

Motuoane Energy (Pty) Ltd

COMBINED SCOPING AND SITE SENSITIVITY VERIFICATION REPORT

**for the proposed
Motuoane Project South-east of
Virginia, Free-State Province**



Study done for:



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Appendix A	Curriculum Vitae
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ABBREVIATIONS

dB/dBA	Decibel (relative loudness of the A-weighted sound level in air)
DFFE	Department of Forestry, Fisheries and the Environment
EARES	Enviro Acoustic Research cc
ECA	Environment Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EHS	Environmental Health and Safety
ENIA	Environmental Noise Impact Assessment
ENPAT	Environmental Potential Atlas for South Africa
EPs	Equator Principles
EPFIs	Equator Principles Financial Institutions
GN	Government Notice
GNR	Government Notice Regulation
I&APs	Interested and Affected Parties
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
ISO	International Organization for Standardization
NEMA	National Environmental Management Act

NCR	Noise Control Regulations
NSR	Noise-sensitive Receptors
PPP	Public Participation Process
PWL	Sound Power Level
SABS	South African Bureau of Standards
SANS	South African National Standards
WHO	World Health Organization

1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

Enviro-Acoustic Research cc was commissioned by Environmental Impact Management Services (Pty) Ltd (the EAP) to undertake a specialist study to determine the potential noise impact on the surrounding environment due to the proposed Motuoane Project near Virginia, Free-State. This report is the result of the scoping (desktop) phase study of the Environmental Impact Assessment (EIA) process investigating the potential noise impact that such a project may have on the surrounding environment, highlighting methodologies, potential issues to be investigated, as well as preliminary findings and recommendations.

It is important to note this document is only an initial report, to be used for site sensitivity verification purposes as well as to advice the future environmental noise impact assessment.

1.2 BRIEF PROJECT DESCRIPTION

Motuoane Energy (Pty) Ltd (Motuoane) propose to optimize the extraction of their gas resource within their production right area, with the product location depicted in **Figure**

1-1. The activities proposed by Motuoane will include the following:

- Provision for ongoing exploration drilling and seismic activities.
- Existing wells may be 'worked over' and possibly included as production sites.
- Drilling of approximately 30-50 wells within identified well production corridors. The wells will be equipped to optimally extract the gas product;
- The installation of trenched sub-surface gas gathering pipelines between the production wells and a gas production plant where the gas will be compressed to deliver compressed Helium and Methane as a first phase, followed by a second phase where the gas will be liquified to produce LNG.

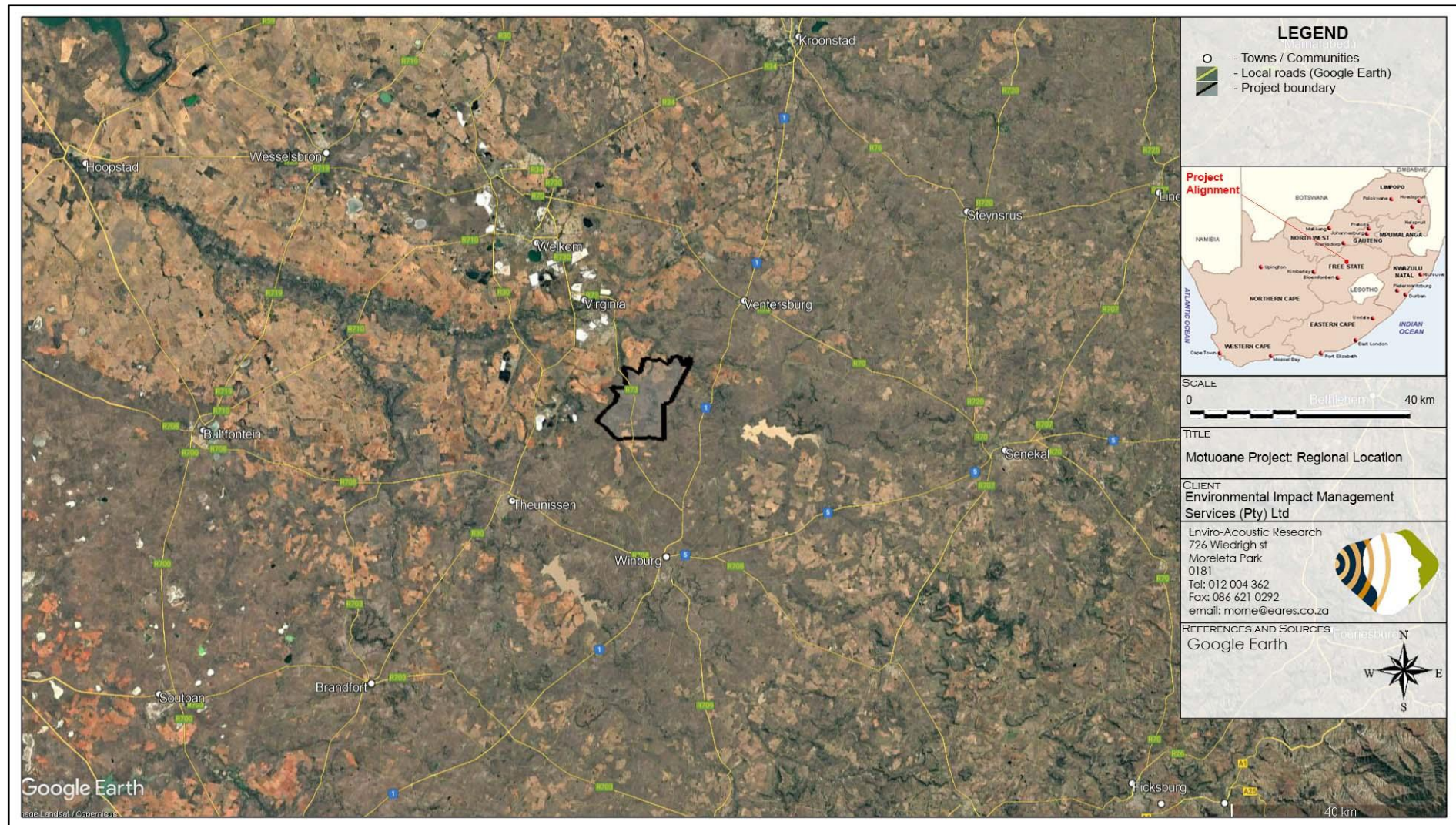


Figure 1-1: Regional Location of the proposed Motuoane project

2 STUDY AREA

The center of the study area is located approximately 16km south-east of Virginia. It falls within the Matjhabeng Local municipality which is part of the Lejweleputswa district. The regional location is illustrated in **Figure 1-1**. A potential project focus area (PFA) was defined approximately 2,000m from locations where the wells or gas plant may be drilled or developed. The PFA is further described in terms of environmental components that may contribute to or change the sound character in the area.

2.1 TOPOGRAPHY

ENPAT¹ (1998) describes the topography as "*lowlands with hills*". There are little natural features that could act as noise barriers considering practical distances at which sound propagates.

2.2 ROADS AND RAIL ROADS

The R73 provincial road, as well as the D143 (branching from the N1 national road) transect the PFA, with a number of small gravel roads leading from these roads. There are a number of smaller gravel roads branching from these roads, mainly used by the farmers and the local communities, although traffic volumes are low on these smaller roads.

Noises from road traffic will be audible up to 2,000m from these roads, depending on the meteorological conditions and prevailing ambient sound levels, though traffic noises will not be considered in the future Environmental Noise Impact Assessment ("ENIA") report.

2.3 LAND USE AND UNRELATED NOISE SOURCES

The surrounding land use is mainly agriculture and wilderness (game farming and ecotourism). There are some mining activities in the larger area.

2.4 RESIDENTIAL AREAS

Excluding farm dwellings, there are no formal residential areas within 2,000m from the proposed activity.

¹ Van Riet, W. Claassen, P. van Rensburg, J. van Viegen & L. du Plessis, "*Environmental Potential Atlas for South Africa*", Pretoria, 1998.

2.5 GROUND CONDITIONS AND VEGETATION

The area falls within the grassland biome, with the natural vegetation historically being *Cymbopogon-themeda* veld. The natural veldt type however has been significantly impacted by agricultural and mining activities. Generally, the ground is covered with grasses, shrubs and other trees. Ground conditions would be considered as 50% acoustically absorbent. This will influence the propagation of the sound from noise sources in the area as the fraction of sound that is reflected from the ground would be influenced as certain frequencies would be absorbed by the ground surface.

