dBAcoustics

KHANYAZWE FLEXPOWER PLANT
Malalane
NKomazi Local Municipality
Ehlanzeni District Municipality
MPUMALANGA PROVINCE

ENVIRONMNETAL NOISE IMPACT ASSESSMENT REPORT

BJB van der Merwe

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Date: 13 June 2024

DECLARATION OF INDEPENDENCE

I, **Barend J B van der Merwe** as duly authorised representative of **dBAcoustics**, hereby confirm my independence and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which **Nsovo Consultant (Pty)Ltd** was appointed as environmental assessment practitioner in terms of the National Environmental Management Act (NEMA), 1998 as amended (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, No 43110 of 20 March 2020 for the **compilation of a Noise Impact Assessment Report for the application for the Khanyazwe Flexpower Gas-Fired Power Plant project – Noise Impact Assessment**. I further declare that I am confident in the results of the studies undertaken and conclusions drawn because of it. I have disclosed, to the environmental assessment practitioner, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2020. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2020 and any other specific and relevant legislation (national and provincial), policies, guidelines, and best practice.

Signature: 

Full Name: Barend Jacobus Barnardt van der Merwe

Date: 13 June 2024

Title / Position: Environmental noise specialist

Qualification(s): MSc Environmental Management

Experience (years): 22 years

Registration(s): SAAI, NACA, SAAG and IAIAsa

Details of specialist and expertise

I, Barend JB van der Merwe of 43 6th Street, Linden Johannesburg have been an environmental noise and ground vibration specialist for the last 22 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise receptors. I am also involved with the noise and ground vibration impact assessments and the environmental management plans compilation of large projects such as wind farms, mining, roads, trains (primarily the Gautrain) and various point noise sources. As a post-graduate student in Environmental Management at the University of Johannesburg, I obtained an MSc degree with the research project concentrating on the impact of noise and ground vibration on a village close to a new underground mine. I have played a major role in the identification, evaluation, and control of physical factors such as noise and ground vibration in the following projects – wind farms, various platinum and coal mines and the quarterly noise evaluation of the Gautrain, construction of the N2 near Butterworth, design of the Musina by-pass, noise mitigatory measures at the N17 road near Trichardt, establishment of the weigh bridge along the N3 near Pietermaritzburg, George Western by-pass. The following large environmental companies are amongst my clients: Chameleon Environmental, Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Hatch, Knight Piesold Environmental (Pty) Ltd and SRK Engineering (Pty) Ltd, WOOD Environmental.

Qualifications

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

Membership

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

Experience

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

• Identification, Evaluation and Control of noise sources in industry.

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

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

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

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information supplied by Nsovo Consulting (Pty)Ltd. The accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. dBAcoustics does not accept responsibility for any errors or omissions in the supplied data and information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions and the findings apply to the site conditions as they existed at the time of the field survey. These opinions do not necessarily apply to conditions that may arise after the date of the field survey and subsequent noise impact assessment report. The report is based on scientific and recommended survey and assessment techniques. This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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EXECUTIVE SUMMARY

Introduction

dBAcoustics was appointed by Nsovo Consulting (Pty)Ltd to assess the potential noise impact of the Khanyazwe Flexpower, Malalane 1200MW Gas-Fired Power Plant Project which will be situated 1 750m south of Malelane and 1 500m from the busy national road (N4) between the Lebombo border to Mozambique and Johannesburg . This a very busy corridor with a continuous flow of traffic during the day and night. The boundaries of the Powerflex footprint is available land are irregular, with an east-west length of about 637m and a north-south length of about 315m, which can meet the land occupation needs of this phase. There are no buildings or structures within the plant site. The gas source of this project is the natural gas compression station (ROMPCO) on the west side of the factory site, which is about 2.7km away from the proposed Powerflex site.

Application for authorisation is made to erect a gas-fired generating plant with a with a total generating capacity of up to 1 000MW.

The following methodology was employed to determine if the projected noise intrusions levels for the project will exceed the 7.0dBA threshold value above the prevailing ambient noise levels of the study area:

- Determine the prevailing ambient noise level in the vicinity of the proposed Khanyazwe Powerflex Power Plant Project;
- Noise modelling will be done to determine the potential noise increase at the noise receptors within and beyond the boundaries of the proposed Khanyazwe Powerflex Power Plant Project;
- The noise data will be used to assess the potential noise intrusion levels at the noise receptors inside and in the vicinity of the approved Khanyazwe Powerflex Power Plant Project boundaries.

The day night noise levels (Ldn) were 43.5dBA with the daytime noise level of 43.5dBA and the night-time noise level of 42.4dBA. The day, evening and night-time noise level was 43.1dBA whereas the daytime noise level was 43.2dBA, the evening noise level was slightly higher 44.4dBA and the night-time noise level was 42.4dBA. There was insects during the night-time period which increased the noise level accordingly. The distant train activity noise and traffic noise contributed to the prevailing ambient noise during the day and night-time periods. Agricultural activities, domestic activities, birds and traffic along the gravel roads contributed to the prevailing ambient noise level for the daytime period.

The following is of relevance to the ambient noise measurements:

- The Long measuring points (LMP) was measured over a 24-hour period at MP 3;
- The L_{Aeq} was measured over a representative sampling period exceeding 10 minutes at each measuring point; and
- The noise survey was conducted during the day and night-time period being 06h00 to 22h00 for the daytime and 22h00 to 6h00 for the night-time;
- The noise survey comply with Noise Protocol 6.

Conclusion

There will be a shift in the prevailing ambient noise level in the immediate vicinity of the Khanyazwe Powerflex Power Plant Project. People who may work or visit the plant will experience an increase in the prevailing ambient noise level in the vicinity of the Khanyazwe Powerflex Power Plant Project.

The prevailing ambient noise levels are largely created by emissions from a combination of noise sources of which the main source is distant traffic noise, agricultural type noises, distant train noise, insects and bird noises. The large variations in the meteorological conditions and the geographical relations between the Khanyazwe Powerflex Power Plant Project footprint and the noise receptors allow for the decrease in the noise as it propagates from the Khanyazwe Powerflex Power Plant Project.

The environmental noise impact during the construction and rehabilitation phases will be low and during the operational phase medium after the implementation of acoustic screening measures. The potential noise intrusion from the proposed power generating activities can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Noise Regulations, 1992 and the International Finance Corporation's Environmental Health and Safety Guidelines.

The proposed Khanyazwe Powerflex project will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place and that the Noise Impact Management Plan (NIMP) and Noise Monitoring Plan (NMP) for the Powerflex project is adhered to.

Barend van der Merwe – MSc UJ
Environmental Noise and Vibration Specialist

ENVIRONMNETAL NOISE IMPACT ASSESSMENT REPORT FOR THE KHANYAZWE FLEXPOWER GAS TO POWER ENERGY FACILITY MALALANE MPUMALANGA PROVINCE

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1a)	Details of -	
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(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	P1-3 to P1-5
b)	A declaration that the specialist is independent	P1-2
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of the base data used for the specialist report	Section1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 1
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 4
f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 5
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ABBREVIATIONS

dBA – A-weighted sound pressure level;

dB – Decibel;

IFC – International Finance Corporation;

Km/h – kilometre per hour;

m – Meters;

MW – megawatt

m/s – meters per second;

N, E, S, W – North, East, West, South

L_{Basic} – Basic noise level in dBA;

NSA – Noise sensitive areas;

MP – Measuring points;

SANS – South African National Standards;

TLB – Tractor loader backhoe.

GLOSSARY

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

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

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

Where

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

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

NOTE The internationally accepted symbol for sound level is dBA.

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

Disturbing noise
A disturbing noise means the following;

- Exceeds the rating level by 7.0dBA;

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

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

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

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

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

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

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

Intelligible speech
Speech that can be understood without undue effort.

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

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

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

Rating level
Means the applicable outdoor equivalent continuous rating level indicated in Table 2 of SANS 10103 2008.

Residual noise
Means means the all-encompassing sound in a given situation at a given time, measured as the reading on an integrated impulse sound level meter for a total period of at least 10 minutes, excluding noise alleged to be causing a noise nuisance or disturbing noise.

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means, and which may be associated with a specific source.

NOTE Complaints about noise usually arise because of one or more specific noises.

1 INTRODUCTION

dBAcoustics was appointed by Nsovo Consulting (Pty)Ltd to assess the potential noise impact of the proposed Khanyazwe Flexpower Gas to Power Project (KFGPP) – Project area. The project area is some 1 850m to the east of the Malelane Commercial area and 1 890m to the south-west of Malelane residential area. Malelane falls within the Mpumalanga Province.

The proposed development entails the following:

Power Plant: The power plant technology will either be Gas Engines (or Internal Combustion Engines (ICE)) or Combined Cycle Gas Turbines (CCGT). The generation activities will entail the development of the following primary activities:

- Development of the gas-to-power facility
- Operation at a maximum capacity of 1000 MW.

Connection to the ROMPCO: An approximately 500 m gas pipeline extension will be required to connect the power plant to the ROMPCO pipeline.

Connection to the Eskom Distribution Grid. This scope of work entails the construction of infrastructure to connect to the Eskom grid in line with Eskom's minimum requirements. KFP will be responsible for the construction, and Eskom will be responsible for the operation and maintenance of the proposed infrastructure. From the power plant, electricity will be evacuated through a double 275kV transmission line and/or a double 132kV transmission line, connecting to an expanded Eskom Khanyazwe Substation located within 500 m of the power plant. Subsequently, the project will include the following:

- Extension of a Busbar at the Eskom Khanyazwe substation; and
- Approximately 0.5km 2x 275kV powerline and/or 2x 132kV powerline will connect to the existing Eskom Khanyazwe 275/132kV substation.

Road Access: An access road (temporary and permanent) will be constructed to link the proposed power station to the nearby existing road network. The current primary road to the proposed development site is a gravel road that connects to the N4. A new access point from the N4 has been proposed. This proposed access will tie in with the gravel road, and two access routes are proposed to access the power plant near the Eskom Khanyazwe substation. The proposed KFGPP will be situated some 3.0km west of the Town Malelane and south of the N4 which is a major transportation route between the Johannesburg and Maputo (Mozambique).

The prevailing ambient noise level within the study area is created by a combination of different noises/sounds. The main noise sources within and beyond the boundaries of the proposed project area:

- Seasonal agricultural activities;
- Traffic noise (N4) which can be continuous and/or intermittent at times;
- Traffic along farm gravel roads;
- Train noise;
- Distant sugar mill;
- Domestic and Agricultural noise;
- Brickmaking noise;
- Running water in channels;
- Corona type noise;
- Animal, insect and bird noises;
- Wind noise – Foliage noise.

The topography, ground conditions, prevailing noise sources and prevailing wind direction will be key aspects on the propagation of sound towards the noise receptors in the vicinity of the proposed project area and Malelane Town. The location of the proposed KFPPP

(turquoise polygon) is illustrated in

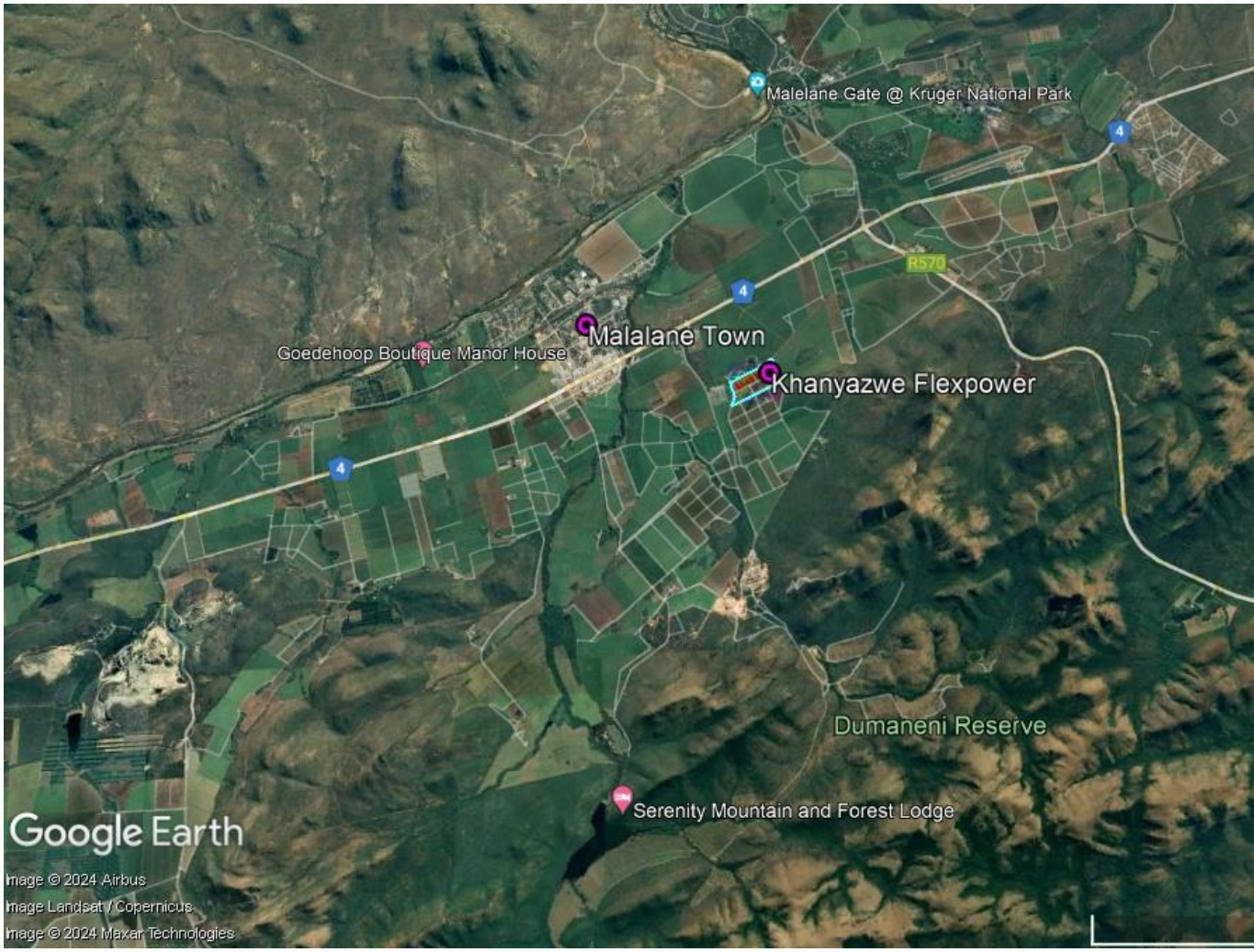


Figure . The project will consist out of a Phase 1 and a Phase 2. The proposed layout of the Khanyazwe plant is illustrated in Figure 1.

