

Just Palm Tree Power (Pty) Ltd

SCREENING NOISE REPORT

FOR BASIC ASESMENT

Establishment of the Koningaas Wind Energy Facility
on various farms near the town of Koningaas,
Northern Cape Province



Study done for:



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GLOSSARY OF ABBREVIATIONS

DEADP	Department of Environmental Affairs and Development Planning
DENC	Department of Environment and Nature Conservation
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act 78 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
FEL	Front End Loader
IAPs	Interested and Affected Parties
i.e.	that is
IEM	Integrated Environmental Management
km	kilometres
LHD	Load haul dumper
m	Meters (measurement of distance)
m ²	Square meter
m ³	Cubic meter
mamsl	Meters above mean sea level
MENCO	M ² Environmental Connections cc
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NCR	Noise Control Regulations (under Section 25 of the ECA)
NGO	Non-government Organisation
PPE	Personal Protective Equipment
PPP	Public Participation Process
SABS	South African Bureau of Standards
SANS	South African National Standards
SHEQ	Safety Health Environment and Quality
REF	Wind Energy Facility
WHO	World Health Organisation
WTG	Wind Turbine Generator



GLOSSARY OF TERMS

<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>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>Background 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>C-Weighting</i>	This is an international standard filter, which can be applied to a pressure signal or to a SPL or PWL 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>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>	Modification of the progressive wave distribution due to the presence of obstacles in the field. 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).
<i>Footprint area</i>	Area to be used for the construction of the proposed development, which does not include the total study area.
<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 Green field is Brown field, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brown field 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>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>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>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) <ol style="list-style-type: none"> 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>Reverberant Sound Reverberation</i>	The sound in an enclosure excluding that is received directly from the source. 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>Sound Level</i>	The level of the frequency weighted and time weighted sound pressure as determined by a sound level meter.
<i>Sound Power Sound Pressure Level (SPL)</i>	Of a source, the total sound energy radiated per unit time. 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 micropascals in air and 100 millipascals in water. SPL 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).

Zone of Potential Influence The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.

Zone Sound Level 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 SANS10103.



1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

M2 Environmental Connections was commissioned to compile a Noise Impact Report as part of a Basic Assessment process conducted for the proposed Koningaas Wind Energy Facility (WEF) on the farm Koningaas 745, about 3km south-west of the town of Koningaas. This facility would be situated in the Northern Cape Province.

This report is the result of an administrative screening procedure as defined in SANS10328:2008.

1.2 BRIEF PROJECT DESCRIPTION

Just Palm Tree Power has identified a site near the town of Koningaas for the establishment of a commercial wind energy facility. The facility is proposed to accommodate up to 24 appropriately spaced turbines that would generate approximately 7 MW of electricity. The facility is to be constructed over an extent of approximately 100 hectares within the De Beers mining area.

Other infrastructure associated with the wind energy facility is proposed to include:

- Cabling between the turbines, to be laid underground where practical, which will connect to the existing on-site substation);
- A switching yard of 50m x 40m will be constructed to convert the current from 33kV to 11kV
- A short 11kV power line to connect the facility to the mine's substation (Koningaas substation);
- Existing roads will be used as far as possible. However, where required, internal access roads of approximately 6m wide will be constructed between the turbines and the on-site substation; and
- Workshop area for maintenance and storage purposes.

1.3 PROJECT LOCATION

The identified site is regarded as favourable due to the wind resource, the disturbed nature of the site, and proximity to a suitable electricity connection point. The study area comprises the farm Koningaas 745 (refer to the attached map).



1.4 TERMS OF REFERENCE

SANS 10328:2008 (Edition 3) specifies the methodology to assess the noise impacts on the environment due to a proposed activity that might impact on the environment. The standard also stipulates the minimum requirements to be investigated for screening purposes. These minimum requirements are:

- a) identification and description of the noise sources and noise-sensitive developments associated with the development that has to be investigated;
- b) identification and description of the noise sources and noise-sensitive developments in the target area that could affect the development (or that could be affected by the development) that has to be investigated;
- c) identification, with the assistance of all interested or affected parties, and description of all the noise sources and noise-sensitive developments associated with the development, or located within the target area, that are to be excluded from the investigation. The reason(s) for the exclusion shall be stated; and
- d) a reference to this standard regarding the method of investigation.

