Arcus GIBB (PTY) LTD

Environmental Impact Assessment
Wolseley Wind Farm

Prepared by: Barend van der Merwe

Prepared for: Arcus GIBB Pty Ltd

Date: 7 April 2012
7 April 2012

DECLARATION OF INDEPENDENCE

I, Barend J B van der Merwe, as duly authorised representative of dBAcoustics, hereby confirm my independence (as well as that of dBAcoustics) as a specialist and declare that neither I nor dBAcoustics have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Arcus GIBB was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Impact Assessment for the proposed Wolseley Wind Farm site, Western Cape. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it – as is described in my attached report.

Full Name:  Barend Jacobus Barnardt van der Merwe
Title / Position:  Owner
Qualification(s):  BSc Honours Geography
Experience (years/ months):  12 Years
Registration(s):  SAAI
EXECUTIVE SUMMARY

SAGIT is proposing to establish a wind farm near Wolseley, hereafter referred to as the Wolseley Wind Farm. The proposed site of the wind farm will be located on the farms Romansrivier, Koppies, de Liefde, de Liefde 2, Vaalvlei, Kleineberg and Tevrede respectively. These farms abut the R43 Provincial Road between Wolseley and Worcester. There are other farms with farmhouses or noise sensitive areas that abut the proposed wind farm development and the railway line, and some gravel feeder roads runs through the proposed development. The aspect of noise will be investigated during the noise impact assessment phase of the project.

An increase in the noise level during any development or change of land use are most of the times associated with unwanted sound and such must be scientifically evaluated. In any given situation or area there is a prevailing ambient noise level that is made up out of traffic noise, farming activities, railway noise, wind noise and domestic type noises. These noises are the acceptable noises of an area and the introduction of a new activity into an area can be prior to the establishment of the activity be determined, evaluated and controlled so that this activity is perceived by the receptors (people) as either acceptable or an intrusion. The current prevailing ambient noise levels within the proposed wind farm boundaries are made up out of traffic noise along the R43 and gravel roads, railroad noise along the existing railway line between the north and the south, farming activity noises, wind noises, barking dogs and domestic type noises.

The project life cycle for the Wolseley Wind Farm will consist of a Construction Phase, Operational Phase, Maintenance Phase and a Decommissioning Phase. Each of these phases will have their own increased noise characteristics that may have an impact on the prevailing ambient noise levels. Increased noise levels may be experienced during the construction and/or decommissioning phases that will be site specific. The noise source during the operational phase will be the wind turbine with noise sources such as the gearbox, generator and the blades of the individual wind turbines which will be investigated in terms of the prevailing ambient noise levels of the specific location of the wind turbines. There will be little to no noise impact during the Maintenance Phase. The impact of the possible noise sources and subsequent noise intrusions will be evaluated in terms of the Western Cape Noise Control Regulations.

The following issues will be investigated during the noise assessment phase of the project:

1. Would the project result in the exposure of persons to or generation of noise levels in excess of the Western Cape Noise Control Regulations?

2. Would the project result in a substantial temporary or periodic increase in the prevailing ambient noise levels in the project vicinity and above noise levels existing without the project?

3. Would the project result in a substantial permanent increase in the prevailing ambient noise levels in the project vicinity and above levels existing without the project?

4. Would the project expose people residing or working in the project area to excessive noise levels?
The noise impact assessment forms part of the specialist noise investigation process of the proposed Wolseley Wind Farm and the purpose of the noise study will be to:

1. Determine the prevailing ambient noise levels along the boundary of the proposed Wolseley Wind Farm and at the noise sensitive area within and in the vicinity of the study area.

2. Quantify the alleged impact of noise on the prevailing ambient levels and the outdoor environment.

3. To make mitigatory recommendations for the proposed project to comply with the International and Local Noise Control Regulations.

4. Make mitigatory recommendations for the proposed project to comply with the International and Western Cape Noise Control Regulations as well as the Guidelines for Wind Energy Development by the Provincial Government of the Western Cape.

The following six-stage process approach to noise assessment and mitigation will be used:

- Step 1 - Define the project requirements and noise problem – gather technical support information;
- Step 2 – Agree on the assessment criteria, establish baseline noise environment and determine extent of the noise impact of initial proposal;
- Step 3 – Identify and agree on noise mitigations options;
- Step 4 – Assess noise impact against criteria of Step 2 and evaluate key considerations and significance for each mitigation option;
- Step 5 – Determine optimal noise control solution;
- Step 6 – Review, implement, monitor and audit

A noise survey will have to be carried out at all the noise sensitive areas in and around the proposed wind farm in order to determine the prevailing noise levels of the study area. The noise survey will be carried out in terms of SANS 10103 of 2008 – “The measurement and rating of environmental noise and to speech communication” as well as the Western Cape Noise Control Regulations.