Figure 1: Regional location of the proposed project area.

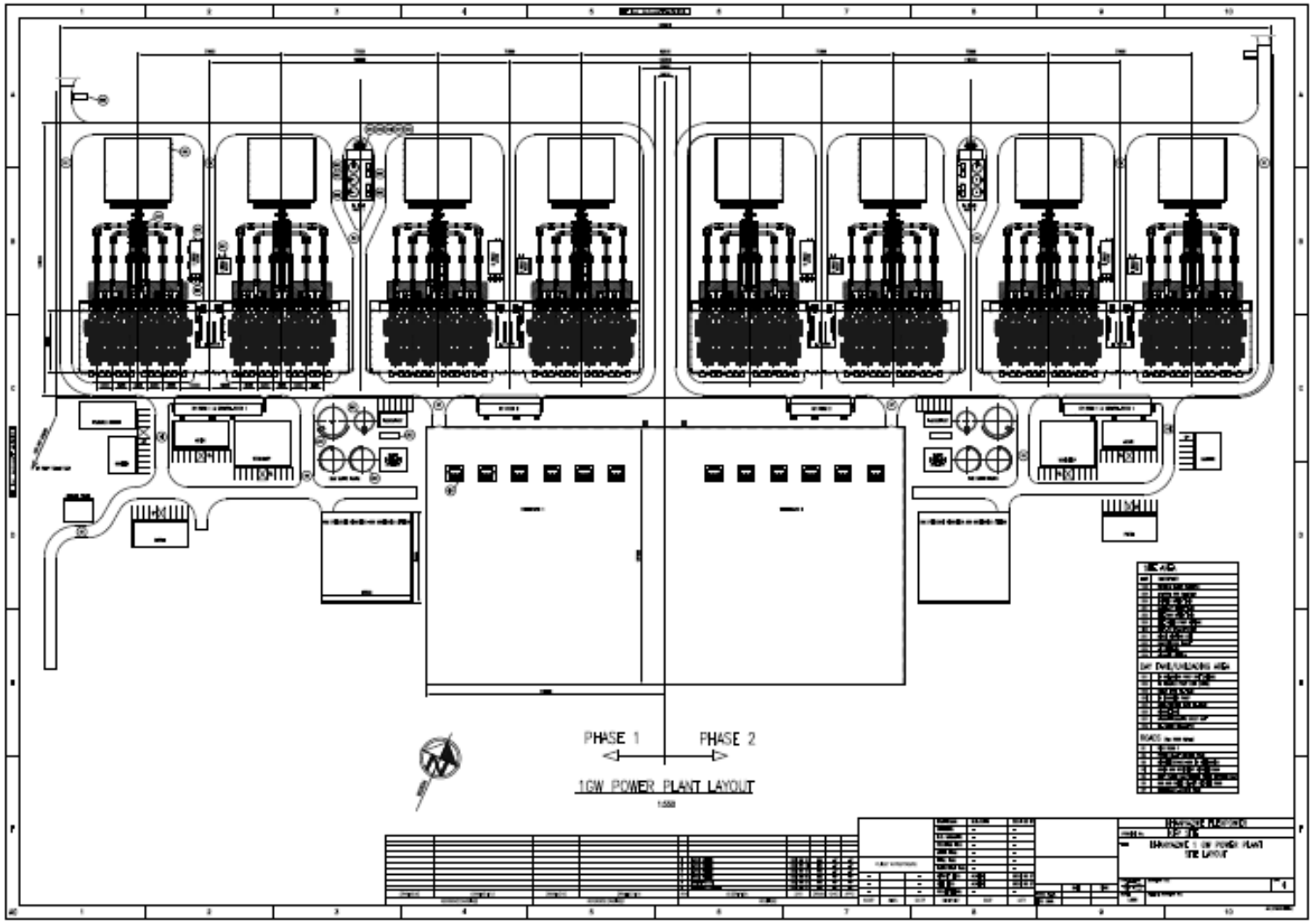


Figure 2: Layout of plant with the cooling radiators facing north

2 BACKGROUND TO NOISE

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

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – Inverse Square Law. Expressed logarithmically as decibels, this means the sound level decrease 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance.

The decibel scale is logarithmic therefore decibel levels cannot be added together in the normal arithmetic way, for example, two sound sources of 50 dB each do not produce 100 dB but 53 dB, nor does 50 dB and 30 dB equal 80 dB but remains 50 dB.

Air absorption is important over large distances at high frequencies, and it depends on the humidity but is typically about 40 dB/km @ 0 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

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

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

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

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation

is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings, and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general, the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3-5 dBA.

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

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95 dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analysed due to loud noises;
- Excessive loudness;
- Annoyance.

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

Types of noise exposure:

- Continuous exposure to noise – The level is constant and does not vary with time e.g., traffic on freeway and an extractor fan;
- Intermittent exposure to noise – The noise level is not constant and occurs at times e.g., car alarms and sirens;
- Exposure to impact noise – A sharp burst of sound at intermittent intervals e.g., explosions and low frequency sound.

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

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

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

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

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

- The trained healthy human ear can discern changes in sound levels of 1 dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3 dBA;
- A change in sound level of 5 dBA is a readily perceptible increase in noise level;
- A 10-dBA change in the sound level is perceived as twice as loud as the original source.

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

- Residential area – 55 dBA for the daytime and 45 dBA for the night-time period;
- Industrial area – 70 dBA for the day- and night-time periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound

and what the noise impact will be. To evaluate such, there must be uniform guidelines to evaluate each scenario. SANS 10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 1.

Table 1: Recommended noise levels for different types of districts

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

The reference time intervals can be specified to cover typical human activities and variations in the operation of noise sources and are for daytime between 6h00 to 22h00 and for night-time between 22h00 and 6h00.

The study area falls within an (a) to (b) type districts because of the type of activities such as main roads, gravel roads, little traffic and major traffic which all have an influence on the prevailing ambient noise level for a specific area.

There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e., residential, agricultural activities (seasonal) and feeder roads in proximity of each other or to a farmhouse. A farmhouse next to the R63 road will experience higher noise levels than the farmhouse/s some distance from roads. The ambient noise level will therefore differ throughout the study area, depending on the location and the measuring position in relation to areas with existing noise sources such as roads.

People exposed to an increase in the prevailing ambient noise level will react differently to the noise levels and the response is given in Table 2.

Table 2: Estimated community/group response when the ambient noise level is exceeded (Source: SANS 10103 of 2008).

1	2	3
Excess $)L_{Req,T}$[1)]	**Estimated community/group response**	
dB	**Category**	**Description**
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

1) Calculate $)L_{Req,T}$ from the appropriate of the following:

a) $)L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determine the specific noise under investigation).

b) $)L_{Req,T}$ = $L_{req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambie table 1.

c) $)L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicab determined from table 2.

The difference between the actual noise and the ambient noise level will determine how people will respond to sound.

3 LEGISLATIVE AND POLICY CONTEXT

The following legislation, regulations, standards guidelines and/or legislation will guide the assessment of potential noise into the living environment:

International Guidelines

- Environmental, Health and Safety (EHS) Guidelines, World Health Organisation (WHO, 2002); and

National legislation

- National Environmental Management Act. 2006 Act 62 of 2008 (RSA, 2008).

Provincial legislation

- Noise Regulations 1992.

National Standards

- SANS 10357 of 2004 – The calculation of sound propagation by the concave method (SANS, 2004);
- SANS 10210 of 2004 – Calculating and predicting road traffic noise (SANS, 2004);
- SANS 10328 of 2008 – Methods for environmental noise impact assessments (SANS, 2008); and
- SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication (SANS, 2008).

A disturbing noise according to the Noise Regulations, 1992 means a noise:

- Exceeds the residual ambient noise level by 7.0 dBA;

The potential noise impact by the plant will be evaluated in terms of the above legislation and if the establishment of the turbines will have a negative effect on the people living in the vicinity of the proposed plant.

4 STUDY METHODOLOGY

4.1 Instrumentation

The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1992 and the SANS 10103 of 2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) using a digital Larson Davis 831 and Larson Davis LXT – Class 1 meters with Logging, Environmental 1/1, 1/3 Octave Band and percentiles Sound Level Meter (Class 1). On taking measurements the device-meter scale was set to the "A" weighed measurement scale which enables the device to respond in the same manner as the human ear. The device was held approximately 1.5 m above the surface and at least 3.0m away from hard reflecting surfaces. A suitable wind shield was used on the microphone for all measurements in order to minimize wind interference. The Instrument was checked and calibrated prior to use and maintained in accordance with equipment and coincided below 1.0dBA.The following instruments were used in the noise survey:

A. Larson Davis 831

- Larson Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072;
- Larson Davis Pre-amplifier – Serial no. PRM831 377B02;
- Larson Davis ½" free field microphone – Serial no. 0206 and 346326;
- Certificate Number: 2024-AS-0006;
- Date of Calibration: 11 January 2024.

B. Larson Davis LXT

- Larson Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0006037;
- Larson Davis Pre-amplifier – Serial no. PRM LXT1 069946;
- Larson Davis ½" free field microphone – Serial no. 069946,316345;
- Certificate Number: 2024-AS-0924;
- Date of Calibration: 7 May 2024.

C. Larson Davis Calibrator 200

- Acoustic Calibrator - Serial no. 9855;

- Certificate Number - 2024-AS-0004;
- Date of Calibration - 11 January 2024.

The instruments were calibrated before and after the measurements were conducted and coincided within 1.0dBA. Batteries were fully charged, and the windshield was always in place. The noise surveys were carried out in terms of the Noise Control Regulations, 1992 being:

“16 (1) Any person taking readings shall ensure that -

(a) sound measuring instruments comply with the requirements for type I instrument in accordance with SABS-IEC 60651, SABS-IEC 60804 and SABS-I EC 60942 as the case may be;(b) the acoustic sensitivity of sound level meters is checked before and after every series of measurements by using a sound calibrator, and shall reject the results if the before and after calibration values differ by more than 1 dBA;(c) the microphones of sound measuring instruments are at all times provided with a windshield;(d) the sound measuring instruments are operated strictly in accordance with the manufacturer's instructions; and,

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

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

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

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

4.2 Measuring points and results

The measuring points for the study area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources

such as distant traffic noise, agricultural activities, traffic noise along the N4 (stationary and moving). The measuring points and physical attributes of each measuring point are illustrated in Table 3. The location of the measuring points 1 to 11 is illustrated in Figure 3.

Table 3: Information of the measuring points

Measuring points	Latitude	Longitude	Type of district according to SANS 10103 of 2008	Type of use
LMP1	31° 31.609'E	31° 31.596'E	Residential	House
1	25° 29.666'S	31° 30.878'E	Residential	House
2	25° 29.722'S	31° 31.355'E	Residential close to the N4	House
3	25° 30.424'S	31° 31.609'E	Suburban with little road traffic	Farmhouse
4	25° 29.168'S	31° 33.350'E	Residential close to the N4	House
5	25° 30.369'S	31° 30.620'E	Residential close to the N4	House
6	25° 31.064'S	31° 30.795'E	Suburban with little road traffic	Farmhouse
7	25° 30.847'S	31° 31.335'E	Suburban with little road traffic	Farmhouse
8	25° 31.687'S	31° 31.085'E	Suburban with little road traffic	Farmhouse
9	25° 31.626'S	31° 31.473'E	Suburban with little road traffic	Farmhouse
10	25° 29.168'S	31° 30.943'E	Residential	House
11	25° 29.366'S	31° 30.859'E	Residential	House

The following is of relevance to the ambient noise measurements:

- The Long measuring points (LMP) was measured over a 24-hour period at MP 3;
- The L_{Aeq} was measured over a representative sampling period exceeding 10 minutes at each measuring point; and
- The noise survey was conducted during the day and night-time period being 06h00 to 22h00 for the daytime and 22h00 to 6h00 for the night-time;
- The noise survey comply with Noise Protocol 6.