2.6 DESIRED RATING LEVELS

The development of the Motuoane project will result in changes in the ambient sound levels during the construction and operational phases. Considering the recommendations from the SANS 10103:2008 guideline, two potential noise rating levels would be relevant, namely:

- Noise Rating Levels relevant for a rural noise district:
 - 45 dBA for the daytime period; and
 - 35 dBA for the night-time period, as well as
- Noise Rating Levels relevant for industrial areas (for the Gas Production Plant, if rezoned to industrial):
 - 70 dBA for the daytime period; and
 - 60 dBA for the night-time period.

These desired rating levels will be refined during the future Environmental Impact Assessment ("EIA") phase.

2.7 POTENTIAL PROJECT ALTERNATIVES

The decision to develop the Motuoane project at this location is the result of a number of feasibility studies, considering a number of factors, including (amongst others):

- the location of a viable gas resource;
- topography and site access;
- land use and suitability;
- landowner support; and
- limited environmental constraints.

2.8 ENVIRONMENTAL SENSITIVITY – NOISE THEME

The project site was assessed in terms of the Noise Sensitivity Theme using the National Web-based Environmental Screening Tool². The site report generated by the Screening Tool highlighted that a Noise Impact Assessment must be completed and appended to the Environmental Authorization (“EA”) application documentation. The screening report was developed for both:

- Mining => Production Right => Gas or Oil Terrestrial, and
- Activity requiring permit or licence in terms of National or Provincial legislation governing the release or generation of emissions => Emissions.

The potential noise sensitive areas layer is not included in the above-mentioned categories, but was obtained from the Utilities Infrastructure => Electricity => Generation => Renewable => Wind category³, with the noise sensitive areas illustrated on **Figure 4-1** (highlighting a few locations to have a “Very High” sensitivity to noise).

2.9 LEGISLATIVE REQUIREMENTS AND TERMS OF REFERENCE

A noise impact assessment must be conducted if the proposed development triggers the following:

- A change in land use as highlighted in SANS 10328:2008 (section 3.3 of the SANS guideline);
- If a wind farm (wind turbines - SANS 10328:2008 [5.4 (i)]) or a source of low-frequency noise (such as cooling or ventilation fans - SANS 10328:2008 [5.4 (I)]) is to be established within 2,000 m from a potential NSR *or visa versa*;
- It is generally required by the local or district authority as part of the environmental authorization or planning approval in terms of Regulation 2(d) or GN R154 of 1992;
- It is a controlled activity in terms of the NEMA EIA Regulations, 2014, as amended and an ENIA is required, because:
 - It may cause a disturbing noise that is prohibited in terms of section 18(1) of the Government Notice 579 of 2010;
 - It is an environmental theme to be further assessed as identified by the National Web-based Environmental Screening Tool as required by Government Gazette No. 42451 of 10 May 2019 (proposed procedures for noise assessments);

² <https://screening.environment.gov.za/screeningtool/#/pages/welcome>

³ Though not applicable for this development, this is the only category providing the noise layer

2.9.1 Requirements as per GG 43110 (GNR 320 of March 2020)

The Department of Forestry, Fisheries and Environment ("DFFE") also promulgated Government Notice Regulation (GNR) 320, dated 20 March 2020 as published in Government Gazette No. 43110. The Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation would be applicable to this project.

This regulation defines the requirements for undertaking a site sensitivity verification, specialist assessment and the minimum report content requirements for environmental impact where a specialist assessment is required but no protocol has been prescribed. It requires that the current land use be considered using the national web based environmental screening tool to confirm the site sensitivity available at: <https://screening.environment.gov.za>.

If an applicant intending to undertake an activity identified in the scope of this protocol for which a specialist assessment has been identified on the screening tool on a site identified as being of:

- "very high" sensitivity for noise, must submit a Noise Specialist Assessment; or
- "low" sensitivity for noise, must submit a Noise Compliance Statement.

On a site where the information gathered from the site sensitivity verification differs from the designation of "very high" sensitivity on the screening tool and it is found to be of a "low" sensitivity, a Noise Compliance Statement must be submitted. On a site where the information gathered from the initial site sensitivity verification differs from the designation of "low" sensitivity on the screening tool and it is found to be of a "very high" sensitivity, a Noise Specialist Assessment must be submitted.

If any part of the proposed development footprint falls within an area of "very high" sensitivity, the assessment and reporting requirements prescribed for the "very high" sensitivity apply to the entire footprint excluding linear activities for which noise impacts are associated with construction activities only and the noise levels return to the current levels after the completion of construction activities, in which case a compliance statement applies. In the context of this protocol, development footprint means the area on which the proposed development will take place and includes any area that will be disturbed.

In terms of GNR320 (of 20 March 2020), the Site Sensitivity Verification should be undertaken prior to the commencement of the Specialist assessment. The protocol states:

1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or a noise specialist, where the noise specialist means someone with relevant academic qualifications and with experience in the domain of acoustic assessments and noise management.
2. The site sensitivity verification must be undertaken through the use of:
 - a) a desktop analysis, using satellite imagery;
 - b) a preliminary onsite inspection; and
 - c) any other available and relevant information.
3. The outcome of the site sensitivity verification must be recorded in the form of a report that:
 - a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool, such as new developments or infrastructure etc.;
 - b) contains a motivation and evidence (e.g., photographs) of either the verified or different use of the land and environmental sensitivity; and
 - c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

The National Web based Environmental Screening Tool⁴ was used to screen the proposed site for the noise environmental sensitivity as per the requirements of Government Notice Regulation ("GNR") 320 (of 20 March 2020), considering the site location illustrated in **Figure 4-1**.

A screening report generated by the Online Screening Tool highlighted that a Noise Impact Assessment must be completed and appended to the Environmental Impact Assessment ("EIA") documentation for the project. The areas defined to have a "**very high**" sensitivity to noise were downloaded as a layer from the online screening tool, with the noise sensitive areas illustrated on **Figure 4-1**.

⁴ <https://screening.environment.gov.za/screeningtool/#/pages/welcome>

3 LEGAL CONTEXT, POLICIES AND GUIDELINES

3.1 THE ENVIRONMENT CONSERVATION ACT (ACT 73 OF 1989)

The Environment Conservation Act No. 73 of 1989 (ECA) allows the Minister of Environment, Forestry and Fisheries to make regulations regarding noise, among other concerns. While most sections of this Act have been repealed with the promulgation of the NEMA, Section 25 of this Act is still in effect.

The Noise Control Regulations (NCR) were promulgated in terms of section 25 of the ECA. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial noise control regulations exist in the Free State, Gauteng and Western Cape provinces.

3.1.1 Noise Control Regulations (GN R154 of 1992)

In terms of section 25 of the ECA, the national Noise Control Regulations (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. The Free State Province did promulgate provincial regulations in 1998.

3.1.2 Free State Provincial Noise Control Regulations (PN 24 of 1998)

The control of noise in the Free State Province is legislated in the form of Noise Control Regulations promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989.

It should be noted that the regulations define:

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

"disturbing noise" - means a noise level that exceeds the ambient sound level measured continuously at the same measuring point by 5 dBA or more.

"noise level" - means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation, and, if the alleged disturbing

noise has a discernible pitch, for example, a whistle, buzz, drone or music, to which 5 dBA has been added;

In addition:

In terms of Regulation 2 (d):

"A local authority may –

before changes are made to existing facilities or existing uses of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests be conducted to the satisfaction of that local authority by the owner, developer, tenant or occupant of the facilities, land or buildings and that reports or certificates relating to the noise impact to the satisfaction of that local authority be submitted by the owner, developer, tenant or occupant to the local authority;

In terms of Regulation 3 (c):

"No person shall –

make changes to existing facilities or existing uses of land or buildings or erect new buildings, if it shall in the opinion of a local authority house or cause activities which shall, after such change or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority";

In terms of Regulation 4 of the Noise Control Regulations:

"No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof".

4 SITE SENSITIVITY VERIFICATION

A site sensitivity verification has been undertaken in accordance with Government Notice Regulation (GNR) 320 as promulgated in Government Gazette (GG) 43110 of 2020, considering available desktop resources. The site will be visited during the future EIA phase to verify the status of the various noise-sensitive receptors (NSR) as identified in this desktop report.

4.1 OUTPUT FROM NATIONAL ENVIRONMENTAL SCREENING TOOL

The site was initially assessed using the National Environmental Screening tool, available at, <https://screening.environment.gov.za>. The output from the National Online Screening tool highlighted at least two areas (within the potential production right area) having a “Very High” sensitivity to noise as illustrated in **Figure 4-1**.