The sound to be created by the wind turbines will become part of the noise regime of the specific site where the wind turbines will be positioned. This noise will however be masked by the wind noise and the noise impact is not predicted to be intrusive as the wind turbines will be situated at a distance from noise sensitive areas. This will be taken into account at the placing of the wind turbines so as to comply with the recommendations for wind farms by the Provincial Government of the Western Cape. It is recommended that the position of the wind turbines be controlled in such a manner that it is not within 400m from any noise sensitive area.

By doing this, the impacts can therefore be controlled and managed by the placing of the wind turbines in areas where there are higher prevailing ambient noise levels and such not to have a negative impact on the noise sensitive areas.
The noise assessment that will be done after the scoping phase will determine the management and mitigatory measures to be implemented for this project to comply with the relevant noise control regulations, local and international, and the Guidelines for Wind Energy Development by the Provincial Government of the Western Cape.
# Environmental Impact Assessment for the Proposed Wolseley Wind Farm in the Western Cape

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1</td>
<td>Infra-structure associated with the wind energy facility</td>
<td>2</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Noise information</td>
<td>3</td>
</tr>
<tr>
<td>1.2</td>
<td>Scope and Limitations</td>
<td>4</td>
</tr>
<tr>
<td>1.3</td>
<td>Methodology</td>
<td>5</td>
</tr>
<tr>
<td>1.3.1</td>
<td>Study Area Sensitivity Analysis</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>DESCRIPTION OF THE RECEIVING ENVIRONMENT</td>
<td>7</td>
</tr>
<tr>
<td>2.1</td>
<td>General Study Area</td>
<td>8</td>
</tr>
<tr>
<td>2.1.1</td>
<td>Proposed wind farm</td>
<td>8</td>
</tr>
<tr>
<td>2.1.2</td>
<td>The measuring points within and abutting the proposed wind farm</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>POTENTIAL IMPACTS AND ISSUES IDENTIFICATION</td>
<td>9</td>
</tr>
<tr>
<td>3.1</td>
<td>Impacts During Different Phases</td>
<td>9</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Construction Phase</td>
<td>9</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Operational Phase</td>
<td>9</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Maintenance Phase</td>
<td>10</td>
</tr>
<tr>
<td>3.1.4</td>
<td>Decommissioning Phase</td>
<td>10</td>
</tr>
<tr>
<td>3.2</td>
<td>Noise Generated by Wind</td>
<td>11</td>
</tr>
<tr>
<td>3.3</td>
<td>Response to Noise</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>TERMS OF REFERENCE FOR IMPACT ASSESSMENT PHASE</td>
<td>12</td>
</tr>
<tr>
<td>4.1</td>
<td>Noise Survey</td>
<td>12</td>
</tr>
<tr>
<td>4.1.1</td>
<td>Instrumentation</td>
<td>13</td>
</tr>
<tr>
<td>4.1.2</td>
<td>Measuring points</td>
<td>13</td>
</tr>
<tr>
<td>4.1.3</td>
<td>Site Characteristics</td>
<td>13</td>
</tr>
<tr>
<td>4.1.4</td>
<td>Current Noise Sources</td>
<td>13</td>
</tr>
<tr>
<td>4.1.5</td>
<td>Atmospheric Conditions</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>CONCLUSIONS AND RECOMMENDATIONS</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>REFERENCES</td>
<td>15</td>
</tr>
</tbody>
</table>
Glossary

Ambient noise
The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far

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

\[
L_{pa} = 10 \log \left( \frac{p_a}{p_o} \right)^2
\]

Where

- \( p_a \) is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and
- \( p_o \) is the reference sound pressure (\( p_o = 20 \, \mu Pa \)).

NOTE The internationally accepted symbol for sound level is dBA.

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

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

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

Where

- \( L_{Aeq,T} \) is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval \( T \) that starts at \( t_1 \) and ends at \( t_2 \);
- \( p_o \) is the reference sound pressure (\( p_o = 20 \, \mu Pa \)); and
- \( p_A(t) \) is the instantaneous A-weighted sound pressure of the sound signal, in pascals.
Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise

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

Intelligible speech
Speech that can be understood without undue effort

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

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

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises are suppressed

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source
NOTE Complaints about noise usually arise as a result of one or more specific noises.

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 that causes the ambient noise level to rise 7dBA above the designated zone level, or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

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

1.1 Background

The demand for alternative green renewable energy has lead to the development of wind turbine electricity generation (Gupta, 2002). The prevailing constant winds in specific areas within the Western Cape and the identification of areas for wind farms by the Government of the Western Cape has guided the applicant to investigate the Wolseley area for the establishment of the wind farm.