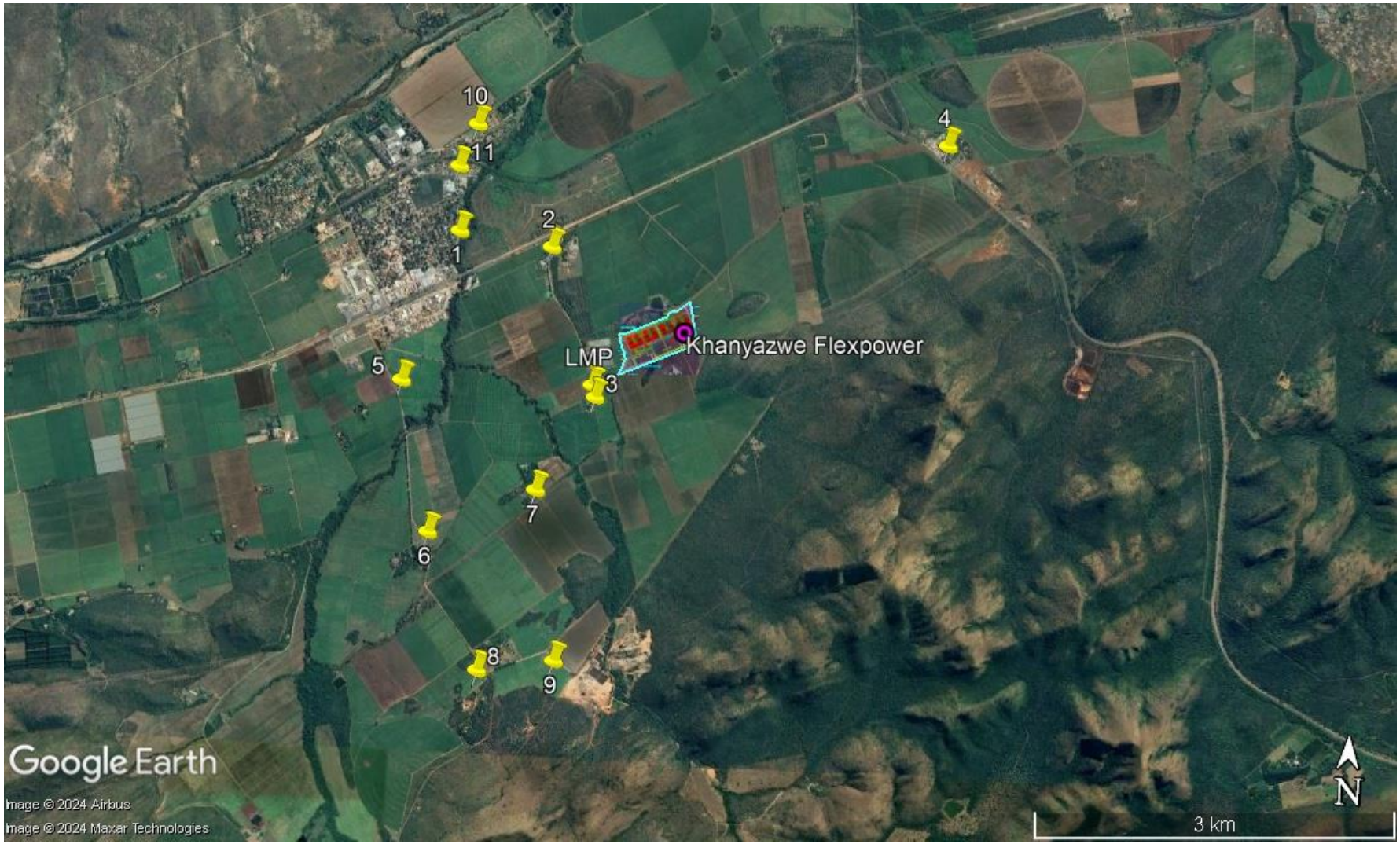


Figure 3: Measuring points

4.2.1 Noise results

The results of the noise survey conducted on 21 May 2024 are given in Table 5. The results of the noise survey are given as the noise levels were found at the time of the survey with no wind 0.3m/s to a wind speed of 0.7m/s. This is to illustrate how the prevailing ambient noise level changes when the windspeed increases. The prevailing ambient noise level also changed when there was distant and/or traffic in the vicinity of the measuring point. The $L_{Aeq}T$ is the average noise level over a period, $L_{A,max}$ is the maximum noise level, $L_{A,min}$ is the minimum noise level. The results of the 24-hour noise reading at the northern boundary of the farmhouse at MP3 is illustrated in Table 5 and in Figure 3. The Ldn is the average for the day and night-time periods and the Lden is the average for the day evening and night-time periods. and the shorter noise readings (during the Day, Night 1 and Night 2 at the farms in the vicinity of the Flexpower Plant, Farms in the vicinity of Flexpower Plant and Malalane Town in Table 6.

The day night noise levels (Ldn) were 43.5dBA with the daytime noise level of 43.5dBA and the night-time noise level of 42.4dBA. The day, evening and night-time noise level was 43.1dBA whereas the daytime noise level was 43.2dBA, the evening noise level was slightly higher 44.4dBA and the night-time noise level was 42.4dBA. There was insects during the night-time period which increased the noise level accordingly. The distant train activity noise and traffic noise contributed to the prevailing ambient noise during the day and night-time periods. Agricultural activities, domestic activities, birds and traffic along the gravel roads contributed to the prevailing ambient noise level for the daytime period.

Train noise increased the prevailing ambient noise levels during the day and the night - time periods. Distant train noise was audible at most of the measuring points during the night-time. The 24-hour noise results at MP3 is illustrated in Table 4 and the graph in Figure 4.

Table 4: Results of the 24-hour noise survey

Ldn	LDay 06:00-22:00	LNight 22:00-06:00	Lden	LDay 06:00-19:00	LEvening 19:00-22:00	LNight 22:00-06:00
43.1	**43.5**	**42.4**	**43.1**	**43.2**	**44.4**	**42.4**

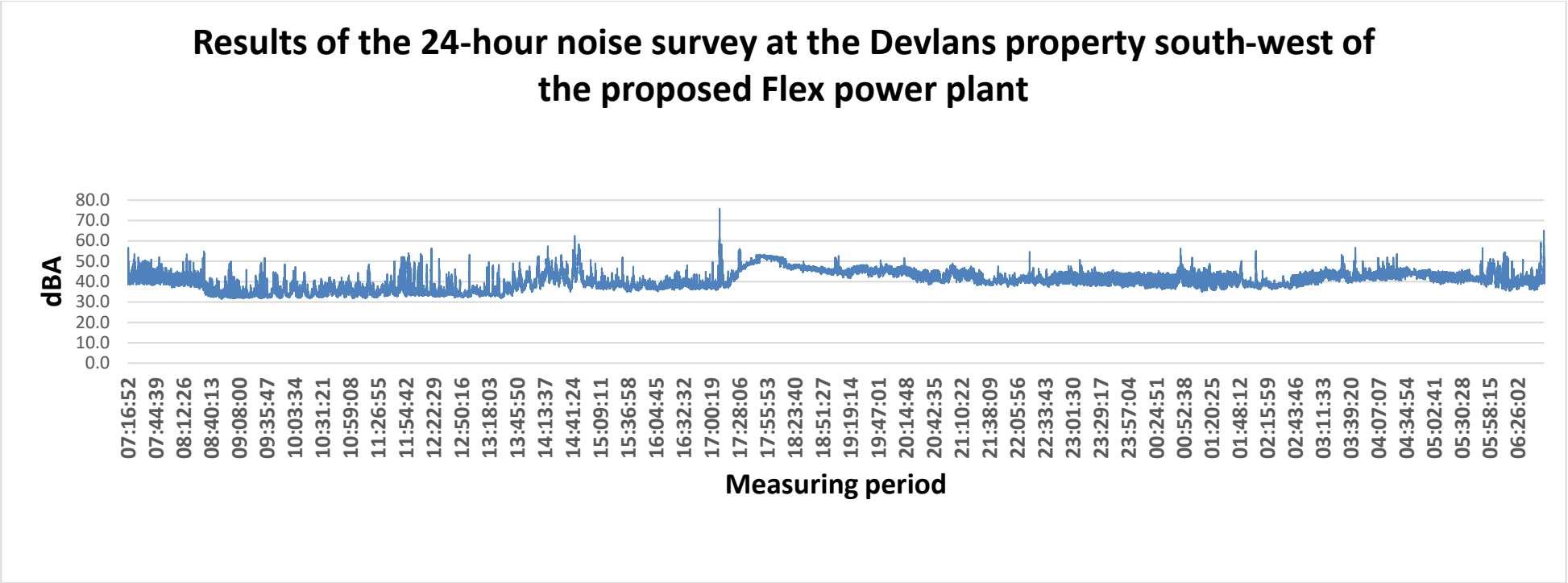


Figure 4: The graph for the 24-hour period - LMS

The noise results for the daytime, night 1 and night 2 ambient noise levels during the beginning of the winter period is noted in Table 5. Traffic noise distant train noise, agricultural activities, vehicles travelling along the gravel roads between the sugar cane fields, and insect noise during the night contribute to the prevailing ambient noise levels of the study area. It can be noted that the night-time noise levels were higher than the daytime noise levels due to increased insect activity noise. The prevailing ambient noise levels will not be constant due to agricultural activities and insect activities which are seasonal and will increase the prevailing ambient noise levels accordingly. The prevailing wind direction in the Malelane project area is a southerly, easterly and northerly side for most of the time which will propagate the noise from the proposed plant for most of the time to the north westerly side and a southerly side of the study area.

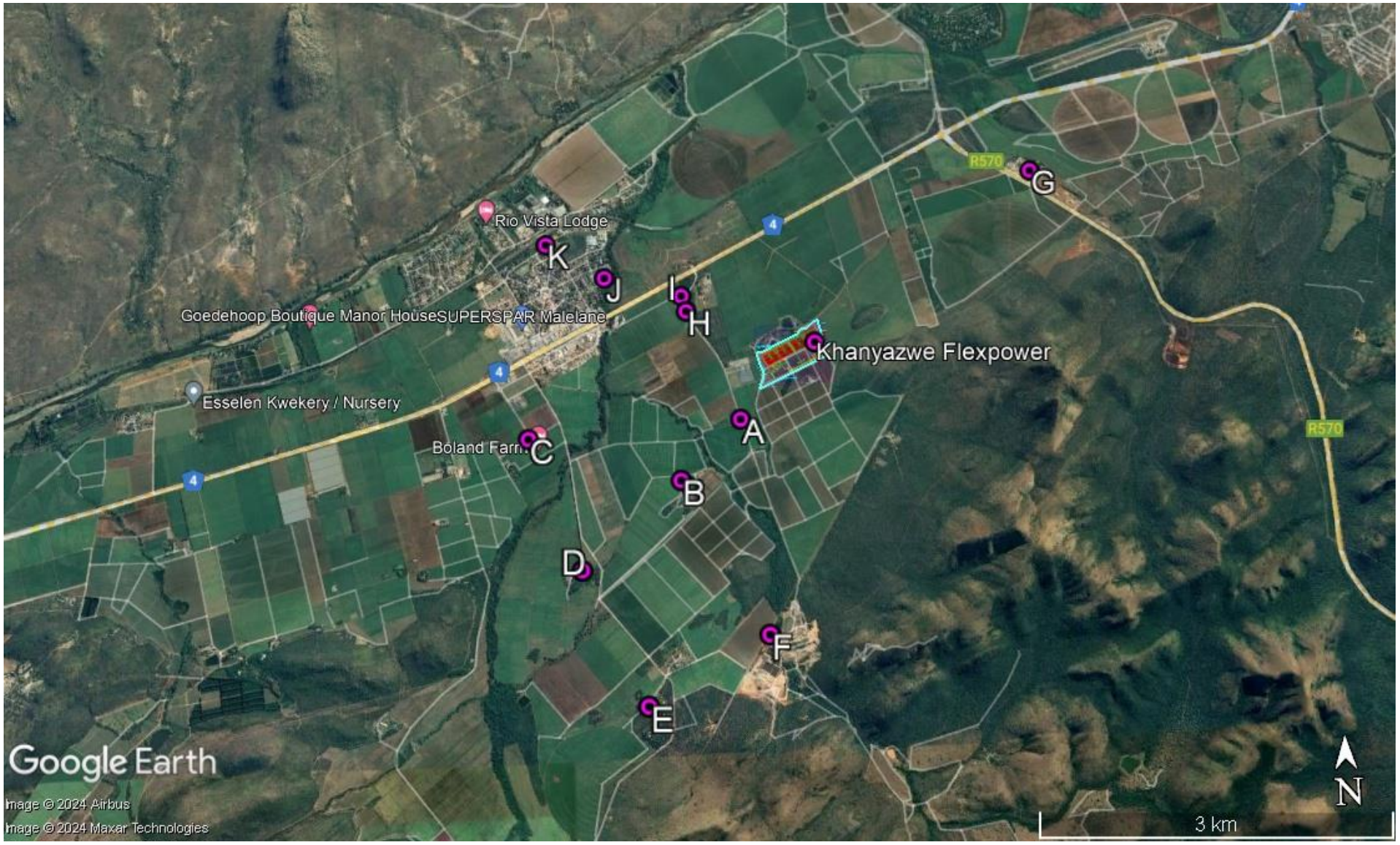
Table 5: Noise results for the day and night-time periods

MP	Daytime - dBA			Night 1 - dBA			Night 2 - dBA			Remarks
	$L_{Aeq,T}$	$L_{A,max}$	$L_{A,min}$	$L_{Aeq,T}$	$L_{A,max}$	$L_{A,min}$	$L_{Aeq,T}$	$L_{A,max}$	$L_{A,min}$	
1	**50.1**	65.8	42.9	**45.0**	62.4	38.8	**47.6**	64.4	40.8	My Lodge Guesthouse. Distant traffic (N4) & insects during the night.
2	**46.3**	71.4	39.6	**50.5**	70.2	39.2	**46.4**	57.5	40.4	Farm housing. Traffic noise during the day and night-time period.
3	**39.3**	63.8	31.9	**42.9**	59.7	38.8	**44.0**	67.3	33.5	Distant traffic, agricultural activities and insects during the night. Devlan's property.
4	**64.7**	77.8	45.8	**65.3**	88.0	41.1	**59.9**	80.5	42.5	Traffic along the R34 road running between the north and the south.
5	**36.9**	62.1	27.0	**46.0**	62.9	41.7	**43.5**	65.2	36.0	Distant traffic, commercial activities and insects during the night.
6	**37.0**	53.0	29.9	**47.1**	60.7	44.6	**41.7**	60.7	36.7	Distant traffic, agricultural and insects during the night.
7	**36.8**	59.3	31.1	**46.5**	63.4	41.9	**43.2**	54.1	38.5	Madelien Estate. Agricultural activities, and insects during the night.
8	**37.2**	56.8	25.8	**37.2**	51.0	32.7	**40.8**	55.4	30.8	Agricultural Housing, Distant agricultural activities and insects during the night.
9	**42.8**	59.1	33.5	**39.8**	58.6	33.4	**39.5**	65.8	33.5	Along the gravel road to brick yard. Distant brickmaking activities and insects during the night.
10	**48.8**	67.7	37.6	**48.3**	57.6	45.7	**51.0**	68.7	45.1	Distant factory, traffic and insects during the night. Intermittent train noise audible.
11	**41.8**	60.3	33.7	**49.1**	62.5	41.1	**53.7**	69.9	49.0	Along Luiperd Street. Distant train activities, traffic, domestic and insects during the night.