4.2 DESCRIPTION ON HOW THE SITE SENSITIVITY VERIFICATION WAS UNDERTAKEN

The site sensitivity verification is based on GoogleEarth images (dated 2025-05-13).

4.3 OUTCOME OF THE SITE SENSITIVITY VERIFICATION

Areas with a “Very High” Sensitivity to noise are indicated on **Figure 4-1**. The online screening tool identified two areas to have a “very high” sensitivity to noise within the production right area. Based on GoogleEarth images, residential activities are associated with these areas. This will be verified during a future site visit.

The desktop review also identified a number of other potential NSR up to 1,000m from the production right area. Considering the location where production wells may be developed, there are residential activities within 1,000m from future project activities (see also **Figure 4-2**).

4.4 POTENTIAL NOISE SENSITIVE RECEPTORS

Figure 4-2 illustrate the locations of potential noise-sensitive receptors as well as potential project infrastructure locations. Generally, noises from construction and operational activities may impact on the soundscape up to 2,000m from such activities (depending on the type of activity and prevailing ambient sound levels).

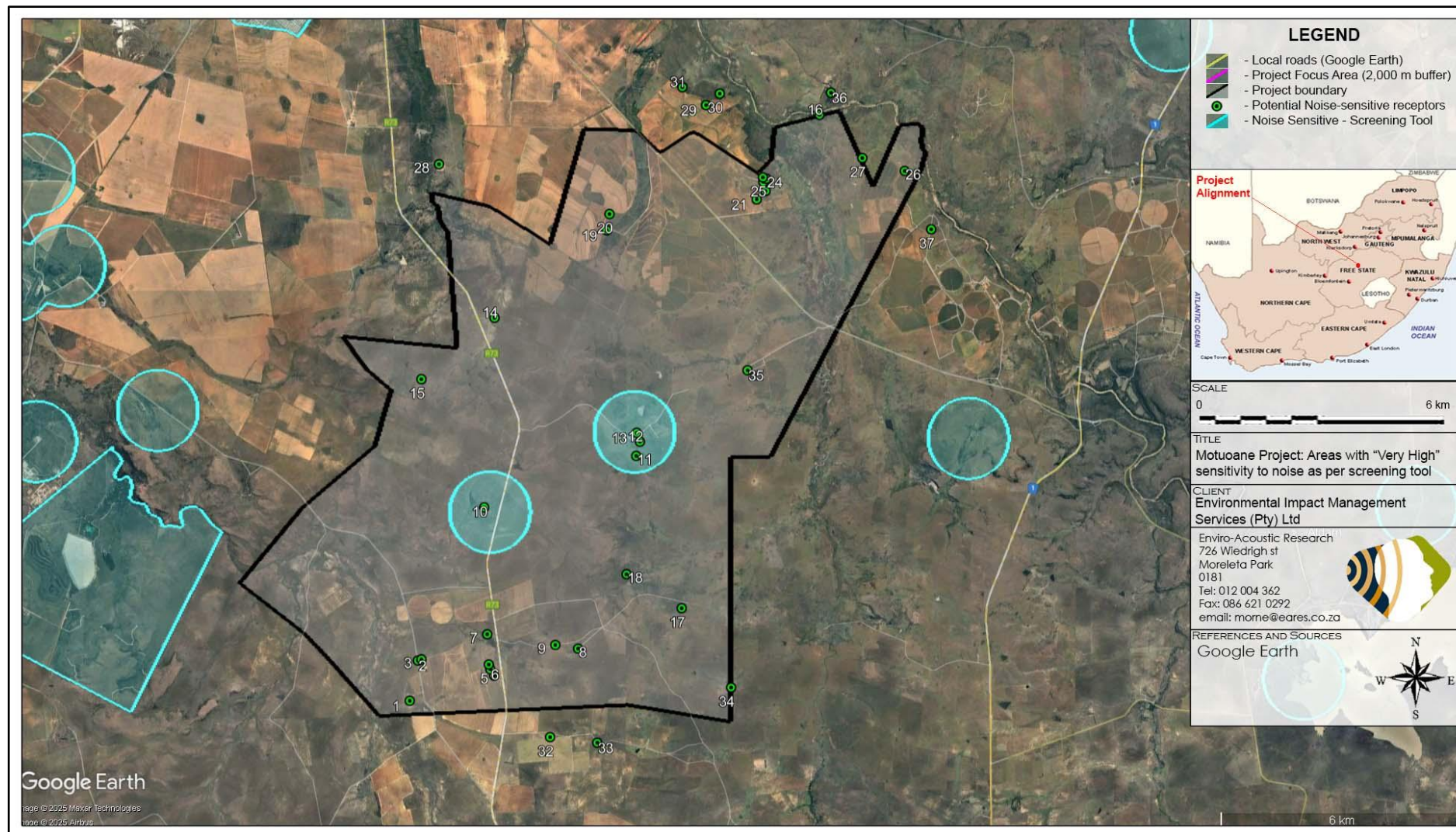


Figure 4-1: Areas identified by the online screening tool to have a "Very High" sensitivity to noise

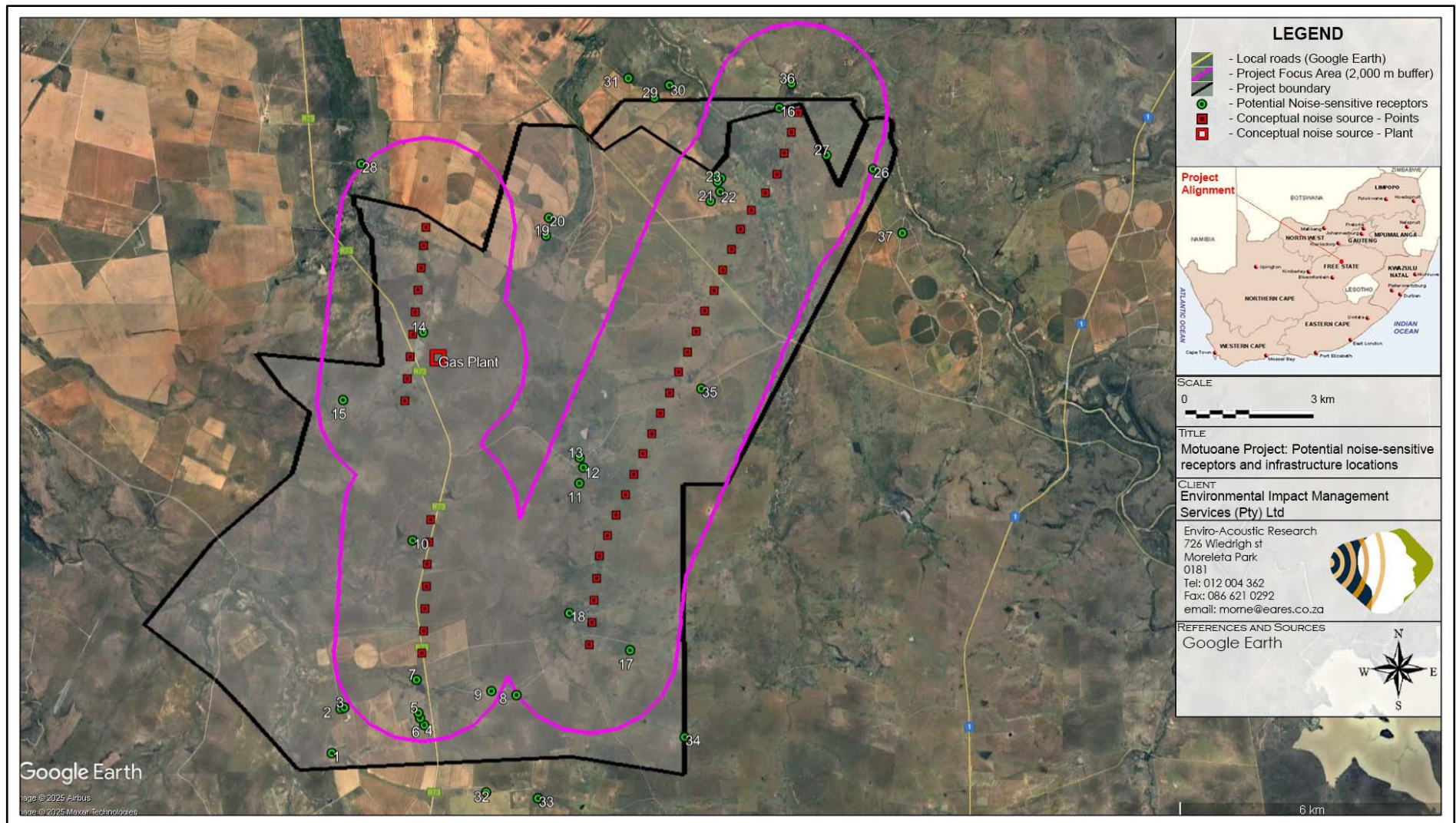


Figure 4-2: Aerial Image indicating closest NSR and potential project infrastructure locations

5 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the development (construction phase) of the production wells and the gas production plant, as well as the operation phase of the activity.