The purpose of the investigation is to determine, by administrative means, whether the proposed development could have any significant acoustical implications. It is based on an overview of all the information available as well as the review of a questionnaire. If the outcome of the all the questions are negative, the planned development or activity is not likely to present a noise disturbance. In this case, a scoping investigation and an environmental noise impact investigation could be dispensed and this Screening report may be submitted to the relevant authorities as part of the Environmental Authorization process.

If one or more of the answers to the questions for this study is affirmative, the acoustical impact could probably be significant and a scoping investigation and, if necessary, an environmental noise impact investigation shall be considered.

1.5 STUDY AREA

The WEF is proposed to be developed on the De Beers mining area, and just east of the processing operations of De Beers. The area is relatively flat and the surface appears to be disturbed (GoogleEarth ® images, 2004).



The proximity to the mine would likely give the area an industrial acoustic character. A site locality map is presented in **Figure 1-1**.

1.6 AVAILABLE INFORMATION

There is no information available regarding the existing soundscape of the area.

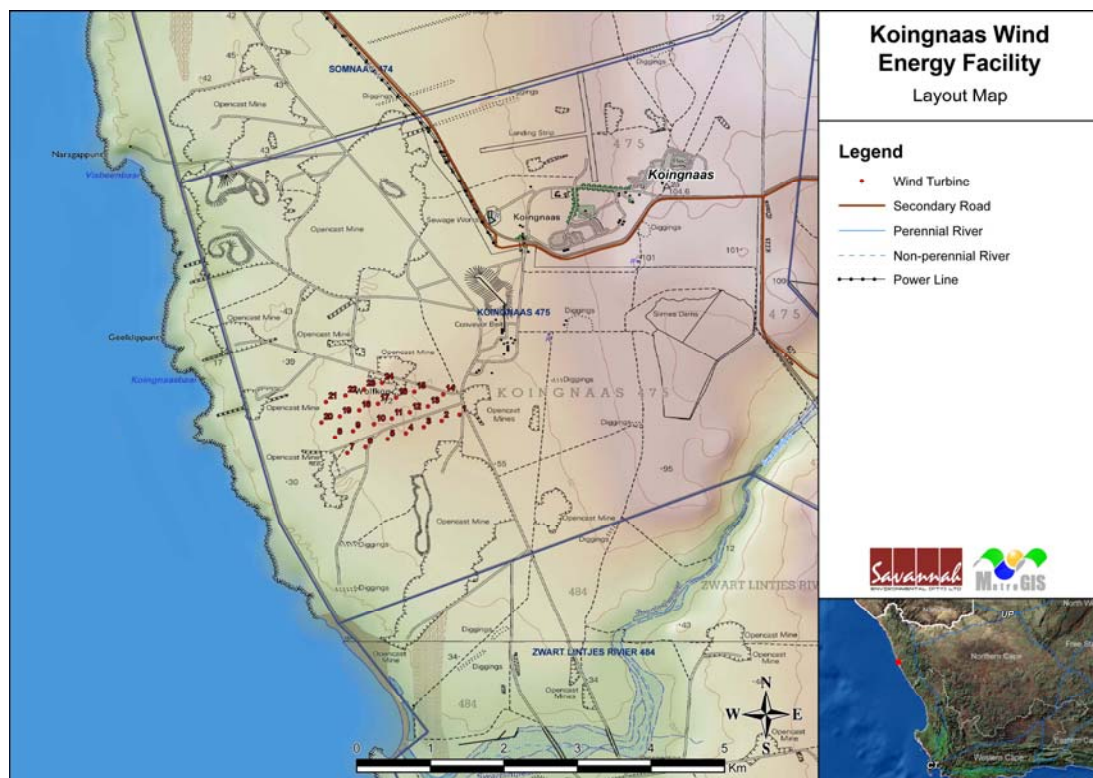


Figure 1-1: Locality map indicating the location of the proposed Wind Energy Facility

1.7 NOISE-SENSITIVE DEVELOPMENTS

An assessment of the area was done using available topographical maps as well as Google Earth® to identify Noise-sensitive developments (NSDs) in the area (within the area proposed, as well as potential NSDs up to 2 km from boundary of facility).