The graphs as illustrated in Appendix B are the prevailing ambient noise levels at the measuring points in the vicinity of the agricultural land (east of the proposed Flexpower plant) during daytime which were between 36.9dBA to 42.8dBA, night 1 between 37.2dBA to 50.1dBA and night 2 between 39.5dBA to 46.4dBA. The prevailing ambient noise level within Malelane during daytime were 41.8dBA to 50.1dBA, night 1 between 45.0dBA to 49.1dBA and night 2 between 46.4dBA to 53.7dBA.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The district where the proposed KFPP will be located will be in the vicinity of the N4 with a continuous flow of traffic during the day and the night-time respectively. Distant farmhouses are situated to the south, commercial area to the immediate north and Malalane to the northeast at 3km. The proposed development will take place on agricultural land of the proposed Flexpower plant. There will be a fluctuation of the prevailing ambient noise levels depending on the seasonal activities, prevailing winds, insect activities and location to busy roads at or in the vicinity of each farm hose. Farmhouses A to I are situated south of the N4 and the residential area of Malelane (J and K) north of the N4 and the railway line between Maputo and Johannesburg runs through a section of Malelane. There is a guesthouse along the R34 which is some distance to the east of the Flexpower plant. The noise receptors in the vicinity of the KFPP footprint are illustrated in Figure 5.



.**Figure 5: Farmhouses and other in the vicinity of the project area**

The distances between the middle of the KFPP and the noise sensitive areas in the vicinity of the site are illustrated in Table 6.

Table 6: Distances between the noise receptors and the Plant

Noise sensitive areas	Middle of the Plant to noise receptors in meters
A	570
B	1 369
C	2 345
D	2 584
E	3 361
F	2 549. Brickyard 250m from staff housing
G	2 698
H	980
I	1 102
J	1 846
K	2 474

5.1.1 Current noise sources

Traffic noise from the N4 (continuous flow of traffic), Farmhouses (intermittent flow of traffic), distant train activities, distant sugar mill, aircraft activities (intermittent), seasonal agricultural activities, animals, farmhouse activities, wind, agricultural traffic along the gravel roads contribute to the prevailing ambient noise level on an intermittent basis, insects and birds and brickmaking activities. The sugar mill is 4 700m and ROMPCO 2 817m to the east of the plant. The prevailing noise level is proportional to the distance from the main noise sources. The wind and the trees play an important role in the change of the pre-vailing ambient noise levels and there is a definite shift in the ambient noise levels at the different wind speeds with an upwards increase of the noise level the higher the wind speed. The period, diurnal and seasonal wind roses for the periods 1 May 2019 to 30 April 2024 for different scenarios is hereby attached in Figures 6 to 9. The period windrose illustrates that the wind blow from a southerly, easterly and northerly side for most of the time.

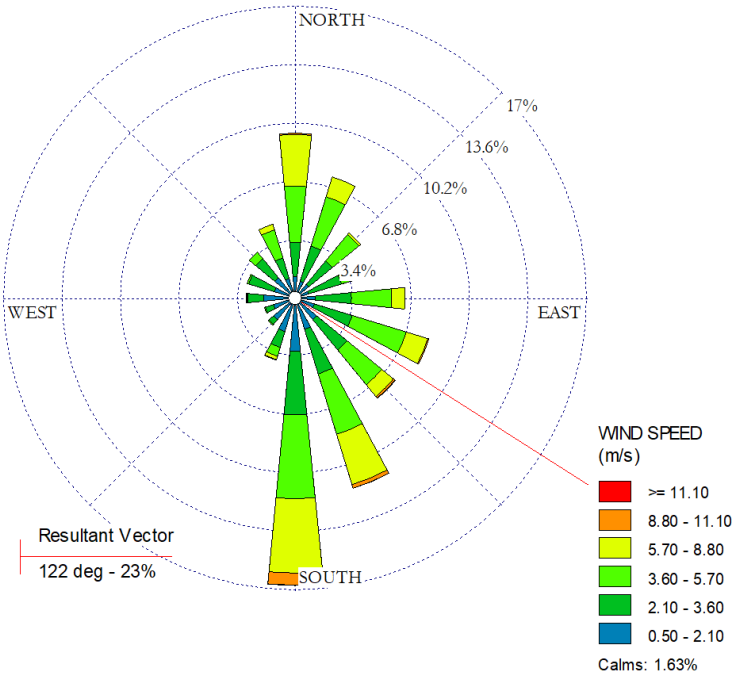


Figure 6: Period wind rose for the Malalane Region

The daytime wind directions are from the southerly, easterly and northerly side for most of the time.

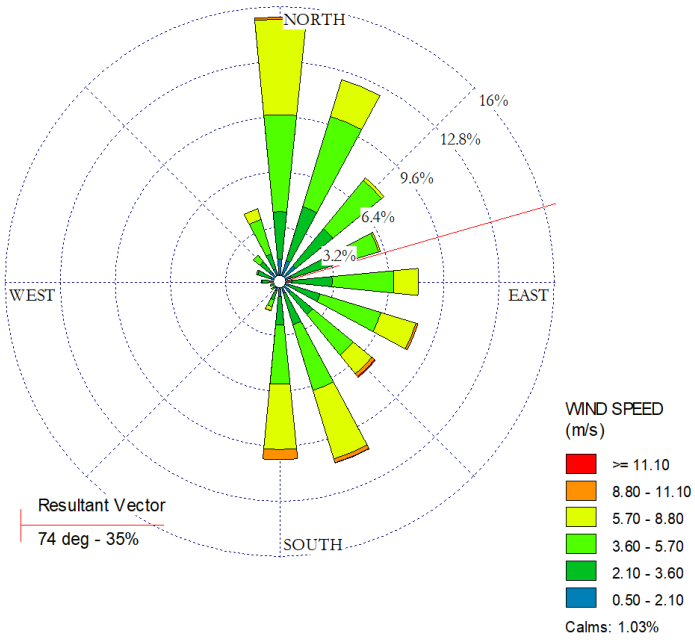


Figure 7: Daytime wind rose for the Malalane Region

The wind direction during the evening is from southern to eastern quadrant and during the night-time it change to a southerly wind direction.

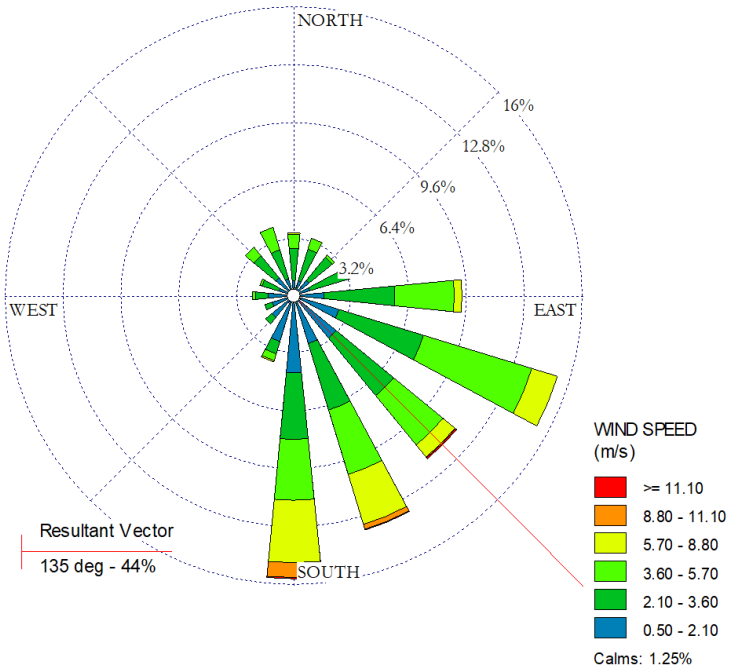


Figure 8: Evening wind rose for the Malalane Region

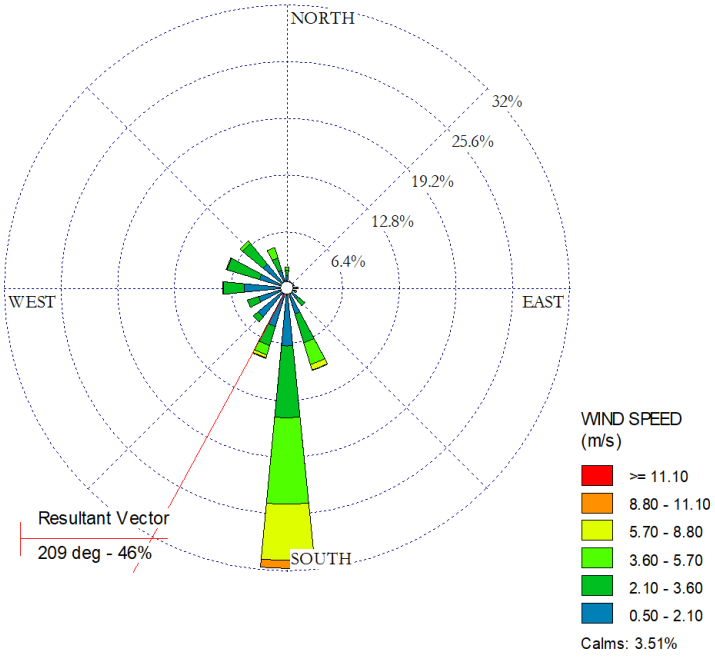


Figure 9: Night-time wind rose for the Malalne Region

6 NOISE MAPPING

6.1.1 Noise sources at the power plant during the construction phase

The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor during the construction phase. The following noise levels as given in Table 6 are construction machinery and equipment that may be used during the construction phase of the project. The cumulative noise levels (when all the machinery is in use) were calculated for setback distances of 2m up to 1 920m.

Table 7: Sound pressure levels of construction machinery

Equipment	**Reduction in the noise level some distance from the source - dBA**								
Cumulative distance from source in meters	2m from the machinery and/or equipment	15m	30m	60m	120m	240m	480m	960m	1920m
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
Backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Jackhammer	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from the construction activities within a radius of 30m	96.2	67.7	61.8	63.3	55.6	43.6	37.6	30.5	24.5

The following equation was used to calculate the noise level at the noise receptors during the construction and rehabilitation phases.

$$Lp = Lw - 20\log R - 5dB$$

Where, Lp is the sound level at a distance from the source in dBA;

Lw is the sound level at the source in dBA;

R is the distance from the source.

The noise levels at the noise receptors will be added in a logarithmic manner to determine the overall sound exposure at the receptor.

- Sound level change of 1.0dB can barely be detected by humans;
- Change of 2.0dB to 3.0dBA, barely noticeable;

- Change of 5.0dB, readily noticeable;
- Change of 10.0dB perceived as a doubling in loudness;
- Change of 20.0dB represents a dramatic change.

The noise intrusion level criteria for the construction phase of the project are given in Table 8 and the noise intrusion levels will be categorized in terms of this noise level criteria.

Table 8: Noise intrusion level criteria

Increase Δ-dBA	**Assessment of impact magnitude**	**Color code**
0 <Δ≤ 1	Not audible	
1 <Δ≤ 3	Very Low	
3 <Δ≤ 5	Low	
5 <Δ≤ 10	Medium	
10 <Δ≤ 15	High	
15 <Δ	Very High	

The calculated noise intrusion levels during the construction phase are noted in Table 8. The noise intrusion levels during the construction phase of the project will be below the threshold value of 7.0dBA. The noise from the proposed construction activities will not be below 1.0dBA at the abutting noise receptors due to the prevailing ambient noise levels at MP1 to MP11.