5.1 POTENTIAL NOISE SOURCES: CONSTRUCTION NOISES

5.1.1 Construction equipment

Construction activities include:

- Site establishment (equipment and material storage, security and access control, security fence – if and as required)
- Development of new access roads/widening of existing roads (if required);
- Vegetation and topsoil removal, digging of trenches for the laying on the low-pressure gas laterals and the medium pressure gas pipelines, trenching, laying of laterals/pipelines, refilling of trenches and the rehabilitation of construction area(s);
- Construction of processing plant infrastructure (site preparation, installation of infrastructure); and
- Drilling of the gas production wells (site establishment, drilling of borehole, deploy infrastructure).

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, are generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB the noise can increase annoyance levels and may ultimately result in noise complaints. Potential maximum noise levels generated by various construction equipment as well as the potential extent of these sounds are presented in **Table 5-1**.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and are the constant sound level that the receptor can experience. Typical sound power levels associated with various activities that may be found at a construction site are presented in **Table 5-2**.

The equipment likely to be required to complete the above tasks will typically include:

- TLB (backhoe, load-tip-bucket, bucket loader), graders, dump trucks(s), drill rig, flatbed truck(s), pile drivers, concrete truck(s), crane(s) and various 4WD and service vehicles.

As can be seen from [Construction Noise Handbook](#)⁵, noise levels could vary with up to 18 dB for similar equipment of different manufacturers. The noises are also based on the equipment operating under load, which will not always be the case, but this data is used as it represents a worst-case scenario.

5.1.2 Traffic

A significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the gas wells, pipelines and processing plant.

5.2 POTENTIAL NOISE SOURCES: OPERATIONAL PHASE

The following noise-generation activities are likely during the operational phase:

- Equipment at gas processing plant (pumps, compressors, fans, blowers, road traffic);
- Equipment at wellhead unit (likely to be gas powered).

Table 5-1 gives an indication of the maximum noise levels potentially generated by a variety of equipment. These are generally an indication of maximum noises, and, while these transient sounds may be brief, they can be highly intrusive especially at night. Maximum noise levels may impact on sleeping patterns if surrounding receptors are exposed to levels exceeding 45 dBA.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and are the constant noise level that the receptor can experience. Typical sound power levels (the potential extent) associated with various activities that may be found at a construction and operational phase of a gas well are presented in **Table 5-2**.

⁵ http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Table 5-1: Potential maximum noise levels generated by construction equipment

Equipment Description ⁶	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential maximum noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Auger Drill Rig	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Chain Saw	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Concrete Pump Truck	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Generator (>25KVA)	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Rock Drill	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6

⁶ Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Table 5-2: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Bulldozer CAT D5	107.4	82.4	76.4	70.4	62.4	56.4	52.9	50.4	46.9	42.4	38.9	36.4	30.4
Blower - centrifugal	107.0	82.0	76.0	70.0	62.0	56.0	52.5	50.0	46.5	42.0	38.5	36.0	30.0
Compressor - LNG Pipeline	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.7	41.3	37.8	35.3	29.3
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Drilling Machine (with air compressor)	120.3	95.3	89.3	83.2	75.3	69.3	65.7	63.2	59.7	55.3	51.8	49.3	43.2
Excavator - Hitachi 270 (30 t)	104.5	79.6	73.5	67.5	59.6	53.5	50.0	47.5	44.0	39.6	36.0	33.5	27.5
FEL - Bell L1806C	102.7	77.7	71.7	65.7	57.7	51.7	48.2	45.7	42.1	37.7	34.2	31.7	25.7
Grader	110.9	85.9	79.9	73.9	65.9	59.9	56.4	53.9	50.3	45.9	42.4	39.9	33.9
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
LNG Booster Pumps	100.9	75.9	69.9	63.9	55.9	49.9	46.4	43.9	40.4	35.9	32.4	29.9	23.9
LNG Pipeline Compressor (800 kW)	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.7	41.3	37.8	35.3	29.3
LNG Send-out pumps (in tanks)	100.3	75.3	69.3	63.3	55.3	49.3	45.8	43.3	39.8	35.3	31.8	29.3	23.3
Road Transport Reversing/Idling	108.2	83.3	77.2	71.2	63.3	57.2	53.7	51.2	47.7	43.3	39.7	37.2	31.2
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Rock Breaker, CAT	120.7	95.7	89.7	83.7	75.7	69.7	66.2	63.7	60.2	55.7	52.2	49.7	43.7

5.3 POTENTIAL NOISE SOURCES: DECOMMISSIONING

The decommissioning of the gas production facilities would take place in some undetermined time in the future and could include:

- Demolishing of infrastructure;
- Loading, hauling, placing, filling and shaping of previously disturbed areas;
- Shaping of any walls and berms;
- Loading, hauling, placing and shaping of topsoil (all disturbed areas);
- Seeding of topsoil;
- Ripping and seeding of unnecessary roads; and
- Continued maintenance activities.

Decommissioning is only discussed in general because the noise impacts associated with the decommissioning phase are normally less than both the construction and operational phases. This is because the noise impacts associated with the decommissioning phase is normally less than both the construction and operation phases for the following reasons:

- Final decommissioning normally takes place only during the day, a time period when existing ambient sound levels are higher, generally masking most external noises for surrounding receptors; and
- There is a lower urgency of completing this phase and less equipment remains onsite (and are used simultaneously) to affect the final decommissioning.

6 METHODS: NOISE IMPACT ASSESSMENT AND SIGNIFICANCE

6.1 WHY NOISE CONCERNS COMMUNITIES⁷

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalize by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered "disturbing". One can refer to a dripping tap in the quiet of the night, or the irritating "thump-thump" of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

⁷World Health Organization, 1999; Noise quest, 2010; Journal of Acoustical Society of America, 2009

6.2 IMPACT ASSESSMENT CRITERIA

6.2.1 Overview: The common characteristics

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine the listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity it is therefore complicated, but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

6.2.2 Noise criteria of concern

The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts considering the EIA Regulations (2014), SANS 10103:2008, as well as guidelines from the WHO.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise. With regards to the Noise Control Regulations (promulgated in terms of the ECA), an increase of more than 7 dBA is considered a disturbing noise. See also **Figure 6-1**.
- *Zone Sound Levels:* Previously referred to as the acceptable rating levels, it sets acceptable noise levels for various areas. See also **Table 6-1**.
- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

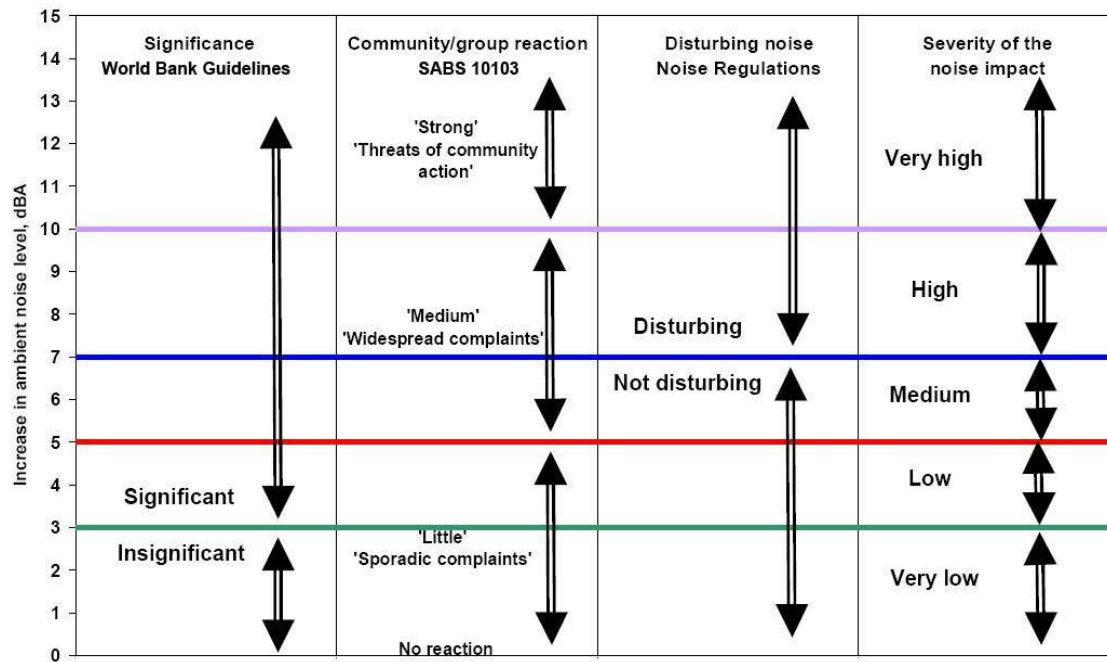


Figure 6-1: Criteria to assess the significance of impacts stemming from noise

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008 (See also **Table 6-1**). It provides the equivalent ambient noise levels (referred to as Rating Levels), $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed.