An assessment however did not indicate any NSDs within 2 km distance from the proposed development, with the closest potentially noise-sensitive developments being the residents of Koningnaas (more than 2,000 meters away).



It is also important to note that the existing De Beers processing operation is situated between Koningaas and the area proposed for the WEF development.



2 POLICIES AND THE LEGAL CONTEXT

2.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT (“THE CONSTITUTION”)

The environmental right contained in section 24 of the Constitution provides that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to well-being. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic, however, which has led to the development of noise standards (see Section 2.7).

“Noise pollution” is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

2.2 THE ENVIRONMENT CONSERVATION ACT

The Environment Conservation Act (“ECA”) allows the Minister of Environmental Affairs and Tourism (“now the Minister of Water and Environmental Affairs”) to make regulations regarding noise, among other concerns. The Minister has made noise control regulations under the ECA (see also section 2.5).

2.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management Act (“NEMA”) defines “pollution” to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating the WEF to prevent noise pollution occurring. NEMA sets out measures which may be regarded as reasonable. They include measures:

1. to investigate, assess and evaluate the impact on the environment;
2. to inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
3. to cease, modify or control any act, activity or process causing the pollution or degradation;
4. to contain or prevent the movement of;
5. to eliminate any source of the pollution or degradation; or
6. to remedy the effects of the pollution or degradation.



2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT ("AQA")

Section 34 of the National Environmental Management: Air Quality Act (Act 39 of 2004) makes provision for:

- (1) the Minister to prescribe essential national noise standards -
 - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or
 - (b) for determining -
 - (i) a definition of noise; and
 - (ii) the maximum levels of noise.
- (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force but no such standards have yet been promulgated.

An atmospheric emission licence issued in terms of section 22 may contain conditions in respect of noise. This however will not be relevant to the WEF.

2.5 NOISE CONTROL REGULATIONS

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.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the NCR was devolved to provincial and local authorities. The Northern Cape has not yet promulgated any Provincial Noise Control Regulations. The National Noise Control Regulations would therefore be of relevance.

This regulation defines:

"controlled area"

means a piece of land designated by a local authority where, in the case of--

- c) industrial noise in the vicinity of an industry-
 - 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;



"disturbing noise"

means 'n noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more;

"zone sound level"

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.

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 are conducted to the satisfaction of that local authority by the owner, developer, tenant or occupant of the facilities, land or buildings or that, for the purposes of regulation 3(b) or (c), reports or certificates in relation to the noise impact to the satisfaction of that local authority are submitted by the owner, developer, tenant or occupant to the local authority on written demand";

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.".

2.6 DRAFT MODEL AIR QUALITY MANAGEMENT BY-LAW FOR ADOPTION AND ADAPTATION BY MUNICIPALITIES

Draft model air quality management by-laws for adoption and adaptation by municipalities was published by the Department of Environmental Affairs in the



Government Gazette of 15 July 2009 as General Notice (for comments) 964 of 2009. Section 18 specifically focuses on Noise Pollution Management, with sub-section 1 stating:

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

The draft regulations differs from the current provincial Noise Control Regulations as it defines a disturbing noise as a noise that is measurable or calculable of which the rating level exceeds the equivalent continuous rating level as defined in SANS 10103.

2.7 NOISE STANDARDS

Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noises from a Wind Energy Facility. They are:

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

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. The recommendations that the standards make are likely to inform decisions by authorities but non-compliance with the standards will not necessarily render an activity unlawful *per se*.