The following activities and noise source levels will become part of the construction phase activities of the proposed Khanyazwe Powerflex project:

- Clearing and grubbing of topsoil and vegetation at the plant footprint – 80.5dBA;
- Construction activities at the Plant structure – 79.5dBA;
- Civil construction activities at the plant footprint – 83.5dBA;
- Installation of plant machinery/equipment – 82.5dBA;
- Cladding of the Plant structure – 80.0dBA;
- Construction activities at the offices, workshop and ablution – 80.5dBA;
- Construction of OHP line and Pylons – 80.5dBA.

The noise intrusion levels during the construction phase at the Flexpower footprint is noted in Table 9.

Table 9: Noise intrusion levels during the construction phase

Residential property	Clearing and grubbing of topsoil and vegetation at the Plant footprint	Construction activities at the Plant structure	Civil construction activities at the plant footprint	Installation of the plant machinery	Cladding activities	Construction activities at the offices, workshops, and ablution facilities	Construction of roads to and from the plant	Construction of OHP and Pylons	Cumulative Levels	Cumulative noise level - Daytime	Intrusion noise level - daytime	Cumulative noise level – Night-time	Intrusion noise level - night-time
A	22.4	21.4	25.4	24.4	21.9	23.4	22.4	17.4	31.8	40.0	0.7	43.2	0.3
B	19.8	13.8	17.8	16.8	14.3	15.8	14.8	9.8	25.2	37.1	0.3	43.3	0.1
C	15.1	9.1	13.1	12.1	9.6	11.1	10.1	5.1	20.5	37.0	0.1	43.5	0.0
D	14.3	8.3	12.3	11.3	8.8	10.3	9.3	4.3	19.7	37.1	0.1	41.7	0.0
E	12.0	6.0	10.0	9.0	6.5	8.0	7.0	2.0	17.4	37.2	0.0	37.2	0.0
F	14.4	8.4	12.4	11.4	8.9	10.4	9.4	4.4	19.8	42.8	0.0	39.8	0.0
G	13.9	7.9	11.9	10.9	8.4	9.9	8.9	3.9	19.3	64.7	0.0	59.9	0.0
H	22.7	16.7	20.7	19.7	17.2	18.7	17.7	12.7	28.1	46.5	0.1	46.3	0.1
I	21.7	15.7	19.7	18.7	16.2	17.7	16.7	11.7	27.1	46.5	0.1	46.3	0.1
J	17.2	11.2	15.2	14.2	11.7	13.2	12.2	7.2	22.6	50.1	0.0	45.0	0.0
K	14.6	8.6	12.6	11.6	9.1	10.6	9.6	4.6	20.0	41.8	0.0	49.1	0.0

6.1.2 Noise sources at the power plant during the operational phase

The cumulative noise projections were done with a Noise Map software program where the different plant equipment, octave band, wind speed, humidity, topography, ground conditions and temperature forms part of the data input. Inventory of the plant, height, noise sources at the plant levels were used in the calculation of the projected noise levels at the abutting residential properties. The following noise sources were used in the noise calculations:

- Noise level inside the power plant - 113.0dBA;
- Exhaust gas outlet of which there will be one outlet per engine – 137.0dBA per outlet and a silencer will be fitted which will reduce the noise level per exhaust outlet by 35.0dBA;
- Exhaust gas ducting with a noise level of 93.0dBA and acoustic treatment will be done with a noise reduction of 20.0dBA;
- Charge air intake of which there will be 2 per engine – 140.0dBA with an air silencer of 45.0dBA;
- Ventilation intake of which there will be 2 per engine – 97.0dBA;
- Roof monitors of which there will be 2 – 106dBA;
- Cooling radiators with a sound level of 89.0dBA at 1 meter from the radiator – 5 radiators per engine (indoors);

- Step up transformers of which there will be 4 units with a noise level of 91.0dBA

A noise modelling exercise was conducted by Wartsila, the suppliers of the plant, and a Cadna A version 2024 was used to calculate the noise contours. The noise contouring was done in conjunction of the International Standard ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: general calculation method. The projected noise level was 46.0dBA north of the property boundary. This is illustrated in Figure 4.Noise calculations were made with Phase 1 in operation and with Phase 2 as a combined Phase 1 and Phase 2.

The noise contours were based on the following sound levels after acoustic screening measures were put in place:

- Exhaust gas outlet - 82.0dBA;
- Roof monitors – 80.0dBA;
- Boundary opposite the cooling radiators – 70.0dBA;
- Noise reduction of 57.0dBA of the walls;
- Noise reduction of 51.0dBA of the roof;
- Noise level of 110.0dBA inside the plant room;
- Acoustic screens at the step-up transformers;
- Acoustic screens and/or acoustic louvres/splitter units at the cooling radiator side;
- Acoustic louvres/splitter units at the ventilation intake – auxiliary side;
- Acoustic louvres/splitter units at the ventilation intake – generator side.

The noise intrusion levels are illustrated in Table 10 a noise contour in Figure 10..

Table 9: noise intrusion levels during the operational phase

Noise receptors	Noise levels in dBA					
	Distance in meters	Contour level	Cumulative level - day	Cumulative level - night	Noise intrusion day	Noise intrusion night
A	570	36.0	41.0	43.7	1.7	0.8
B	1 369	24.0	37.0	43.3	0.2	0.1
C	2 345	14.0	36.9	43.5	0.0	0.0
D	2 584	12.0	37.0	41.7	0.0	0.0
E	3 361	12.0	37.2	37.2	0.0	0.0
F	2 549	12.0	42.8	39.8	0.0	0.0
G	2 698	12.0	64.7	59.9	0.0	0.0
H	980	27.0	46.4	46.3	0.0	0.1
I	1 102	29.0	46.5	46.3	0.1	0.1
J	1 846	22.0	50.1	45.0	0.0	0.0
K	2 474	9.0	41.8	49.1	0.0	0.0

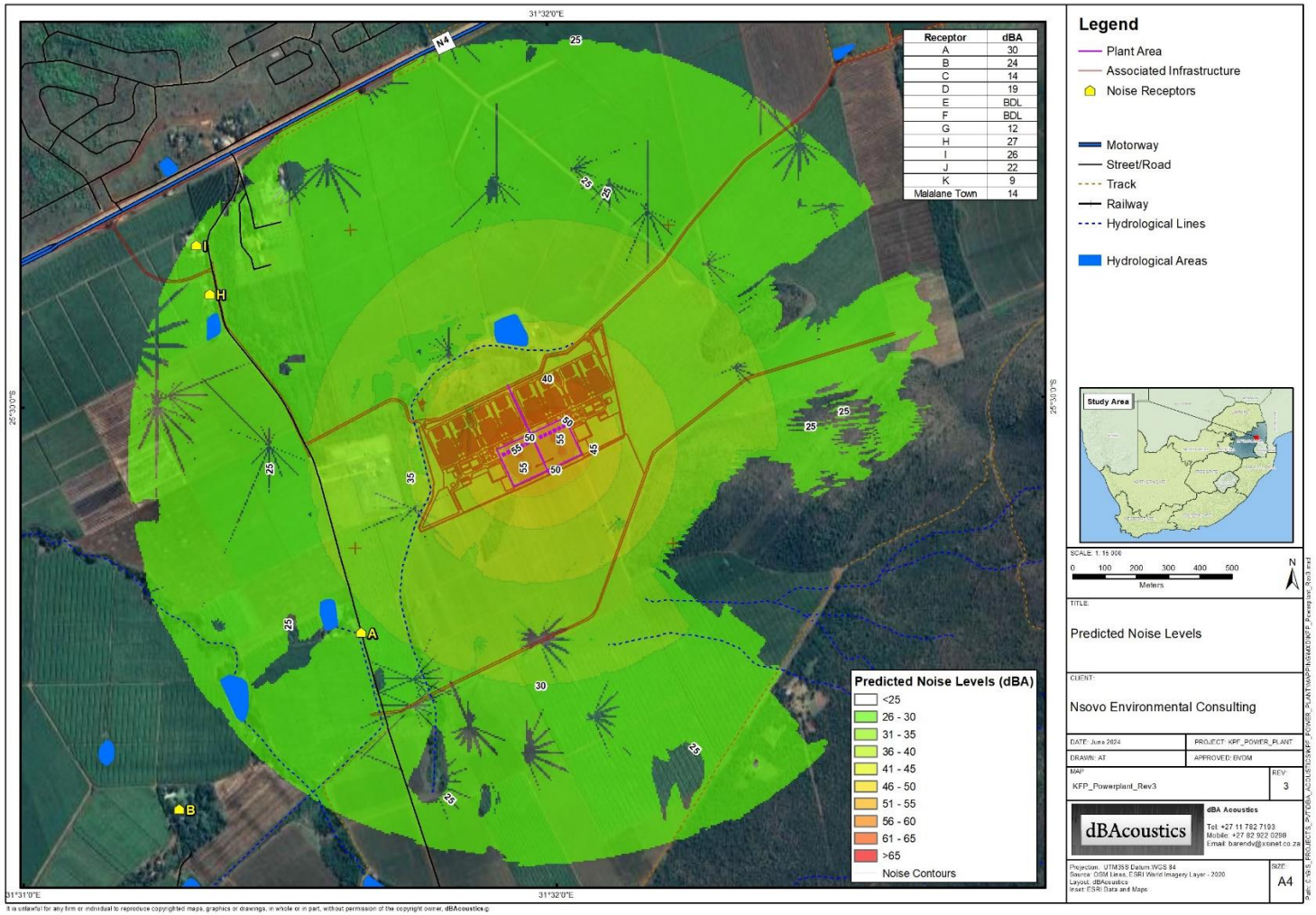


Figure 10: Noise contours

Due to the nature of the proposed development, there will be an increase in the prevailing ambient noise levels within the vicinity of the proposed plant and the following noise levels will have to be adhered to at the footprint boundaries after the implementation of noise mitigatory measures at the structure of the plant enclosure, roof area, at ventilation openings in the sides of the plant enclosure and /or any noise survey outside the plant building..

6.1.3 Rehabilitation phase

The following noise sources were used in calculating the potential noise intrusion levels during the rehabilitation phase when the plant and/or infrastructure will be removed from the site:

- Rehabilitation of disturbed areas – 86.5dBA;
- Planting of grass and vegetation – 84.5dBA.

The noise intrusion levels during the rehabilitation phase of the project is noted in Table 11.

Table 11: Noise intrusion levels during the rehabilitation phase

Residential	Removal of all infra-structure	Earthworks and planting of grass	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level -Night-time	Intrusion noise level - Daytime	Intrusion noise level - Night-time
A	22.4	21.4	24.9	39.5	43.0	0.2	0.1
B	14.8	13.8	17.3	36.8	43.2	0.0	0.0
C	10.1	9.1	12.6	36.9	43.5	0.0	0.0
D	9.3	8.3	11.8	37.0	41.7	0.0	0.0
E	7.0	6.0	9.5	37.2	37.2	0.0	0.0
F	9.4	8.4	11.9	42.8	39.8	0.0	0.0
G	8.9	7.9	11.4	64.7	59.9	0.0	0.0
H	17.7	16.7	20.2	46.4	46.2	0.0	0.0
I	16.7	15.7	19.2	46.4	46.2	0.0	0.0
J	12.2	11.2	14.7	50.1	45.0	0.0	0.0
K	9.6	8.6	12.2	41.8	49.1	0.0	0.0

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

- The increase in the noise level because of the construction, operational and rehabilitation phases, and;

- The overall noise level produced by power generation.

The prevailing ambient noise level may change according to the season of the year when farming activities and/or insects becomes the pre-dominant contributor to the higher ambient noise levels.

6.1.4 Assumptions and Limitations

The following assumptions were used in the noise impact assessment:

- Power generation operations will take place on a 24-hour basis;
- The abutting occupants of the farmhouses (depending on the location of the houses to the proposed project areas) are exposed to distant noise such as traffic noise, train noise and insects during the day and the night;
- Seasonal agricultural activities increase the prevailing ambient noise level accordingly;
- The prevailing wind direction propagates the noise in a northerly, north westerly and southerly direction most of the time; and
- Power generation is a necessity in South Africa.

There were no limitations at the time of compiling the report as all the relevant information for project was provided by the Environmental Assessment Practitioner.

7 IMPACTS IDENTIFICATION AND ASSESSMENT

7.1 Identification of Impacts

7.1.1 Construction Phase –

- Grading and building of new roads and trenches

  Noise may be generated by the construction activities and the use of construction equipment such as Graders, TLB's and Front-end loaders. The use of this equipment will create an increase in noise levels in the immediate vicinity of the construction activities and in some cases at some distance from the activities.

- Preparation of the footprint, digging of trenches, earthworks, and construction of the base of the plant.

  Noise could be generated by the following activities: generator noise, civil construction and in extreme cases localised blasting.

- Construction of the plant footprint on site

  The construction of the plant could generate localised noise increase in particular the use of cranes and generators during the assembly stage of the different components of the plant.

- Construction traffic

  Construction traffic to and from the site would create a temporary linear noise source.

7.1.2 Operational Phase –

- Noise generated by the KFPP.

- Turbines – mechanical noise

- Plant - normal wear and tear, and the lack of preventative maintenance.

Noise could be generated through the lack of a cyclic maintenance programme to identify normal wear and tear of the essential components.

- Traffic

  Traffic noise is created by vehicle movement where mechanical noise, rattles, and road surface play an important role on the noise levels along roads or some distance from roads.

- Sub-station and overhead power lines

  A sub-station can generate noise from the blowers and transformers, and corona noise from the overhead power lines. These noise levels are site specific.

- Maintenance activities

  The regular maintenance activities may give rise to site-specific increase in the noise levels.