Acoustical measurements indicate an area where the ambient sound levels are very high, typical of an industrial area and the following study area rating levels are proposed:

- “Equator principles” (55 and 45 dBA day/night-time Rating i.t.o. IFC Noise Limits).

SANS 10103:2008 also provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in sound level, the following criteria are of relevance:

- **$\Delta \leq 3$ dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **$3 < \Delta \leq 5$ dBA:** An increase of between 3 dBA and 5 dBA will elicit ‘little’ community response with ‘sporadic complaints’. People will just be able to notice a change in the sound character in the area.
- **$5 < \Delta \leq 15$ dBA:** An increase of between 5 dBA and 15 dBA will elicit a ‘medium’ community response with ‘widespread complaints’. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of

more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Note that an increase of more than 7 dBA is defined as a disturbing noise and prohibited (National Noise Control Regulations).

Table 6-1: Acceptable Zone Sound Levels for noise in districts (SANS 10103:2008)

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level ($L_{Req,T}$) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day/night $L_{R,dn}^a$	Daytime $L_{Req,d}^b$	Night-time $L_{Req,n}^b$	Day/night $L_{R,dn}^a$	Daytime $L_{Req,d}^b$	Night-time $L_{Req,n}^b$
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 one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

7 PROJECTED NOISE RATING LEVELS

7.1 CONSTRUCTION PHASE NOISE IMPACT

Noise levels associated with potential construction activities will only be evaluated during the future noise impact assessment. However, based on **Table 5-1**, maximum noise levels could be in the region of 90 – 105 dBA when near construction equipment (within 10 m), but noise levels will reduce the farther a conceptual receptor (such as an employee) is from a noise-generating activity. For all construction work, workers working with or in close proximity to noise-generating activities or equipment will be exposed to high levels of noise as can be seen from **Table 5-2**.

While maximum noise levels may reach up to 60 dBA at 1,000 meters (worst-case scenario for a pile driver), such noise levels are not a constant, and equivalent (average) A-weighted night-time noise levels of up to 49 dBA may be expected at 1,000 meters (rock breaker or drilling machine - refer also **Table 5-2**).

There are a number of potential NSRs identified living approximately 1,000m from locations where construction activities may take place. These noise levels are significantly higher than the rural rating levels (both for the day- and night-time periods), and it is possible that the construction activities may impact on the NSR.

7.2 OPERATIONAL PHASE NOISE IMPACT

Considering the location of potential noise-generating activities, the cumulative effects from pumps, compressors and boosters may raise noise levels at the closest NSR (such as NSR10, located approximately 350m from a production well). Night-time noises may exceed the rural rating level, though the significance of this noise impact can only be determined during the EIA stage.

8 SIGNIFICANCE OF THE NOISE IMPACT

8.1 CONSTRUCTION PHASE NOISE IMPACT

The impact assessment for the various activities (that can create noise and may impact on the surrounding environment) defined in **Section 5.1** and discussed in **Section 7.1** is summarized in the following **Table 8-1**.

Table 8-1: Impact Assessment: Potential Construction Activities

Impacts: Increases in noise levels at closest NSR.		
Desktop Sensitivity Analysis (worst-case due to the precautionary principle): The proposed activities may raise ambient sound levels higher than the rating level.		
Issue	Nature of Impact	Extent of Impact
Increase in noise level at NSR. Disturbing noises.	Increased noises or disturbing noises may increase annoyance levels with project.	Multiple night-time construction activities taking place simultaneously may impact an area within 2,000m from the activities
Significance level for scoping: Medium to low		
Gaps in Knowledge: Noise modelling will calculate potential noise levels considering topography, ground surface constants and potential noise-emitting activities.		
Comments: Ambient sound levels may be low (typical of a rural noise district). Without information about actual ambient sound levels as well as the potential construction noise levels, there is a low confidence in this assessment.		
Mitigation Measures: Mitigation will depend on the noise levels calculated at the closest receptors.		
Recommendations: Scoping level assessment is not sufficient, full Environmental Noise Impact Assessment is required.		

8.2 OPERATIONAL PHASE NOISE IMPACT

The impact assessment for the various activities defined in **Section 5.2** and discussed in **section 7.2** will increase the ambient noise levels in the area. The operational noise impact is assessed and summarized in the following **Table 8-2**, considering only the night-time scenario as this is the most critical time period when a quiet environment is desired.

Table 8-2: Impact Assessment: Operational Activities

Impacts: Increases in noise levels at closest NSR.		
Desktop Sensitivity Analysis (worst-case due to the precautionary principle): The proposed activities may raise ambient sound levels higher than the rating level.		
Issue	Nature of Impact	Extent of Impact
Increase in noise level at receptors. Potential disturbing noise levels.	Increased noises or disturbing noises may increase annoyance levels with project.	Multiple night-time operational activities taking place simultaneously may impact an area within 1,000m from the activities
Significance level for scoping: Medium to low		
Gaps in Knowledge: Noise modelling will calculate potential noise levels considering topography, ground surface constants and potential noise-emitting activities.		
Comments: Ambient sound levels may be low (typical of a rural noise district). Without information about actual ambient sound levels as well as the potential operational noise levels at NSR, there is a low confidence in this assessment.		
Recommendations: Scoping level assessment is not sufficient, full Environmental Noise Impact Assessment is required.		

8.3 DECOMMISSIONING PHASE NOISE IMPACT

Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a very small risk for a noise impact.

9 TERMS OF REFERENCE FOR THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT PHASE

Work that will take place during the ENIA phase is defined in section 8 of SANS 10328:2008.

9.1 PURPOSE OF THE ENVIRONMENTAL NOISE IMPACT ASSESSMENT

The purpose of an environmental noise impact investigation and assessment is to determine and quantify the acoustical impact of a proposed development on potential NSR.

9.2 PLAN OF STUDY FOR ENVIRONMENTAL NOISE IMPACT INVESTIGATION AND ASSESSMENT

In this regard the following will be included to assist the EAP in the compilation of the Plan of Study (PoS) for the EIA:

- Site visit to verify the status of identified NSR;
- Site visit to measure ambient sound levels and confirm the rating level of the area;
- Data (layout and PWL of potential project equipment and/or activities) will be used to model the potential noise impact. The following information will be considered:
 - The PWL details of a number of typical equipment and activities that may be used at such a project;
 - The project layout;
 - The surface contours of the project focus area;
 - Surface and meteorological constants;
- The potential impact will be evaluated (where possible) in terms of the nature (description of what causes the effect, what/who might be affected and how it/they might be affected) as well as the extent of the impact;
- The potential significance of the identified issues will be calculated based on the evaluation of the issues/impacts;
- The development of an Environmental Management Plan and a proposal of potential mitigation measures (if required); and
- Recommendations.

9.3 ENVIRONMENTAL NOISE IMPACT INVESTIGATION

9.3.1 Sound emission from the identified noise sources

Sound power emission data as used for similar projects would be used to calculate the potential noise emissions from the project. In the instance that this data is unavailable,

sound emission data as included in the SoundPlan library, or received from equipment manufacturers could be used.

The operating cycle and nature of the sound emission (impulsiveness and/or tonal character) would, where relevant, be considered when the expected rating level in the target area is calculated.

9.3.2 Determination of Rating levels

The sound propagation model defined by ISO 9613-2:1996 for both the construction and operational phases to calculate projected equivalent noise levels. Other input parameters used would include:

- Air temperature of 10 °C;
- Relative humidity of 70%;
- Layout of the proposed facility as provided by the developer;
- Topography details;
- Projected outside equivalent noise levels at potentially NSR at height above sea-level (plus 2 meters for the construction and operational phases);
- 50% medium ground surface for the construction and operational phases.

9.3.3 Assessment of the noise impact: No mitigation

The significance will be determined considering the defined magnitude of the noise level, the extent as well as the duration of the projected noise impact, as well as the probability that this impact may take place.