2.8 INTERNATIONAL GUIDELINES

While there exist a number of international guidelines and standards that could encompass a document in itself, the three mentioned below were selected as they are used by different countries in the subject of environmental noise management, with the last two documents specifically focussing on the noises associated by wind energy facilities.



2.8.1 Guidelines for Community Noise (WHO, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the L_{Aeq} and $L_{A,max}$ noise descriptors to define noise levels. This document was important in the development of the SANS 10103 standard.

2.8.2 The Assessment and Rating of Noise from Wind Farms (ETSU, 1997)

This report describes the findings of a Working Group on Wind Turbine Noise, facilitated by the United Kingdom Department of Trade and Industry. It was developed as an Energy Technology Support Unit¹ (ETSU) project. The aim of the project was to provide information and advice to developers and planners on noise from wind turbines. The report represents the consensus view of a number of experts (experienced in assessing and controlling the environmental impact of noise from wind farms). Their findings can be summarised as follows:

1. Absolute noise limits applied at all wind speeds are not suited to wind farms; limits set relative to the background noise are more appropriate;
2. $L_{A90,10mins}$ is a much more accurate descriptor when monitoring ambient and turbine noise levels;

¹ ETSU was set up in 1974 as an agency by the United Kingdom Atomic Energy Authority to manage research programmes on renewable energy and energy conservation. The majority of projects managed by ETSU were carried out by external organisations in academia and industry. In 1996, ETSU became part of AEA Technology plc which was separated from the UKAEA by privatisation.



3. The effects of other wind turbines in a given area should be added to the effect of any proposed wind energy facility, to calculate the cumulative effect;
4. Noise from a wind energy facility should be restricted to no more than 5 dBA above the current ambient noise level at a NSD. Ambient noise levels is measured onsite in terms of the $L_{A90,10min}$ descriptor for a period sufficiently long enough for a set period;
5. Wind farms should be limited to within the range of 35dBA to 40dBA (day-time) in a low noise environment. A fixed limit of 43 dBA should be implemented during all night time noise environments. This should increase to 45 dBA (day and night) if the NSD has financial investments in the wind energy facility;
6. A penalty system should be implemented for wind turbine/s that operates with a tonal characteristic.

This is likely the guideline used in the most international countries to estimate the potential noise impact stemming from the operation of a Wind Energy Facility. It also recommends an improved methodology (compared to a fixed upper noise level) on determining ambient sound levels in periods of higher wind speeds, critical for the development of a wind energy facility. Because of its international importance, the methodologies used in the ETSU R97 document will be recommended in this Scoping Report for implementation during the Environmental Noise Impact Assessment phase should projected noise levels (from the proposed WEF at PSRs) exceed the zone sound levels as recommended by SANS 10103:2008.

2.8.3 Noise Guidelines for Wind Farms (MoE, 2008)

This document establishes the sound level limits for land-based wind power generating facilities and describes the information required for noise assessments and submissions under the Environmental Assessment Act and the Environmental Protection Act, Canada.

The document defines:

- Sound Level Limits for different areas (similar to rural and urban areas), defining limits for different wind speeds at a 10 m height
- The Noise Assessment Report, including;
 - Information that must be part of the report
 - Full description of noise sources
 - Adjustments, such as due to the wind speed profile (wind shear)
 - The identification and defining of NSDs
 - Prediction methods to be used (ISO 9613-2)
 - Cumulative impact assessment requirements
 - It also defines specific model input parameters



- Methods on how the results must be presented
- Assessment of Compliance (defining magnitude of noise levels)

The document used the $L_{Aeq,1h}$ noise descriptor to define noise levels.





3 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the construction of the WEF and related infrastructure, as well as the operational phase of the activity. The specific activities relating to construction of the WEF will only be discussed in a generalised manner in the following sections.

However, commonly the most significant stage relating to noise is the operational phase, and not the construction phase. This is because the duration of activities during the construction phase are generally short.