In line with this, SAGIT Energy Ventures is proposing to establish a wind energy facility along with the infra-structure such as roads, sub-stations feeding into the ESKOM electricity network on a site in the vicinity of Wolseley. The proposal is referred to as the Wolseley Wind Farm and dBAcoustics has been appointed as the environmental noise specialist consultant for the project.

The site of the proposed Wolseley Wind Farm includes the following farms:

- Farm 320 – Romansriver;
- Portions 6/334, RE/334, 5/334 – De Liefde 2;
- Portion 6/323 – De Liefde;
- Portions 72/208, 64/208 – Kleineberg;
- Portions 324, RE/355 – Vaalvlei;
- Portion 21/208 – Tevrede;
- Portion 7/323 – Koppies.

These farms are in the vicinity of the R43 Provincial road between Ceres and Worcester, the railway line between the north and the south and feeder gravel roads. There are noise sensitive areas that consist of farm houses, staff accommodations, Dwarsriver Jail within the boundaries of the proposed wind farm as well as on the areas that abuts the proposed wind farm. The distances to these noise sensitive areas vary.

The farm portions where the proposed wind farm will be established are illustrated in Figure 1.
The prevailing ambient noise levels within the study area is created by the R43 provincial road, railway corridor, gravel roads, farming activities, barking dogs and wind noise.

1.1.1 Infra-structure associated with the wind energy facility

The infra-structure associated with the wind energy facility will include:

- The full phased project will be 20-35 wind turbines with a total capacity of 50-110MW;
- The study area is zoned agricultural and no re-zoning will be required as the continued use of the land will be for agricultural purposes;
- Each turbine will require a concrete foundation of 30 x 30 x 3m set below ground level to support the turbine towers;
- Underground cables connect the turbines;
- Roads to the different positioned wind turbines and access roads to the sites will be from the R43 and gravel roads;
- The internal roads will be level and well maintained gravel roads;
- Heavy lift cranes and heavy-duty vehicles will use the access roads during the construction phase of the project after which the roads will only be used by the maintenance staff.

While the specifications of the wind turbines will still have to be determined, each typically consists of a steel column (80 to 110m), nacelle and the turbine blades (40 to 60m in length). The wind turbines will be optimally positioned to make the most of the prevailing wind conditions. These individual wind turbines will be positioned several
hundred meters apart. Since wind turbines utilize such a small portion of the land surface, once the facility is established normal agricultural activities can continue on the land. The major part of the land is currently used for fruit growing and vine-yards.

1.1.2 Noise information

Noise is an important environmental issue when a wind turbine and/or wind turbine farm is to be established in a specific area. In South Africa the generation of electricity by wind turbines is a new science and people have not been exposed to such a type of noise source. The norm for electricity generation in South Africa is the traditional coal-fired power station with its own noise related problems. There is still a lot of ignorance regarding noise from wind turbines and generally about the alleged noise nuisance and/or noise disturbance of wind turbines (Heiman & Salomons, 2004).

Most of the experience of wind turbines is based on perceptions (Pederson & Larsman, 2008); visits by people to overseas wind farms and wind turbine literature that may be outdated because there are a lot of development to make wind turbines more environmentally friendly in terms of noise levels. One of the main environmental aspects of wind turbines is noise emission (Bjorkman, 2004). The sound/noise which is generated by a wind turbine is the aerodynamic type broad spectrum noise of the blade as it passes through the air at high speed. The source of aerodynamic noise can be divided into low-frequency; turbulence noise and airfoil noise (Oerlemans et al, 2006).

The noise assessment will address the following issues:

1. Would the project result in the exposure of persons to or generation of noise levels in excess of the Western Cape Noise Control Regulations?

2. Would the project result in a substantial temporary or periodic increase in the prevailing ambient noise levels in the project vicinity and above noise levels existing without the project?

3. Would the project result in a substantial permanent increase in the prevailing ambient noise levels in the project vicinity and above levels existing without the project?

4. Would the project expose people residing or working in the project area to excessive noise levels?

Some valuable studies have been done on the type of blade and the angle of the blade in terms of noise generation and this ‘state of the art’ technology will be incorporated in the noise evaluation of the wind turbines (Ragheb, 2010). Whilst it is noted that the topography and distance to noise receptors may differ, the principle and baseline information of the noise from the wind turbine will be the same. This information of the latest wind turbine technology can therefore be plotted on the existing prevailing ambient noise levels of the Wolseley wind farm to determine the
possible impact on the noise sensitive areas in close proximity to the proposed wind farm.