The magnitude of the noise impact will be assessed by considering:

- The total projected cumulative noise level compared to the appropriate acceptable rating levels as defined in Table 2 of SANS 10103:2008;
- The potential community response from Table 5 of SANS 10103:2008. In addition, other relevant and suitable literature may be consulted as defined in the scoping report. In particular the likely ambient sound levels due to wind induced noises will be estimated at the wind speed under investigation and considered; and
- The likely and projected ambient sound levels.

Likely ambient sound levels associated with wind speeds as well as the projected change in ambient sound levels would also be considered when estimating the probability that a NSR may be impacted by increased noise levels.

9.3.4 Assessment of the noise impact: With Implementation of Mitigation

Should the significance of the impact be medium or high, the potential significance will be estimated considering that the developer would be implementing reasonable mitigation measures. Potential viable mitigation measures will be included.

9.4 ENVIRONMENTAL NOISE IMPACT REPORT

The Environmental Noise Impact Report will cover the following points:

- the purpose of the investigation;
- a brief description of the planned development or the changes that are being considered;
- a brief description of the existing environment including, where relevant, the topography, surface conditions and meteorological conditions during measurements;
- the identified noise sources together with their respective sound pressure levels or sound power levels (or both) and, where applicable, the operating cycles, the nature of sound emission, the spectral composition and the directional characteristics;
- the identified noise sources that were not taken into account and the reasons as to why they were not investigated;
- the identified Potentially Sensitive Receptors and the noise impact on them;
- where applicable, any assumptions, with references, made with regard to any calculations or determination of source and propagation characteristics;
- an explanation, either by a brief description or by reference, of all measuring and calculation procedures that were followed, as well as any possible adjustments to existing measuring methods that had to be made, together with the results of calculations;
- an explanation, either by description or by reference, of all measuring or calculation methods (or both) that were used to determine existing and predicted rating levels, as well as other relevant information, including a statement of how the data were obtained and applied to determine the rating level for the area in question;
- the location of measuring or calculating points in a sketch or on a map;
- quantification of the noise impact with, where relevant, reference to the literature consulted and the assumptions made;
- alternatives that were considered and the results of those that were investigated;
- a list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation (if comments are received);
- a detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them (if comments are received);

- conclusions that were reached;
- proposed recommendations including potential mitigation measures;
- any follow-up investigation which should be conducted at completion of the project as well as at regular intervals after the commissioning of the project so as to ensure that the recommendations of this report will be maintained in the future.

10 CONCLUSIONS AND RECOMMENDATIONS

This report is a combination scoping and site sensitivity verification report for a proposed Motuoane Project south-east of Virginia, Free State.

This assessment confirms that there are two locations that can be considered to have a “very high” sensitivity to noise within the project boundary. This site sensitivity verification therefore partly agrees with the findings of the online screening tool. There are also a number of NSR located near locations where construction or operational activities may take place. Though not identified by the online screening tool, these locations could be considered noise-sensitive.

With the preliminary data available, this assessment indicated that there is a risk of a noise impact during the construction and operational phases due to the proximity of NSR to the project site (where noise generating activities may take place).

Due to the “very high” sensitivity of the area to noise, further study is required and it is recommended that a full Environmental Noise Impact Assessment study be conducted for the project. Additional information to be considered will be:

- Project design and layout;
- Topography between the proposed activity locations and identified NSR;
- A more accurate description of equipment to be used in and around the proposed project. This would include data such as the type of equipment, but also the number of equipment to be used.

Information not provided or available will be estimated using internet sources.



Morné de Jager

Enviro-Acoustic Research cc

2025 – 10 – 10

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APPENDIX A

Curriculum Vitae

Author:

The author started his career in the mining industry as a bursar Learner Official (JCI, Randfontein), working in the mining industry, doing various mining related courses (Rock Mechanics, Surveying, Sampling, Safety and Health [Ventilation, noise, illumination etc.] and Metallurgy. He did work in both underground (Coal, Gold and Platinum) as well as opencast (Coal) for 4 years. He changed course from Mining Engineering to Chemical Engineering after his second year of his studies at the University of Pretoria.

After graduation he worked as a Water Pollution Control Officer at the Department of Water Affairs and Forestry for two years (first year seconded from Wates, Meiring and Barnard), where duties included the perusal (evaluation, commenting and recommendation) of various regulatory required documents (such as EMPR's, Water Use License Applications and EIA's), auditing of license conditions as well as the compilation of Technical Documents.

Since leaving the Department of Water Affairs, Morné has been in private consulting for the last 20 years, managing various projects for the mining and industrial sector, private developers, business, other environmental consulting firms as well as the Department of Water Affairs. During that period he has been involved in various projects, either as specialist, consultant, trainer or project manager, successfully completing these projects within budget and timeframe. During that period he gradually moved towards environmental acoustics, focusing on this field exclusively since 2007.

He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control as well as blasting impacts. Since 2007 he has completed more than 300 Environmental Noise Impact Assessments, numerous Noise Monitoring Reports as well as various acoustic consulting services, including amongst others:

Wind Energy Facilities

Full Environmental Noise Impact Assessments for - Bannf (Vidigenix), iNca Gouda (Aurecon SA), Isivunguvungu (Aurecon), De Aar (Aurecon), Kokerboom 1 (Aurecon), Kokerboom 2 (Aurecon), Kokerboom 3 (Aurecon), Kangnas (Aurecon), Plateau East and West (Aurecon), Wolf (Aurecon), Outeniqua (Aurecon), Umsinde Emoyeni (ARCUS), Komsberg (ARCUS), Karee (ARCUS), Kolkies (ARCUS), San Kraal (ARCUS), Phezukomoya (ARCUS), Canyon Springs (Canyon Springs), Perdekraal (ERM), Scarlet Ibis (CESNET), Albany (CESNET), Sutherland (CSIR), Kap Vley (CSIR), Kuruman (CSIR), Rietrug (CSIR), Sutherland 2 (CSIR), Perdekraal (ERM), Teekloof (Mainstream), Eskom Aberdene (SE), Dorper (SE), Spreeukloof (SE), Loperberg (SE), Penhoek Pass (SE), Amakhala Emoyeni (SE), Zen (SRK Consulting (South Africa) – SE), Goereesoe (SE), Springfontein (SE), Garob (SE), Project Blue (SE), ESKOM Kleinsee (SE), Namas (SE), Zonnequa (SE), Walker Bay (SE), Oyster Bay (SE), Hidden Valley (SE), Deep River (SE), Tsitsikamma (SE), AB (SE), West Coast One (SE), Hopefield II (SE), Namakwa Sands (SE), VentuSA Gouda (SE), Dorper (SE), Klipheuwel (SE), INCA Swellendam (SE), Cookhouse (SE),