3.1 POTENTIAL NOISE SOURCES: CONSTRUCTION PHASE

3.1.1 Construction equipment

Construction activities include:

- construction of access roads;
- establishment of turbine tower foundations and electrical substation(s);
- establishment of foundations for photovoltaic arrays;
- the possible establishment, operation and removal of concrete batching plants;
- the construction of any buildings;
- digging of trenches to accommodate underground power cables; and
- the erection of turbine towers and assembly of WTGs.

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

- excavator/grader, bulldozer, dump trucks, vibratory roller, bucket loader, rock breaker, (*potentially*) drill rig, excavator/grader, bulldozer, dump truck, flat bed trucks, concrete truck(s), cranes, fork lift and various 4WD and service vehicles.

3.1.2 Material supply: Concrete batching plants and use of Borrow Pits

Instead of transporting the required material to the site using concrete trucks, portable concrete batching plants may be required to supply concrete onsite. Batching plant equipment may be relocated between the sites as the works progress to different areas of the site. The need for such batching plants, the number, and whether they will be moved is yet unknown.

3.1.3 Blasting

Blasting may also be required as part of the civil works to clear obstacles or to prepare foundations.



However, blasting will not be considered further for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner. With regards to blasting in borrow pits, explosives are used with a low detonation speed, reducing vibration, sound pressure levels and air blasts. The breaking of obstacles with explosives is also a specialized field, and when correct techniques are used, it causes less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast.
- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relative fast, resulting in a higher acceptance of the noise.

3.1.4 Traffic

The last significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependant upon the construction activities being conducted, which will vary during the construction period. Noise levels due to traffic will be estimated using the methodology stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

3.2 POTENTIAL NOISE SOURCES: OPERATIONAL PHASE

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources normally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the sub-stations, traffic (maintenance) and transmission line noise.

The developer indicated that they would be considering a purposely build 300 kW wind turbine developed in South Africa. The hub height would be 35 meters with rotor diameter of 32 meters. The turbine is therefore relatively small. As the IEC 61400-11 Noise Emission Certificate is not available, the turbine would be treated as a normal wind



turbine, generating sound pressure levels in the region of 100 – 105 dBA (ref 1 meter). Studies done by the Author as well as a number of international publications indicated that the noise emissions of these turbines generally do not significantly impact on noise-sensitive developments further than 1,000 meters from the wind turbine.

With the proposed turbines being both smaller and lower than the wind turbines considered by the author as well as other publications, it is likely that the proposed wind turbines would have a noise impact of a lower magnitude on the surrounding environment.

3.2.1 Wind Turbine Noise: Aerodynamic sources²

Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:

1. Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge.
2. Noise due to inflow turbulence (turbulence in the wind interacting with the blades).
3. Discrete frequency noise due to trailing edge thickness.
4. Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade).
5. Noise generated by the rotor tips.

3.2.2 Wind Turbine: Mechanical sources³

Mechanical noise is normally perceived within the emitted noise from wind turbines as an audible tone(s) which is subjectively more intrusive than a broad band noise of the same sound pressure level. Sources for this noise are normally associated with:

- the gearbox and the tooth mesh frequencies of the step up stages;
- generator noise caused by coil flexure of the generator windings which is associated with power regulation and control;
- generator noise caused by cooling fans; and
- control equipment noise caused by hydraulic compressors for pitch regulation and yaw control.

Tones are noises with a narrow sound frequency composition (e.g., the whine of an electrical motor). Annoying tones can be created in numerous ways: machinery with rotating parts such as motors, gearboxes, fans and pumps often create tones. An imbalance or repeated impacts may cause vibration that, when transmitted through

² [Reference source 6](#)

³ [Reference source 6](#)



surfaces into the air, can be heard as tones. Pulsating flows of liquids or gases can also create tones, which may be caused by combustion processes or flow restrictions. The best and most well known example of a tonal noise is the buzz created by a flying mosquito.