7.1.3 Rehabilitation phase - Environmental Authorisation already issued for this phase. There will be no changes to the rehabilitation phase.

The dismantling of the plant will involve mechanical machinery with associated mechanical type noise which will be a point noise source.

7.2 Impact Assessment Methodology

The significance of the identified impacts will be determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, 2014. As with all impact methodologies, the impact is defined in a semi-quantitative way and will be assessed according to methodology prescribed in the following section.

Table 12: Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating	Scale	Description / criteria
MAGNITUDE of negative impact (at the indicated spatial scale)	**10**	**Very high**	Bio-physical and/or social functions and/or processes might be *severely* altered.
	8	**High**	Bio-physical and/or social functions and/or processes might be *considerably* altered.
	6	**Medium**	Bio-physical and/or social functions and/or processes might be *notably* altered.
	4	**Low**	Bio-physical and/or social functions and/or processes might be *slightly* altered.
	2	**Very low**	Bio-physical and/or social functions and/or processes might be *negligibly* altered.
	0	**Zero**	Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10**	**Very high**	Positive: Bio-physical and/or social functions and/or processes might be *substantially* enhanced.
	8	**High**	**Positive**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced.
	6	**Medium**	**Positive**: Bio-physical and/or social functions and/or processes might be *notably* enhanced.
	4	**Low**	**Positive**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced.
	2	**Very low**	**Positive**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced.
	0	**Zero**	**Positive**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
DURATION	**5**	**Permanent**	**Impact in perpetuity. –**
	4	**Long term**	Impact ceases after operational phase/life of the activity > 60 years.
	3	**Medium term**	Impact might occur during the operational phase/life of the activity – 60 years.
	2	**Short term**	Impact might occur during the construction phase - < 3 years.
	1	**Immediate**	**Instant impact.**
EXTENT (or spatial scale/influence of impact)	**5**	**International**	**Beyond the National boundaries.**
	4	**National**	Beyond provincial boundaries, but within National boundaries.
	3	**Regional**	Beyond 5 km of the Khanyazwe Powerflex footprint and within the provincial boundaries.
	2	**Local**	Within a 5 km radius of the Khanyazwe Powerflex footprint.
	1	**Site-specific**	On site or within 100 meters of the site boundaries**.**
	0	**None**	**Zero extent.**
IRREPLACEABLE loss of resources	**5**	**Definite**	**Definite** loss of irreplaceable resources.
	4	**High potential**	**High** potential for loss of irreplaceable resources.
	3	**Moderate potential**	**Moderate** potential for loss of irreplaceable resources.
	2	**Low potential**	**Low** potential for loss of irreplaceable resources.
	1	**Very low potential**	**Very low** potential for loss of irreplaceable resources.
	0	**None**	**Zero potential.**
REVERSIBILITY of impact	**5**	**Irreversible**	Impact **cannot** be reversed.
	4	**Low irreversibility**	**Low** potential that impact might be reversed.
	3	**Moderate reversibility**	**Moderate** potential that impact might be reversed.
	2	**High reversibility**	**High** potential that impact might be reversed.
	1	**Reversible**	Impact **will be** reversible.
	0	**No impact**	No impact.
PROBABILITY (of occurrence)	**5**	**Definite**	>95% chance of the potential impact occurring.
	4	**High probability**	75% - 95% chance of the potential impact occurring.
	3	**Medium probability**	25% - 75% chance of the potential impact occurring
	2	**Low probability**	5% - 25% chance of the potential impact occurring.
	1	**Improbable**	<5% chance of the potential impact occurring.
	0	**No probability**	**Zero probability.**
Evaluation Component	**Rating scale and description / criteria**		
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional, or national concern. ***Medium:*** The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional, or national concern. ***Low:*** The activity is localised and might have a negligible cumulative impact. ***None:*** No cumulative impact on the environment.		

Once the Environmental Risk Ratings have been evaluated for each potential environmental impact, the Significance Score of each potential environmental impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Environmental Significance of each potential environmental impact as per Table 13 below. The Environmental Significance rating process is completed for all identified potential environmental impacts both before and after implementation of the recommended mitigation measures.

Table 13: Scale used for the evaluation of the Environmental Significance Ratings

Significance Score	Environmental Significance	Description / criteria
125 – 150	Very high (VH)	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	High (H)	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	Medium-high (MH)	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked at.
40 – 74	Medium (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	Low (L)	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect and is likely to contribute to positive decisions about whether or not to proceed with the project.

7.2.1 The risk assessment for the ***construction phase***

The risk assessment for the different activities during the construction phase is illustrated in Table 14 to 20.

Table 14: Clearing and stripping of topsoil and vegetation at the Powerflex footprint

Activity	***Clearing and stripping of topsoil and vegetation at the Powerflex footprint***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Earthwork activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 15: Construction activities at the Plant structure

Activity	***Construction activities at the Plant structure***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Plant structure preparation to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 16: Civil construction activities at the plant footprint

Activity	***Construction activities at the Plant footprint***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Construction activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 17: Installation of plant machinery/equipment

Activity	***Installation of Plant/equipment***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Construction activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 18: Cladding of the Plant structure

Activity	***Cladding of the Plant structure***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium

Mitigation measures	*Construction activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 19: Construction activities at the offices, workshop and ablution

Activity	***Construction activities at the offices, workshop and ablution***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Construction activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 20: Construction of OHP line and Pylons

Activity	***Construction activities at the new areas***							
Project phase	*Construction phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Construction activities to be done during daytime only and if the prevailing ambient noise level will not be exceeded during night-time.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

7.2.2 Impact assessment during the operational phase

The risk assessment during the *operational phase* is illustrated in Tables 21 to 28.

Table 21: Powerflex power generation

Activity	***Powerflex power generation***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and/or at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 22: Fan cooling radiators – acoustic louvres

Activity	***Fan cooling radiators – acoustic louvres***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 23: Exhaust gas ducting

Activity	***Exhaust gas ducting***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 24: Ventilation intake

Activity	***Ventilation intake***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 25: Roof monitors

Activity	***Roof monitors***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 26: Step up transformers

Activity	***Step up transformers***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

Table 27: Emergency generator

Activity	***Emergency generator***							
Project phase	*Operational phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	8	6	2	4	4	4	96	Medium-High
Mitigation measures	*Noise monitoring on an annual basis to identify noise intrusion levels on a pro-active basis.* *Acoustic screening measures in place and fully operational according to acoustic screening methods.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	6	5	2	2	3	3	54	Medium

7.2.3 Impact assessment during the rehabilitation phase

The risk assessment during the *rehabilitation phase* is illustrated in Tables 28 to 29.

Table 28: Removal of structures, equipment and machinery

Activity	***Removal of structures, equipment and machinery***							
Project phase	*Rehabilitation phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Demolition activities to be done during daytime periods only*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Significance score***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

Table 29: Earthworks and planting of vegetation

Activity	***Earthworks and planting of vegetation***							
Project phase	*Rehabilitation phase*							
Impact Summary	*Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the Powerflex footprint and at the abutting residential areas*							
Potential Impact Rating	***Magnitude***	***Duration***	***Scale***	***Irreplaceable***	***Reversibility***	***Probability***	***Significance score***	***Significance***
	4	2	2	3	3	3	42	Medium
Mitigation measures	*Earthworks and planting of vegetation to be done during daytime periods only.*							
After Management Impact rating	***Probability***	***Duration***	***Extent***	***Magnitude***	***Reversibility***	***Significance score***	***Significance score***	***Significance***
	2	2	2	3	3	3	36	Low

8 RECOMMENDATIONS

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

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

The last option is not applicable and the noise levels at the noise source will be controlled in a pro-active manner when and if such increases occur and there may be an increase in the prevailing noise levels.

The recommended noise levels according to SANS 10103 of 2008 will be 70.0dBA during the day and the night as the plant will operate on a 24-hour cycle (this is according to the recommended noise level for an Industrial area). The location of the site was taken into consideration and the following noise levels were calculated to be environmentally sustainable ito the nearest residential area which is some 570m from the northern side of the proposed plant – see Figure 2. The engines will be situated on the northern side of the building. The cooling fans were also replaced with cooling radiators which will ventilate to the northern side and not to the residential areas to the south and /or west.

In order to achieve these sound levels, it will be required to acoustically attend to the following areas:

- Acoustical treatment of the engines, sound power level inside the plant, treatment of the internal walls, separating walls between the engines;
- Walls of the plant room ito of type of wall, thickness and acoustic material which will be used;
- Roof of the plant ito of type of roof, thickness and acoustic material which will be used;
- Exhaust gas outlet - silencers;
- Insulated exhaust gas ducting;
- Charge air intake – split units acoustic louvres;
- Ventilation intake at the generator side – split units acoustic louvres;
- Ventilation intake at the auxiliary sides – split unit acoustic louvres;
- Ventilation outlet roof monitor – acoustic screen;

- 4-fan cooling radiators – split unit acoustic louvres;
- Step-up transformer – acoustic screen;
- Switch yard – acoustic screen.

The following are the Environmental, Health and Safety Guidelines of the IFC of the World Bank, which should be implemented during the construction, operational and rehabilitation phases of the project:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment causing radiating noise;
- Installing vibration isolation for mechanical equipment;
- Re-locate noise sources to areas which are less noise sensitive, to take advantage of distance and natural shielding;
- Taking advantage during the design stage of natural topography as a noise buffer;
- Develop a mechanism to record and respond to complaints.

The Noise Impact Management Plan (NIMP) in Table 30 for the proposed Powerflex plant and abutting areas will consist of the following. Environmental monitoring will provide the data for reviewing, checking, and revising the NIMP.

Table 30: Noise impact management plan

Action	Description	Frequency	Responsible person
Management objective	To ensure that the legislated noise levels will always be adhered to .	Noise surveys to verify the recommended prevailing noise levels according to Noise Control Regulations, 1992 and SANS 10103 of 2008.	The appointed engineer during the construction phase.
Monitoring objective – Construction phase	Measure the environmental noise levels during the construction phase of the project to ensure compliance to the recommended noise levels.	Noise surveys on a quarterly basis to verify the recommended prevailing noise levels according to SANS 10103 of 2008.	Appointed contractor.
Monitoring objective – Operational phase	Measure the environmental noise levels during the operational phase of the project to ensure compliance to the recommended noise levels.	Noise surveys to verify the recommended prevailing noise levels according to SANS 10103 of 2008..	Health section at the Power plant.
Monitoring technology	The environmental noise monitoring must take place with a calibrated Class 1 noise monitoring equipment.	Noise surveys to verify the recommended prevailing noise levels according to SANS 10103 of 2008.	Health section at the Power plant.
Specify how the collected information will be used	The noise data will have to be discussed after each monitoring period and pro-active measures to be implemented if the threshold of 70.0dBA were exceeded.	After each monitoring session.	Health section at the Power plant.

Spatial boundaries	At the boundaries of the identified abutting communities as well as at the Powerflex property boundaries.	Annually.	Engineer.
Define how the data will be analysed and interpreted and how it should be presented in monitoring reports	Reports must be compiled for each monitoring cycle and the results must be compared to the previous set of results to determine if there was a shift in the prevailing ambient noise.	Noise surveys to verify the recommended prevailing noise levels according to SANS 10103 of 2008..	Engineer.
Accuracy and precision of the data	The noise surveys will have to be conducted in terms of the recommendations of the Noise Control Regulations and SANS 10103 of 2008.	Calibrated equipment must be used at all times .	Environmental noise and vibration specialist

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9 NOISE MONITORING PROGRAMME

This is part of the environmental authorisation which may be granted.

The noise monitoring programme will need to be a pro-active programme to manage the noise levels within the boundaries of the plant. The monitoring programme must be conducted during the Construction and Operational phases of the project.

The noise monitoring must take place at the Powerflex property boundaries along the Northern boundary (2), Eastern boundary (2), Southern boundary (2) and Western boundary (2). The measuring points at the abutting farmhouses is illustrated in Figure 11.

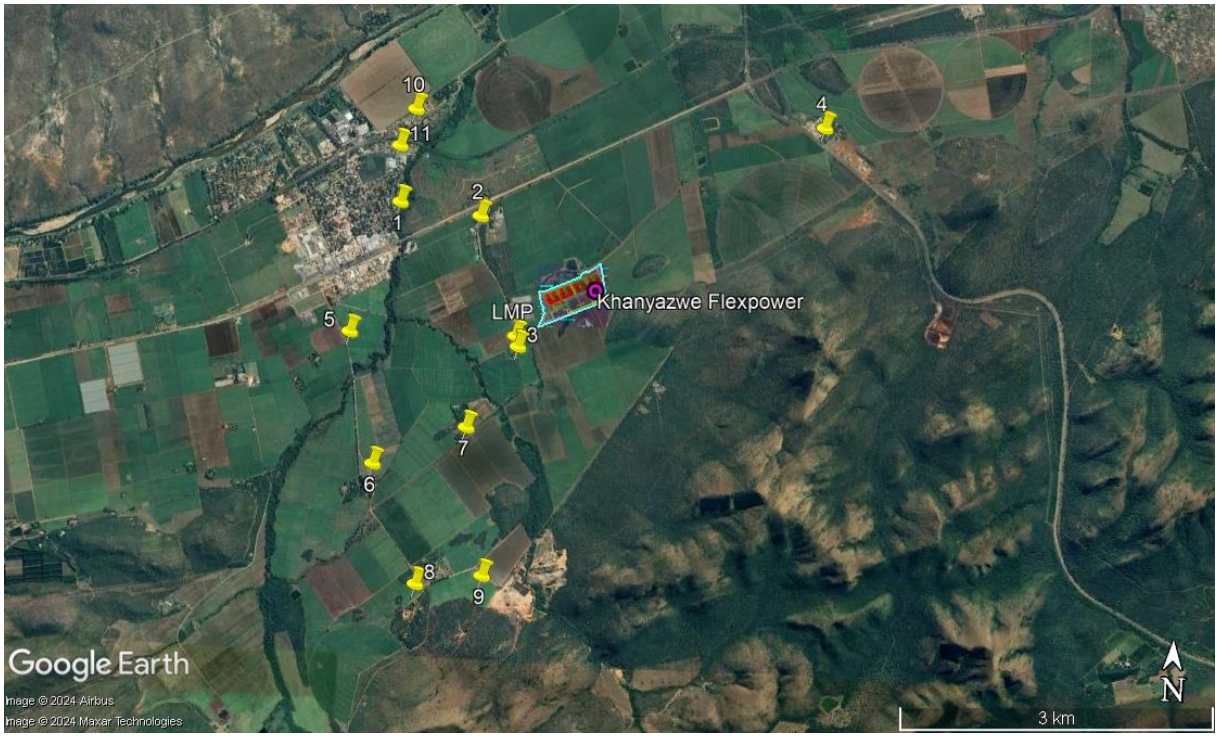


Figure 4: Recommended noise measuring points

The geographical information of the measuring points is illustrated in Table 31.