		Iziduli (SE), Msenge (SE), Cookhouse II (SE), Rheboksfontein (SE), Suurplaat (SE), Karoo Renewables (SE), Koningaas (SE), Spitskop (SE), Castle (SE), Khai Ma (SE), Poortjies (SE), Korana (SE), IE Moorreesburg (SE), Gunstfontein (SE), Boulders (SE), Vredenburg (Terramanzi), Loeriesfontein (SiVEST), Rhenosterberg (SiVEST), Noupoot (SiVEST), Prieska (SiVEST), Dwarsrug (SiVEST), Graskoppies (SiVEST), Philco (SiVEST), Hartebeest Leegte (SiVEST), Ithemba (SiVEST), IXha Boom (SiVEST), Spitskop West (Terramanzi), Haga Haga (Terramanzi), Vredenburg (Terramanzi), Msenge Emoyeni (Windlab), Wobben (IWP), Trakas (SiVest), Beaufort West (SiVest)
Mining and Industry	and	Full Environmental Noise Impact Assessments for – Delft Sand (AGES), BECSA – Middelburg (Golder Associates), Kromkrans Colliery (Geovicon Environmental), SASOL Borrow Pits Project (JMA Consulting), Lesego Platinum (AGES), Tweefontein Colliery (Cleanstream Environmental), Evraz Vametco Mine and Plant (JMA), Goedehoop Colliery (Geovicon), Hacra Project (Prescali Environmental), Der Brochen Platinum Project (J9 Environment), Brandbach Sand (AGES), Verkeerdepans Extension (CleanStream Environmental), Dwaalboom Limestone (AGES), Jagdlust Chrome (MENCO), WPB Coal (MENCO), Landau Expansion (CleanStream Environmental), Otjikoto Gold (AurexGold), Klipfontein Colliery (MENCO), Imbabala Coal (MENCO), ATCOM East Expansion (Jones and Wagner), IPP Waterberg Power Station (SE), Kangra Coal (ERM), Schoongesicht (CleanStream Environmental), EastPlats (CleanStream Environmental), Chapudi Coal (Jacana Environmental), Generaal Coal (JE), Mopane Coal (JE), Glencore Boshoeck Chrome (JMA), Langpan Chrome (PE), Vlakpoort Chrome (PE), Sekoko Coal (SE), Frankford Power (REMIG), Strahrae Coal (Ferret Mining), Transalloys Power Station (Savannah), Pan Palladium Smelter, Iron and PGM Complex (Prescali Environmental), Fumani Gold (AGES), Leiden Coal (EIMS), Colenso Coal and Power Station (SiVEST/EcoPartners), Klippootjie Coal (Gudani), Rietspruit Crushers (MENCO), Assen Iron (Tshikovha), Transalloys (SE), ESKOM Ankerlig (SE), Nooitgedacht Titano Project (EcoPartners), Algoa Oil Well (EIMS), Spitskop Chrome (EMAssistance), Vlakfontein South (Gudani), Leandra Coal (Jacana), Grazvalley and Zoetveld (Prescali), Tjate Chrome (Prescali), Langpan Chromite (Prescali), Vereeniging Recycling (Pro Roof), Meyerton Recycling (Pro Roof), Hammanskraal Billeting Plant 1 and 2 (Unica), Development of Altona Furnace, Limpopo Province (Prescali Environmental), Haakdoorn drift Opencast at Amandelbult Platinum (Aurecon), Landau Dragline relocation (Aurecon), Stuart Coal Opencast (CleanStream Environmental), Tetra4 Gas Field Development (EIMS), Kao Diamonds – Tipping Village Relocation (EIMS), Kao Diamonds – West Valley Tailings Deposit (EIMS), Upington Special Economic Zone (EOH), Arcellor Mittal CCGT Project near Saldanha (ERM), Malawi Sugar Mill Project (ERM), Proposed Mooifontein Colliery (Geovicon Environmental), Goedehoop North Residue Deposit Expansion (Geovicon Environmental), Mutsho 600MW Coal-Fired Power Plant (Jacana Environmental), Tshivhaso Coal-Fired Power Plant (SRK Consulting (South Africa)), Doornhoek Fluorspar Project (Exigo), Royal Sheba Project (Cabanga Environmental), Rietkol Silica (Jacana), Gruisfontein Colliery (Jacana), Lehlabile Colliery (Jaco-K Consulting), Bloemendal Colliery (Enviro-Insight), Rondevly Colliery (REC), Welgedacht Colliery (REC), Kalabasfontein Extension (EIMS), Waltloo Power Generation Project (EScience), Buffalo Colliery (Marang), Balgarthen Colliery (Rayten), Kusipongo Block C (Rayten), Zandheuvel (Exigo), NamPower Walvis Bay (GPT), Eloff Phase 3 (EIMS), Dunbar (Enviro-Insight), Smokey Hills (Prescali), Bierspruit (Aurecon)
Road and Railway	and	K220 Road Extension (Urbansmart), Boskop Road (MTO), Sekoko Mining (AGES), Davel-Swaziland-Richards Bay Rail Link (Aurecon), Moloto Transport Corridor Status Quo Report and Pre-Feasibility (SiVEST), Postmasburg Housing Development (SE), Tshwane Rapid Transport Project, Phase 1 and 2 (NRM Consulting/City of Tshwane), Transnet Apies-river Bridge Upgrade (Transnet), Gautrain Due-diligence (SiVest), N2 Piet Retief (SANRAL), Atterbury Extension, CoT (Bokomoso Environmental), Riverfarm Development (Terramanzi), Conakry to Kindia Toll Road (Rayten)
Airport		Oudtshoorn Noise Monitoring (AGES), Sandton Heliport (Alpine Aviation), Tete Airport Scoping (Aurecon)
Noise monitoring and Audit Reports		Peerboom Colliery (EcoPartners), Thabametsi (Digby Wells), Doxa Deo (Doxa Deo), Harties Dredging (Rand Water), Xstrata Coal – Witbank Regional (Xstrata), Sephaku Delmas (AGES), Amakhala Emoyeni WEF (Windlab Developments), Oyster Bay WEF (Renewable Energy Systems), Tsitsikamma WEF Ambient Sound Level study (Cennergi and SE), Hopefield WEF (Umoya), Wesley WEF (Innowind), Ncora WEF (Innowind), Boschmanspoort (Jones and Wagner), Nqamakwe WEF (Innowind), Hopefield WEF Noise Analysis (Umoya), Dassiesfontein WEF Noise Analysis (BioTherm), Transnet Noise Analysis (Aurecon), Jeffries Bay Wind Farm (Globeleq), Sephaku Aganang (Exigo), Sephaku Delmas (Exigo), Beira Audit (BP/GPT), Nacala Audit (BP/GPT), NATREF (Nemai), Rappa Resources (Rayten), Measurement Report for Sephaku Delmas (Ages), Measurement Report for Sephaku Aganang (Ages), Bank of Botswana measurements (Linnspace), Skukuza Noise Measurements (Concor), Development

	noise measurement protocol for Mamba Cement (Exigo), Measurement Report for Mamba Cement (Exigo), Measurement Report for Nokeng Fluorspar (Exigo), Tsitsikamma Community Wind Farm Pre-operation sound measurements (Cennerg), Waainek WEF Operational Noise Measurements (Innowind), Sedibeng Brewery Noise Measurements (MENCO), Tsitsikamma Community Wind Farm Operational noise measurements (Cennerg), Noupoot Wind Farm Operational noise measurements (Mainstream), Twisdraai Colliery (Lefatshe Minerals), SASOL Prospecting (Lefatshe Minerals), South32 Klipspruit (Rayten), Sibanye Stillwater Kroondal (Rayten), Rooiberg Asphalt (Rooiberg Asphalt), SASOL Shondoni (Lefatshe), SASOL Twisdraai (Lefatshe), Anglo Mototolo (Exigo), Heineken Inyaniga (AECOM), Glencore Izimbiwa (Cleanstream) Glencore Impunzi (Cleanstream), Black Chrome Mine (Prescali) Sibanye Stillwater Ezulwini (Aurecon), Sibanye Stillwater Beatrix (Aurecon), Bank of Botswana (Linspace), Lakeside (Linspace), Skukuza (SiVest), Rietvlei Colliery (Jaco-K Consulting)
Small Noise Impact Assessments	TCTA AMD Project Baseline (AECOM), NATREF (Nemai Consulting), Christian Life Church (UrbanSmart), Kosmosdale (UrbanSmart), Louwlandia K220 (UrbanSmart), Richards Bay Port Expansion (AECOM), Babalegi Steel Recycling (AGES), Safika Slag Milling Plant (AGES), Arcelor Mittal WEF (Aurecon), RVM Hydroplant (Aurecon), Grootvlei PS Oil Storage (SiVEST), Rhenosterberg WEF, (SiVEST), Concerto Estate (BPTrust), Ekuseni Youth Centre (MENCO), Kranskop Industrial Park (Cape South Developments), Pretoria Central Mosque (Noman Shaikh), Soshanguve Development (Maluleke Investments), Seshego-D Waste Disposal (Enviroexcellence), Zambesi Safari Equipment (Owner), Noise Annoyance Assessment due to the Operation of the Gautrain (Thornhill and Lakeside Residential Estate), Upton Solar (SE), Ilangaletu Solar (SE), Pofadder Solar (SE), Flagging Trees WEF (SE), Uyekraal WEF (SE), Ruuki Power Station (SE), Richards Bay Port Expansion 2 (AECOM), Babalegi Steel Recycling (AGES), Safika Ladium (AGES), Safika Cement Isando (AGES), RareCo (SE), Struisbaai WEF (SE), Perdekraal WEF (ERM), Kotula Tsatsi Energy (SE), Olievenhoutbosch Township (Nali), , HDMS Project (AECOM), Quarry extensions near Ermelo (Rietspruit Crushers), Proposed uMzimkhulu Landfill in KZN (nZingwe Consultancy), Linksfield Residential Development (Bokomoso Environmental), Rooihuiskraal Ext. Residential Development, CoT (Plandev Town Planners), Floating Power Plant and LNG Import Facility, Richards Bay (ERM), Floating Power Plant project, Saldanha (ERM), Vopak Growth 4 project (ERM), Elandsport Ext 3 Residential Development (Gibb Engineering), Tiegerpoort Wedding Venue (Henwood Environmental), Monavoni Development (Marindzini), Rezoning of Portion 1 (Primo Properties), Tswaing Mega City (Makole), Mabopane Church (EP Architects), ERGO Soweto Cluster (Kongiwe), Fabio Chains (Marang), GIDZ JMP (Marang), Temple Complex (KWP Create), Germiston Metals (Dorean), Sebenza Metals (Dorean)
Project reviews and amendment reports	Loperberg (Savannah), Dorper (Savannah), Penhoek Pass (Savannah), Oyster Bay (RES), Tsitsikamma Community Wind Farm Noise Simulation project (Cennerg), Amakhala Emoyeni (Windlab), Spreukloof (Savannah), Spinning Head (SE), Kangra Coal (ERM), West Coast One (Moyeng Energy), Rhebokfontein (Moyeng Energy), De Aar WEF (Holland), Quarterly Measurement Reports – Dangote Delmas (Exigo), Quarterly Measurement Reports – Dangote Lichtenburg (Exigo), Quarterly Measurement Reports – Mamba Cement (Exigo), Quarterly Measurement Reports – Dangote Delmas (Exigo) Quarterly Measurement Reports – Nokeng Fluorspar (Exigo), Proton Energy Limited Nigeria (ERM), Hartebeest WEF Update (Moorreesburg) (SRK Consulting (South Africa)), Modderfontein WEF Opinion (Terramanzi), IPD Vredenburg WEF (IPD Power Vredenburg), Paul Puts WEF (ARCUS), Juno WEF (ARCUS), etc.

