locations

Plan 2: Construction Noise Propagation

Plan 3: Operational Noise Propagation Daytime

Plan 4: Operational Noise Propagation Night time

Plan 1

Sasol Mooikraal 3

Noise Measurement Locations

Legend

- 3 Shaft Area
- Noise Measurement Locations
- Conveyor Belt
- 10 Mℓ / Day Pipeline
- Main Road
- Minor Road
- Non-Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan

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N

0 100 200 400 600

Metres

1:12 000

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Plan 2

Sasol Mooikraal 3

Construction Noise Dispersion

27°49'30"E 27°50'15"E 27°51'0"E

26°50'15"S 26°51'0"S

R57

30 45 50 55 60 65 70 75 80 75 75 75 65 60 55 50 45 40 35

LEEUSPRUIT

Legend

- 3 Shaft Area
- Conveyor Belt
- 10 Mℓ / Day Pipeline
- Arterial / National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Dam Wall
- Dam / Lake
- Perennial Pan

Construction Noise Dispersion dBA

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80

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Date: 11/10/2018

N

0 100 200 400 600

Metres

1:13 000

Plan 3

Sasol Mooikraal 3

Operational Noise Dispersion Daytime

27°49'30"E
27°50'15"E
27°51'0"E
26°50'15"S
26°51'0"S

R57
LEEUSPRUIT

45
60
70
75
65
55
50
40
35
30

Legend

- 3 Shaft Area
- Conveyor Belt
- 10 Mℓ / Day Pipeline
- Arterial / National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Dam Wall
- Dam / Lake
- Perennial Pan

Operational Noise Dispersion Daytime

dBA

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85

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Date: 11/10/2018

N

0 100 200 400 600
Metres
1:13 000

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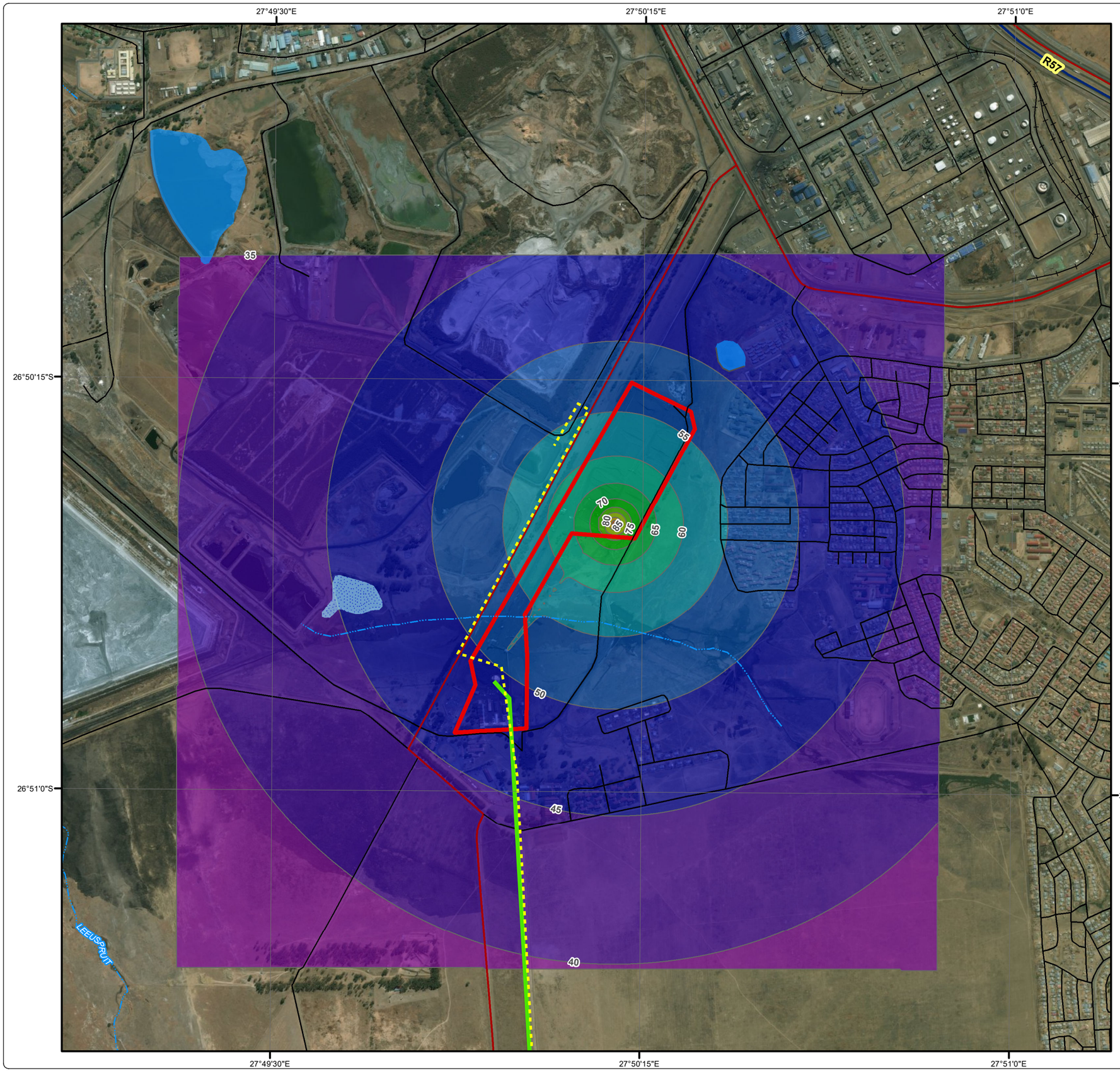
Plan 4

Sasol Mooikraal 3

Operational Noise Dispersion Night Time



Legend

- 3 Shaft Area
- Conveyor Belt
- 10 Mℓ / Day Pipeline
- Arterial / National Route
- Main Road
- Minor Road
- Railway Line
- Non-Perennial Stream
- Dam Wall
- Dam / Lake
- Perennial Pan

Operational Noise Dispersion Night Time

dBA

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85
- 90
- 95

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Date: 11/10/2018

N

0 100 200 400 600

Metres

1:13 000

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