Where complaints have been received due to the operation of wind farms, tonal noise from the installed wind turbines appears to have increased the annoyance perceived by the complainants and indeed has been the primary cause for complaint.

However, tones were normally associated with the older models of turbines. All turbine manufacturers have started to ensure that sufficient forethought is given to the design of quieter gearboxes and the means by which these vibration transmission paths may be broken. Through the use of careful gearbox design and/or the use of anti-vibration techniques, it is possible to minimise the transmission of vibration energy into the turbine supporting structure. The benefits of these design improvements have started to filter through into wind farm developments which are using these modified wind turbines. ***New generation wind turbine generators do not emit any clearly distinguishable tones.***

3.2.3 Transformer noises (from Sub-stations)

Also known as magnetostriction, this is when the sheet steel used in the core of the transformer tries to change shape when being magnetized. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed.

This deformation is not uniform; consequently it varies all over a sheet. With a transformer core being composed of many sheets of steel, these deformations is taking place erratically all over each sheet, and each sheet is behaving erratically with respect to its neighbour. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" take place 100 times a second, resulting in a tonal noise at 100Hz. ***However, this is a relative easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer and will not be considered further in this or EIA study.***

3.2.4 Transmission Line Noise (Corona noise)

Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. It can generate an audible and radio-frequency noise,



but generally only occurs in humid conditions, as provided by fog or rain. A minimum line potential of 70 kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines.

Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but ***fortunately it is generally only a feature during fog or rain.***

It will not be further investigated, as corona discharges results in:

- Power losses,
- Audible noises,
- Electromagnetic interference,
- A purple glow,
- Ozone production; and
- Insulation damage.

As such Electrical Service Providers such as ESKOM go to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relatively short duration compared to other operational noises.

3.2.5 Low Frequency Noise

3.2.5.1 Background and Information

Low frequency sound is the term used to describe sound energy in the region below ~200Hz. The rumble of thunder and the throb of a diesel engine are both examples of sounds with most of their energy in this low frequency range. Infrasound is often used to describe sound energy in the region below 20Hz. Almost all noise in the environment has components in this region although they are of such a low level that they are not significant (wind, ocean, thunder).

While significant work has been done on this field, there exist uncertainties around Infrasound and Low Frequency Noise.



3.2.5.2 *The generation of Low Frequency Sounds*

Because of the low rotational rates of the blades of a WTG, the peak acoustic energy radiated by large wind turbines is in the infrasonic range with a peak in the 8-12 Hz range. For smaller machines, this peak can extend into the low-frequency "audible" (20-20KHz) range because of higher rotational speeds and multiple blades.

3.2.5.3 *Detection of Low Frequency Sounds*

Investigations have shown that the perception and the effects of sounds differ considerably at low frequencies as compared to mid- and high frequencies. The main aspects to these differences are:

- a weakening of pitch sensation as the frequency of the sound decreases below 60 Hz;
- perception of sounds as pulsations and fluctuations;
- a much more rapid increase of loudness and annoyance with increasing sound level at low frequencies than at mid- or high frequencies;
- complaints about the feeling of ear pressure;
- annoyance caused by secondary effects like rattling of building elements, e.g. windows and doors or the tinkling of bric-a-brac;
- other psycho acoustic effects, e.g. sleep deprivation, a feeling of uneasiness; and
- reduction in building sound transmission loss at low frequencies compared to mid- or high frequencies.

3.2.5.4 *Measurement, Isolation and Assessment of Low Frequency Sounds*

There remain significant debate regarding the noise from WTG's, public response to that noise, as well as the presence or not of low frequency sound and how it affects people. While low frequency sounds can be measured, it is far more difficult to isolate low frequency sounds due to the numerous sources generating these sounds.

From sound power level emission tables (for Wind Turbines) it can be seen that a wind turbine has potential to generate low frequency sounds with sufficient energy to warrant the need to investigate WTG as a source of low frequency sounds. Each turbine make, model and size has a specific noise emission characteristic. The larger a wind turbine (especially the blades), the higher the acoustical energy in the lower frequencies and the potential for low frequency sounds should be evaluated for each project and turbine proposed.