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APPENDIX B

Glossary of Terms

GLOSSARY OF ACOUSTIC TERMS, DEFINITIONS AND GENERAL INFORMATION

<i>1/3-Octave Band</i>	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
<i>A – Weighting</i>	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
<i>Air Absorption</i>	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
<i>Alternatives</i>	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called “no go” alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
<i>Ambient</i>	The conditions surrounding an organism or area.
<i>Ambient Noise</i>	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
<i>Ambient Sound</i>	The all-encompassing sound at a point being composite of sounds from near and far.
<i>Ambient Sound Level</i>	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 a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
<i>Amplitude Modulated Sound</i>	A sound that noticeably fluctuates in loudness over time.
<i>Applicant</i>	Any person who applies for an authorisation to undertake a listed activity or to cause such activity in terms of the relevant environmental legislation.
<i>Assessment</i>	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
<i>Attenuation</i>	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
<i>Audible frequency Range</i>	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
<i>Ambient Sound Level</i>	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g., sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
<i>Broadband Noise</i>	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
<i>C-Weighting</i>	This is an international standard filter, which can be applied to a pressure signal or to a <i>PWL</i> spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
<i>Controlled area (as per National Noise Control Regulations)</i>	a piece of land designated by a local authority where, in the case of- (a) road transport noise in the vicinity of a road- (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period extending from 06:00 to 24:00 while such meter is in operation, exceeds 65 dBA; or (ii) the equivalent continuous “A”-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the

	<p>ground for a period extending from 06:00 to 24:00 as calculated in accordance with SABS 0210-1986, titled: "Code of Practice for calculating and predicting road traffic noise", published under Government Notice No. 358 of 20 February 1987, and projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA;</p> <p>(b) aircraft noise in the vicinity of an airfield, the calculated noisiness index, projected for a period of 15 years following the date on which the local authority has made such designation, exceeds 65 dBA; or</p> <p>(c) industrial noise in the vicinity of an industry-</p> <ul style="list-style-type: none"> (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or (ii) the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the ground for a period of 24 hours, exceeds 61 dBA;
<i>dB(A)</i>	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
<i>Decibel (dB)</i>	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 μ Pa.
<i>Diffraction</i>	The process whereby an acoustic wave is disturbed and its energy redistributed in space as a result of an obstacle in its path, Reflection and refraction are special cases of diffraction.
<i>Direction of Propagation</i>	The direction of flow of energy associated with a wave.
<i>Disturbing noise</i>	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.
<i>Environment</i>	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
<i>Environmental Control Officer</i>	Independent Officer employed by the applicant to ensure the implementation of the Environmental Management Plan (EMP) and manages any further environmental issues that may arise.
<i>Environmental impact</i>	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
<i>Environmental Impact Assessment</i>	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and monitoring measures.
<i>Environmental issue</i>	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
<i>Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)</i>	The value of the average A-weighted sound pressure level measured continuously within a reference time interval T , which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
<i>Equivalent continuous A-weighted rating level ($L_{Req,T}$)</i>	The Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$) to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 ($T=16$ hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 ($T=8$ hours). It is a calculated value.
<i>F (fast) time weighting</i>	(1) Averaging detection time used in sound level meters.

	(2) Fast setting has a time constant of 125 milliseconds and provides a fast reacting display response allowing the user to follow and measure not too rapidly fluctuating sound.
<i>Footprint area</i>	Area to be used for the construction of the proposed development, which does not include the total study area.
<i>Free Field Condition</i>	An environment where there is no reflective surfaces.
<i>Frequency</i>	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
<i>Green field</i>	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Greenfield is Brownfield, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brownfield suggests that an investigation should be made to determine if environmental damage exists.
<i>G-Weighting</i>	An International Standard filter used to represent the infrasonic components of a sound spectrum.
<i>Harmonics</i>	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
<i>I (impulse) time weighting</i>	(1) Averaging detection time used in sound level meters as per South African standards and Regulations. (2) Impulse setting has a time constant of 35 milliseconds when the signal is increasing (sound pressure level rising) and a time constant of 1,500 milliseconds while the signal is decreasing.
<i>Impulsive sound</i>	A sound characterized by brief excursions of sound pressure (transient signal) that significantly exceed the ambient sound level.
<i>Infrasound</i>	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
<i>Integrated Development Plan</i>	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
<i>Integrated Environmental Management</i>	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
<i>Interested and affected parties</i>	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
<i>Key issue</i>	An issue raised during the Scoping process that has not received an adequate response and that requires further investigation before it can be resolved.
<i>L_{A90}</i>	the sound level exceeded for the 90% of the time under consideration
<i>Listed activities</i>	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
<i>L_{AMin} and L_{AMax}</i>	Is the RMS (root mean squared) minimum or maximum level of a noise source.
<i>Loudness</i>	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
<i>Magnitude of impact</i>	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
<i>Masking</i>	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
<i>Mitigation</i>	To cause to become less harsh or hostile.

<i>Negative impact</i>	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
<i>Noise</i>	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
<i>Noise Level</i>	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
<i>Noise-sensitive development</i>	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008) 1. rural districts, 2. suburban districts with little road traffic, 3. urban districts, 4. urban districts with some workshops, with business premises, and with main roads, 5. central business districts, and 6. industrial districts; b) educational, residential, office and health care buildings and their surroundings; c) churches and their surroundings; d) auditoriums and concert halls and their surroundings; e) recreational areas; and f) nature reserves. In this report Noise-sensitive developments is also referred to as a Potential Sensitive Receptor
<i>Octave Band</i>	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
<i>Positive impact</i>	A change that improves the quality of life of affected people or the quality of the environment.
<i>Property</i>	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
<i>Public Participation Process</i>	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
<i>Reflection</i>	Redirection of sound waves.
<i>Refraction</i>	Change in direction of sound waves caused by changes in the sound wave velocity, typically when sound wave propagates in a medium of different density.
<i>Reverberant Sound</i>	The sound in an enclosure which results from repeated reflections from the boundaries.
<i>Reverberation</i>	The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
<i>Significant Impact</i>	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
<i>S (slow) time weighting</i>	(1) Averaging times used in sound level meters. (2) Time constant of one [1] second that gives a slower response which helps average out the display fluctuations.
<i>Sound Level</i>	The level of the frequency and time weighted sound pressure as determined by a sound level meter, i.e., A-weighted sound level.
<i>Sound Power</i>	Of a source, the total sound energy radiated per unit time.
<i>Sound Pressure Level (PWL)</i>	Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micro pascals in air and 100

	millipascals in water. PWL is reported as L_p in dB (not weighted) or in various other weightings.
<i>Soundscape</i>	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
<i>Study area</i>	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
<i>Sustainable Development</i>	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
<i>Tread braked</i>	The traditional form of wheel brake consisting of a block of friction material (which could be cast iron, wood or nowadays a composition material) hung from a lever and being pressed against the wheel tread by air pressure (in the air brake) or atmospheric pressure in the case of the vacuum brake.
<i>Zone of Potential Influence</i>	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
<i>Zone Sound Level</i>	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS 10103:2008.