Table 31: Geographical information of the measuring points

Measuring points	Latitude	Longitude	Type of use
LMP1	31° 31.609'E	31° 31.596'E	House
1	25° 29.666'S	31° 30.878'E	House
2	25° 29.722'S	31° 31.355'E	House
3	25° 30.424'S	31° 31.609'E	Farmhouse
4	25° 29.168'S	31° 33.350'E	House
5	25° 30.369'S	31° 30.620'E	House
6	25° 31.064'S	31° 30.795'E	Farmhouse
7	25° 30.847'S	31° 31.335'E	Farmhouse
8	25° 31.687'S	31° 31.085'E	Farmhouse
9	25° 31.626'S	31° 31.473'E	Farmhouse
10	25° 29.168'S	31° 30.943'E	House
11	25° 29.366'S	31° 30.859'E	House

9.1 Conditions of the Environmental Authorisation - Noise

The following conditions will be applicable on the authorisation of this project:

- Baseline environmental noise levels to be collected and recorded;
- All acoustic screening measures must be in place before commissioning the power generation project;
- Environmental noise monitoring to be carried out during the different phases of the project;
- The noise (Noise Control Regulations, 1992) and/or guidelines to be always adhered to.

10 CONCLUSION

The environmental noise impact during the construction and rehabilitation phases will be low and during the operational phase medium after the implementation of the following acoustic screening measures:

- Exhaust gas outlet - 82.0dBA;
- Roof monitors – 80.0dBA;
- Boundary opposite the cooling radiators – 70.0dBA;
- Noise reduction of 57.0dBA of the walls;
- Noise reduction of 51.0dBA of the roof;
- Noise level of 110.0dBA inside the plant room;
- Acoustic screens at the step-up transformers;
- Acoustic screens and/or acoustic louvres/splitter units at the cooling radiator side;
- Acoustic louvres/splitter units at the ventilation intake – auxiliary side;
- Acoustic louvres/splitter units at the ventilation intake – generator side.

The potential noise intrusion from the proposed power generating activities can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Noise Regulations, 1992 and the International Finance Corporation's Environmental Health and Safety Guidelines.

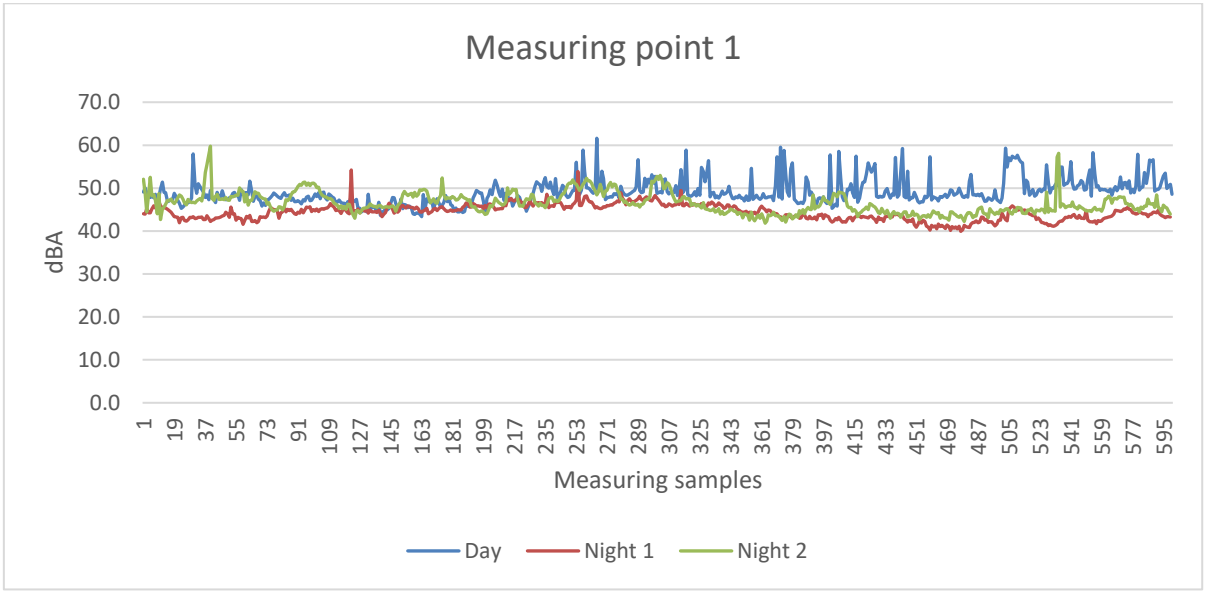
The proposed Khanyazwe Powerflex project will be in line with the environmental noise standards and guidelines provided that all the noise mitigatory measures are in place and that the Noise Impact Management Plan (NIMP) and Noise Monitoring Plan (NMP) for the Powerflex project is adhered to.

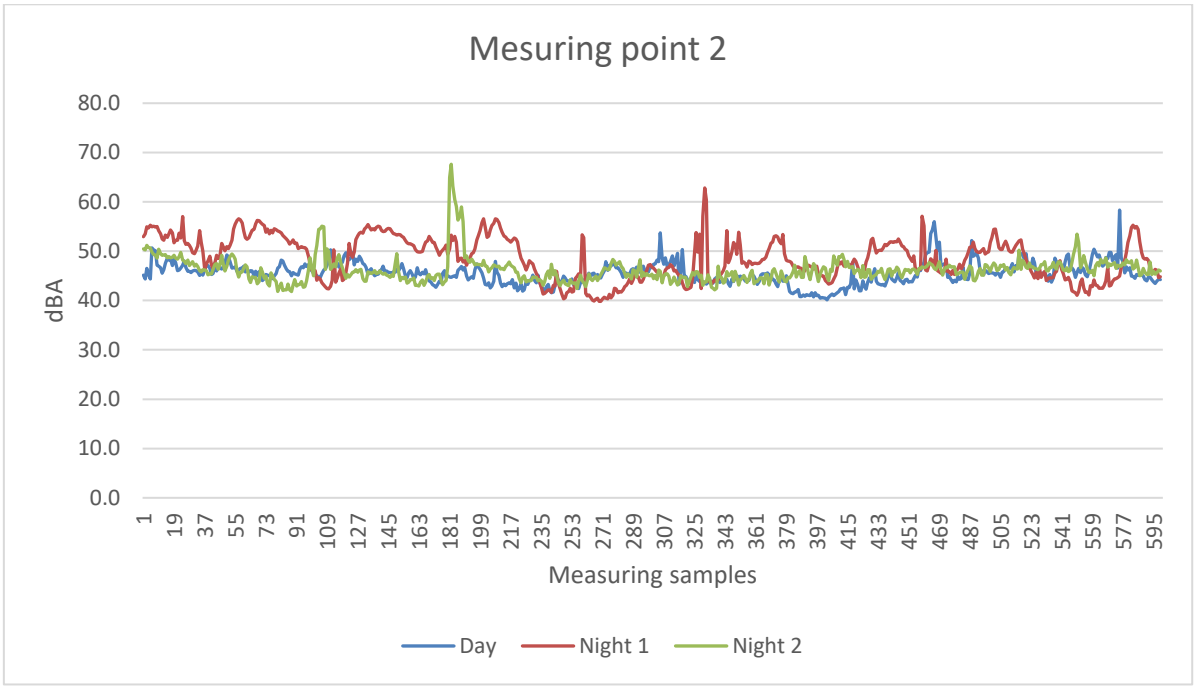
Barend van der Merwe – MSc Environmental Management UJ.
Environmental noise and vibration specialist

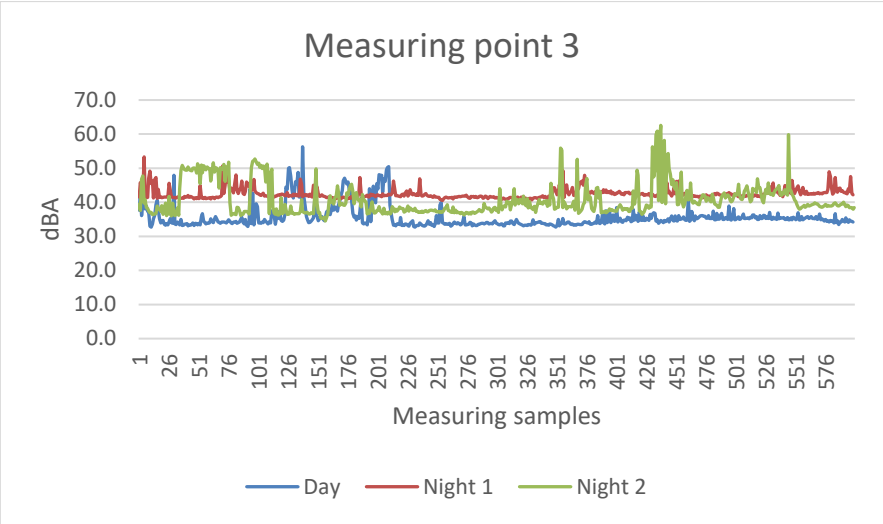
11 REFERENCES

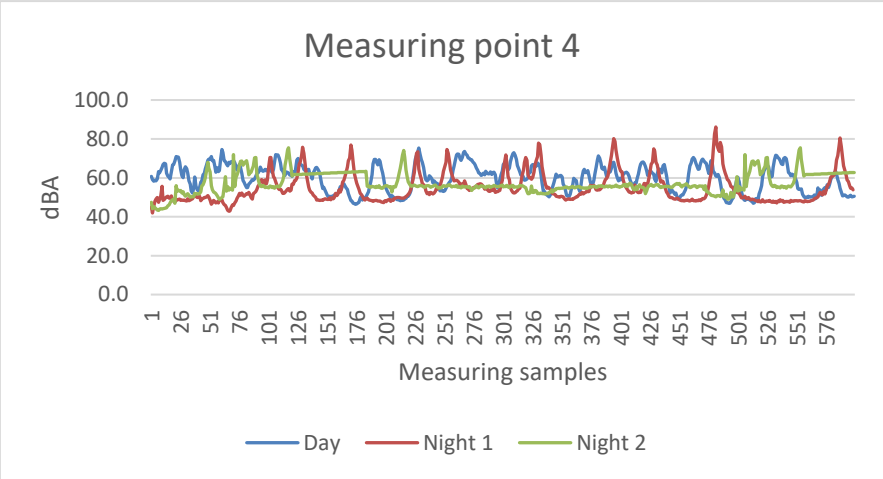
- SANS, 2008 - SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.
- SANS, 2004. SANS 10357 of 2004 – The calculation of sound propagation by the concave method.
- SANS, 2004. SANS 10210 of 2004 – Calculating and predicting road traffic noise.
- SANS, 2008. SANS 10328 of 2008 – Methods for environmental noise impact assessments.
- SANS, 2008. SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication.
- RSA, 1996. Statute of the Republic of South Africa – Constitutional Law, No 108 of 1996.