SANS 10103:2004 proposes a method to identify whether low frequency noise could be an issue. It proposes that if the difference between the A-frequency weighted and the C-



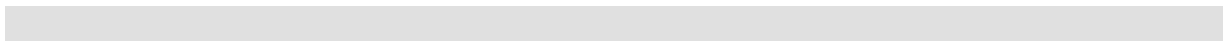
frequency weighted equivalent continuous ($L_{Aeq} \gg L_{Ceq}$) sound pressure levels is greater than 10 dB, a predominant low frequency component **may** be present.

3.2.6 Amplitude modulation

There is one other characteristic of wind turbine sound that could increase the sleep disturbance potential above that of other long-term noise sources. The amplitude modulation of the sound emissions from the wind turbines create a repetitive rise and fall in sound levels synchronized to the blade rotation speed, sometimes referred to as a "swish" or "thump". Many common weather conditions increase the magnitude of amplitude modulation. Unfortunately most of these occur at night. It is also reported that for many people, especially seniors, children and those with pre-existing medical conditions, this represents a major challenge to restful sleep.

Regrettably the mechanism of this noise is not known though various possible reasons have been put forward. Although the prevalence of complaints about amplitude modulation is relatively small, it is not clear whether this is because it does not occur often enough or whether it is because housing is not in the right place to observe it. Furthermore the fact that the mechanism is unknown means that it is not possible to predict when or whether it will occur.

Even though there are thousands of wind turbine generators in the world, amplitude modulation is one subject receiving the least complaints and due to this very few complaints, little research has gone into this subject. ***It is included in this report to highlight all potential risks, albeit extremely low risks such as this (low significance due to very low probability).***





4 METHODOLOGY: SCREENING QUESTIONNAIRE

As the noise emission characteristics of the propose wind turbine is unknown, the potential noise impact would be evaluated as defined by SANS 10328:2008. This evaluation would be relevant for both the construction and operational phases.

Table 4.1: Questions for Noise Screening (SANS 10328:2008)

Question	Answer	Comment
Does the planned linear source (arterial road, planned arterial road reserve, or a main line railway line) at any position along the route pass within 1 000 m from an area which is developed or zoned for residential purposes?	No	Not relevant
Does the planned linear source (suburban road, planned suburban road reserve where only two lanes of traffic will be present at an average speed limit not exceeding 60 km/h, or a suburban electric traction railway line) at any position along the route pass within 500 m from an area which is developed or zoned for residential purposes?	No	Not relevant
Does the planned development of a residential area or a piece of land zoned for residential purposes fall within 1 000 m from a planned linear source (arterial road, planned arterial road reserve, or a main line railway line)?	No	Not relevant
Does the planned development of a residential area or a piece of land zoned for residential purposes fall within 500 m from a planned linear source (suburban road, planned suburban road reserve where only two lanes of traffic will be present at an average speed limit not exceeding 60 km/h, or a suburban electric traction railway line)?	No	Not relevant
Does a planned industrial development or a building housing plant fall within a distance of 1 000 m from an already developed residential area or land zoned for residential purposes?	No	Not relevant
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 1 000 m from an already developed industrial area or a building housing plant?	No	Not relevant
Does planned light industrial development or a building(s) housing workshops fall within a distance of 500 m from an already developed residential area or land zoned for residential purposes?	No	Not relevant
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 500 m from an already developed light industrial development or a building(s) housing workshops?	No	Not relevant
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 2 000 m from an existing wind generator farm?	No	Not relevant
Does a piece of land to be developed as a wind generator farm fall within 2 000 m from a piece of land to be developed for residential purposes or land to be zoned for residential purposes?	No	De Beers Mining area
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 2 000 m from a low frequency source (e.g. low speed ventilation fans or low speed diesel engines)?	No	De Beers Mining area
Does an activity containing a low frequency source (e.g. low speed ventilation fans or low speed diesel engines) to be developed fall within 2 000 m from a piece of land to be developed for residential purposes or land use to be zoned for residential purposes?	No	De Beers Mining area
Will the planned repaving of a suburban street be provided with a normal, non-sound absorptive bitumen or cement concrete paving?	No	Not relevant
Where an aircraft landing strip, heliport, hoverport or airport is planned, or is to be altered, will this planned activity be such that the calculated appropriate limit noise contour for the full planned use of the activity fall inside the boundaries of any residential area or any piece of land zoned for residential purposes?	No	Not relevant
Where a residential area is planned or a piece of land is to be zoned for residential purposes, will the evaluated appropriate limit noise contour for the full planned use of an aircraft landing strip, heliport, hoverport or airport fall inside the boundaries of the residential area or the piece of land zoned for residential purposes?	No	Not relevant