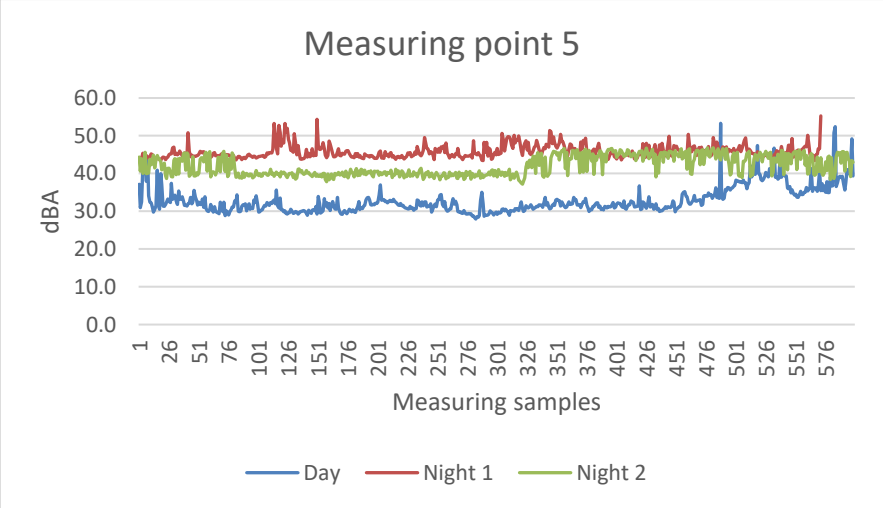
Appendix A – Prevailing ambient noise levels

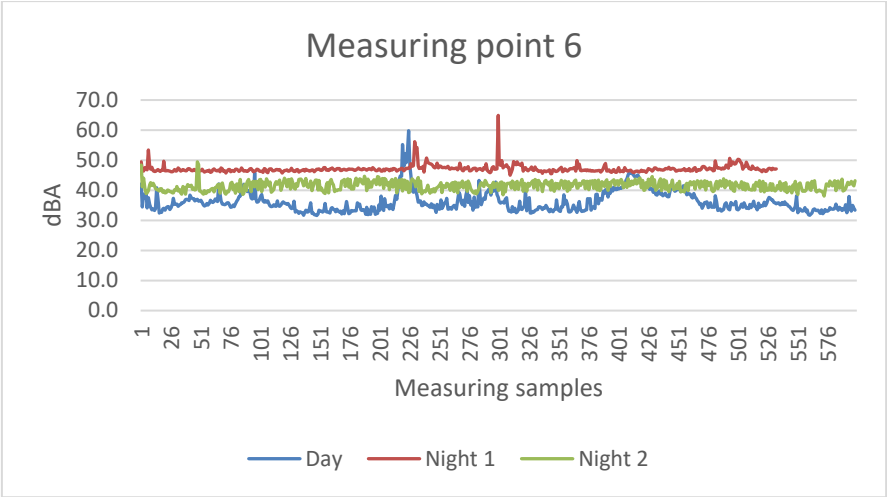





Measuring point 3
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1 26 51 76 101 126 151 176 201 226 251 276 301 326 351 376 401 426 451 476 501 526 551 576
Measuring samples
Day
Night 1
Night 2


Measuring point 4
100.0
80.0
60.0
40.0
20.0
0.0
dBA
1 26 51 76 101 126 151 176 201 226 251 276 301 326 351 376 401 426 451 476 501 526 551 576
Measuring samples
Day
Night 1
Night 2


Measuring point 5
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1 26 51 76 101 126 151 176 201 226 251 276 301 326 351 376 401 426 451 476 501 526 551 576
Measuring samples
Day
Night 1
Night 2


Measuring point 6
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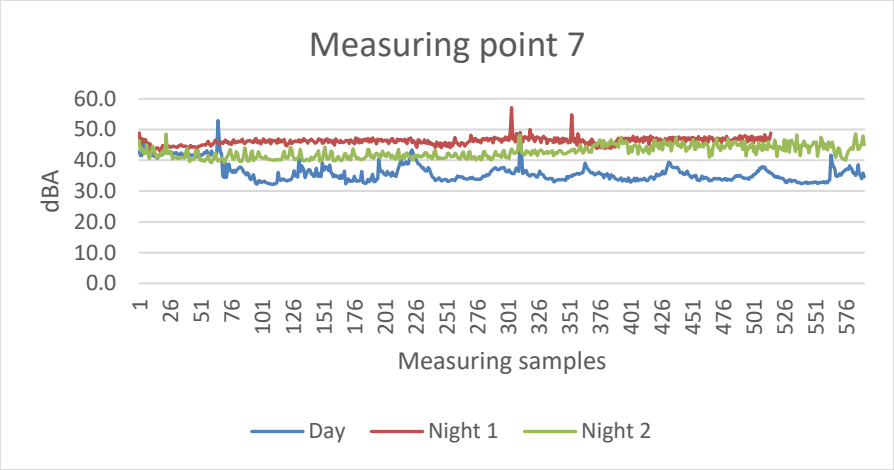
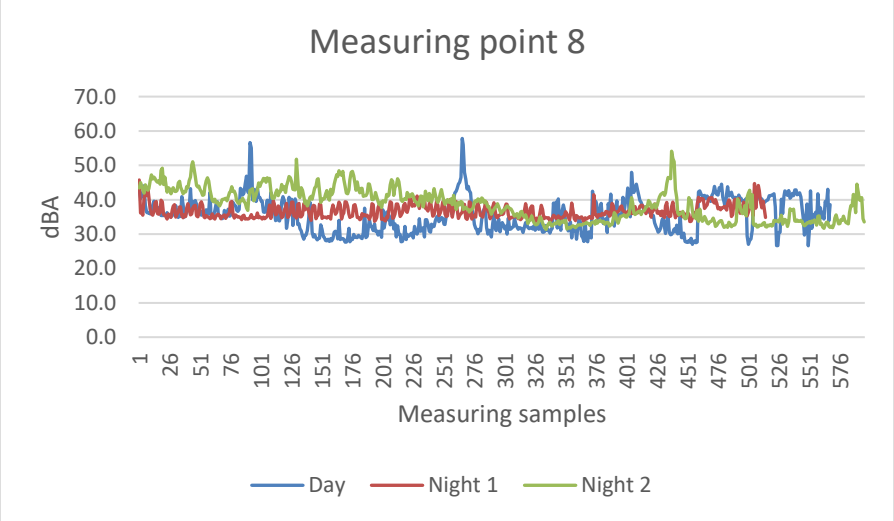
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2


Measuring point 7
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2


Measuring point 8
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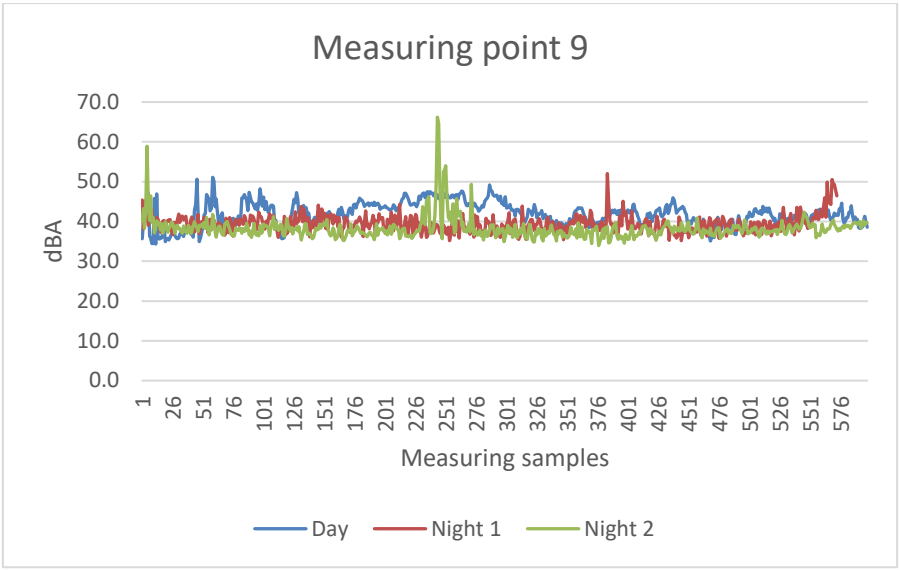
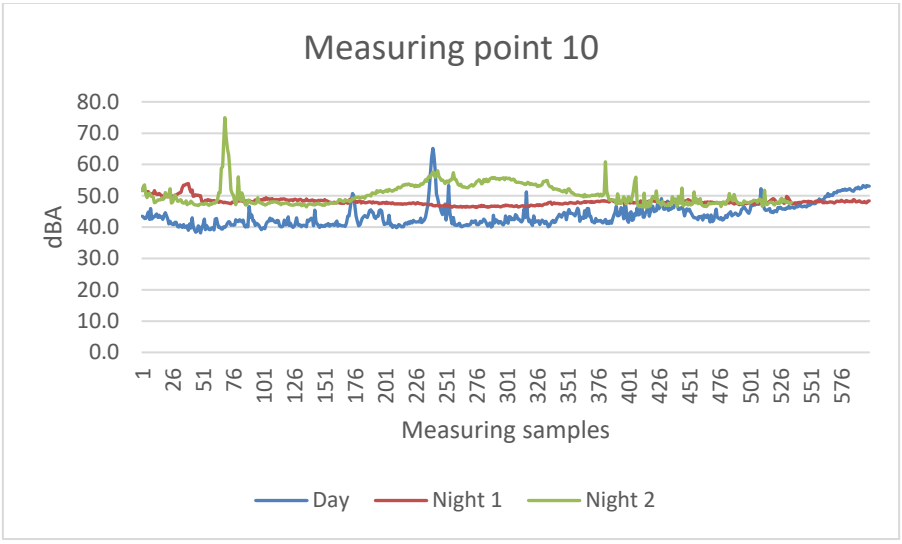
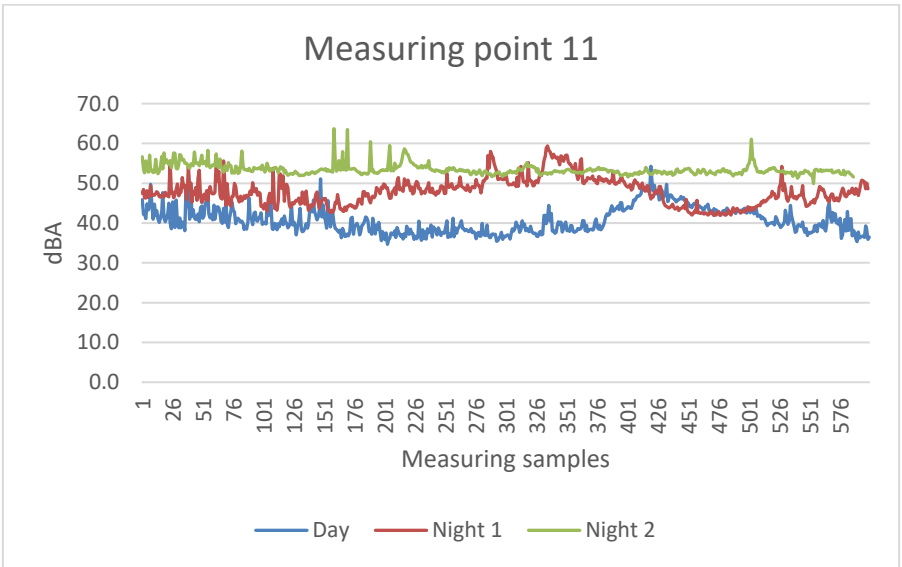
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2


Measuring point 9
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2


Measuring point 10
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2


Measuring point 11
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
dBA
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
Measuring samples
Day
Night 1
Night 2

APPENDIX B – CALIBRATION CERTIFICATES

sanas
Calibration Laboratory
148
1302

M AND N ACOUSTIC SERVICES (Pty) Ltd
Co. Reg. No: 2012/123238/07 VAT NO: 4300255876 BEE Status: Level 4
P.O. Box 61713, Pierre van Ryneveld, 0045
No. 15, Mustang Avenue
Pierre van Ryneveld, 0045
Tel: 012 689-2008 (076 920 3070) • Fax: 086 211 4690
E-mail: admin@mnacoustics.co.za / marianka@mnacoustics.co.za
Website: www.mnacoustics.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2024-AS-0924
ORGANISATION	DB ACOUSTICS CC
ORGANISATION ADDRESS	P.O. BOX 1219, ALLANSNECK, 1737
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with built-in ⅓ OCTAVE/OCTAVE FILTER and ½" MICROPHONE
MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	LXT, PRM LXT1L and 377M 02
SERIAL NUMBERS	0006037, 069946 and 316345
DATE OF CALIBRATION	06 - 07 MAY 2024
RECOMMENDED DUE DATE	MAY 2025
PAGE NUMBER	PAGE 1 OF 5

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The measurement results recorded in this certificate were correct at the time of calibration. The subsequent accuracy will depend on factors such as care, handling, frequency of use and the number of different users. It is recommended that re-calibration should be performed at an interval, which will ensure that the instrument remains within the desired limits and/or manufacturer's specifications.

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Calibrated/Supervised by Calibration Technician:	W.S SIBANYONI	**Clause 3.1 - 3.3**
Authorized/Checked by SANAS Technical Signatory:	M. NAUDÉ	**Date of Issue: 07 MAY 2024**

Director: Marianka Naudé (082 727 3312)

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Calibration Laboratory
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M AND N ACOUSTIC SERVICES (Pty) Ltd
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Website: www.mnacoustics.co.za

CERTIFICATE OF CALIBRATION

CERTIFICATE NUMBER	2024-AS-0006
ORGANISATION	DB ACOUSTIC CC
ORGANISATION ADRESS	P.O. BOX 1219, ALLENSNECK, 1737
CALIBRATION OF	INTEGRATING SOUND LEVEL METER complete with built-in ⅓ OCTAVE/OCTAVE FILTER and ½" MICROPHONE
MANUFACTURERS	LARSON DAVIS and PCB
MODEL NUMBERS	831, PRM 831 and 377B02
SERIAL NUMBERS	0001072, 0206 and 346326
DATE OF CALIBRATION	11 - 12 JANUARY 2024
RECOMMENDED DUE DATE	JANUARY 2025
PAGE NUMBER	PAGE 1 OF 6

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Calibrated by:	Authorized/Checked by:	Date of Issue:
W.S. SIBANYONI (CALIBRATION TECHNICIAN)	M. NAUDÉ (SANAS TECHNICAL SIGNATORY)	15 JANUARY 2024

Director: Marianka Naudé (082 727 3312)