5 CONCLUSIONS AND RECOMMENDATIONS

This report is a Screening Noise Assessment to be used in the Basic Assessment process due to the development of the proposed Koningaas Wind Energy Facility on various farms south-west of the town of Koningaas.

It is based on a desktop administrative assessment as defined in SANS 10328:2008 and considered the following:

- The proposed wind turbine is relatively small in terms of generating capacity;
- The proposed wind turbine is not very high (comparing to the typical 60 – 120 meters above ground level turbine);
- The area already has an industrial noise source situated between the proposed WEF and the closest noise-sensitive receptor (Koningaas);
- The proposed WEF would be too far (more than 1 km) from any potentially noise-sensitive receptor to pose any significant risk of a noise disturbance being created by either the construction or operational phase.

The information at hand is sufficient to conclude that this assessment is adequate to conclude that the potential noise impact would be insignificant, and that no additional Noise Impact Assessments are required.



6 THE AUTHOR

The author of this report, M. de Jager (B. Ing (Chem), UP) graduated in 1998 from the University of Pretoria. He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker enclosure design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. As from 2007 he has been involved with the following projects:

- Full Noise Impact Studies for a number of Wind Energy Facilities, including: Cookhouse, Amakhala Emoyeni, Dassiesfontein/Klipheuwel, Rheboksfontein, AB, Dorper, Suurplaat, Gouda, Riverbank, Deep River, West Coast, West Coast One, Karoo, Velddrift and Saldanha.
- Full Noise Impact Studies for a number of mining projects, including: Skychrome (Pty) Ltd (A Ferro-chrome mine), Mooinooi Chrome Mine (WCM), Buffelsfontein East and West (WCM), Elandsdrift (Sylvania), Jagdlust Chrome Mine (ECM), Apollo Brick (Pty) Ltd (Clay mine and brick manufacturer), Arthur Taylor Expansion project (X-Strata Coal SA), Klipfontein Colliery (Coal mine), Landau Expansion project (Coal mine), Modelling for Tweefontein Colliery Expansion.

The author is an independent consultant to the project, the developer as well as Savannah Environmental (Pty) Ltd. He,

- does not and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations
- have and will not have no vested interest in the proposed activity proceeding
- have no and will not engage in conflicting interests in the undertaking of the activity
- undertake to disclose all material information collected, calculated and/or findings, whether favourable to the developer or not
- will ensure that all information containing all relevant facts be included in this report.



7 REFERENCES

In this report reference was made to the following documentation:

1. Norton, M.P. and Karczub, D.G.: Fundamentals of Noise and Vibration Analysis for Engineers, Second Edition, 2003
2. SANS 0103:2004. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
3. SANS 0210:2004. 'Calculating and predicting road traffic noise'.
4. SANS 10328:2003. 'Methods for environmental noise impact assessments'.
5. SANS 0357:2004 The calculation of sound propagation by the Concave method'.
6. The Assessment and Rating of Noise from Wind Farms: Working Group on Noise from Wind Turbines, September 1996 – ETSU-97.