1.2 Scope and Limitations

The purpose of the noise survey will be to determine the prevailing ambient noise levels along the boundaries of the proposed wind farm study area and at noise sensitive areas that abuts the proposed wind farm. There is currently no noise data available and existing linear and point sources that create an increased noise level in the vicinity of the wind farm.

Information on wind farms is available in the format of scientific reports and the guidelines for wind farms – Towards a regional methodology for wind energy site selection by the Provincial Government of the Western Cape.

The proposed wind farm will be situated in an area with a higher prevailing ambient noise level for agricultural districts which is created by the high wind that blows in this district, linear noise sources such as the R43, railway line activities and gravel roads. The point sources such as the farming activities, domestic areas and store rooms are a further source of noise within the study area.

The limitations to the study area will be the lack of noise level information of the area, variation of the noise sources that prevail within the study area and the distances between the noise sources and the receiving environment. The prevailing winds will propagate the existing noise and will change depending on the direction of the wind.

The study to determine the noise impact such a proposed development will have on the environment will be based on:

- SANS 10328 of 2008 – Methods for environmental noise impact assessments;
- SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication.
- Guidelines for community noise impact assessments by the IFC of the World Bank.

The noise survey from an environmental noise point of view will have to be done during day and night time periods to determine the prevailing ambient noise levels. The noise impact assessment will be done along the boundaries of the proposed wind farm site, along the routes to the site and at the nearest noise sensitive areas.

The construction, operational and closure phases will be addressed in the report and the baseline information; existing and newly acquired data will be used to determine the potential impact and management mitigatory measures.

It will be important to assess the wind turbine sites and the environment in and around the nearest receptors because the sound from the wind turbines will create the “new” prevailing ambient noise level of the area.
It is proposed to make use of the following six-stage process approach to assessment and mitigation:

**Step 1** - Define the project requirements and noise problem – gather technical support information

**Step 2** – Agree on the assessment criteria, establish baseline noise environment and determine extent of the noise impact of initial proposal

**Step 3** – Identify and agree on noise mitigations options

**Step 4** – Assess noise impact against criteria of Step 2 and evaluate key considerations and significance for each mitigation option

**Step 5** – Determine optimal noise control solution

**Step 6** – Review, implement, monitor and audit

There will be two types of noise sources at the proposed development, a point source at the one wind turbine with its own noise sources which will have to be identified and addressed and the line source which will be the collective wind turbines and these two categories of noise sources will determine how mitigation and the management thereof will be addressed.

The proposed noise survey will consist out of the following:

- Preliminary survey and identification of measuring points
- All measurements will be done on the boundary of the property.
- Sound pressure readings will also be done at the closest residential area
- Noise survey at the identified measuring sites – Ambient noise measurements
- Calculation of noise propagation
- Analysing of results
- Results of the survey, report and recommendations and mapping of noise contours for the proposed site.

### 1.3 Methodology

The site visit that was carried out determined the activities that takes place in and around the proposed wind farm study area that contribute to the prevailing ambient noise level of the district. Measuring points were also identified to measure the prevailing ambient noise levels of the district.

Noise measurements were done in terms of the prescribed requirements for doing noise surveys according to SANS 10103 of 2008 and the Western Cape Noise Control Regulations.

A preliminary impact assessment on the noise sensitive areas based on the requirements of the Western Cape Noise Control Regulations, SANS 10103 of 2008 and the International Standards for wind turbines/ farms has also been undertaken.
This assessment will be confirmed during the Impact Assessment Phase once the positions of the wind turbines and associated infrastructure has been identified and recorded.

1.3.1 Study Area Sensitivity Analysis

The proposed wind farm is some 4.0km from the Town Wolseley and in the region where there is a jail (Dwarsriver Jail), farmhouses, broiler house, wine cellar and a conservation residential development area (4de Liefde).

The sensitivity analysis of the region is illustrated in Table 1.1

<table>
<thead>
<tr>
<th>Table 1: Sensitivity Analysis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Sensitivity</td>
<td>Wolseley Town, 4de Liefde Conservation area</td>
</tr>
<tr>
<td>Medium Sensitivity</td>
<td>Farm houses and Dwarsriver Jail, wine cellars and broiler house in the abutting areas to the proposed wind farm</td>
</tr>
<tr>
<td>High Sensitivity</td>
<td>Farm houses within the proposed wind farm study area</td>
</tr>
</tbody>
</table>
DESCRIPTION OF THE RECEIVING ENVIRONMENT

The position of the wind turbines within the proposed wind farm area will determine which of the areas within the wind farm area and other areas abutting the wind farm study area will be impacted upon. The noise from the wind turbines will be masked by the noise from the wind. The areas that will be the least affected will be the areas where there are vertical structures and/or trees. Previous studies have shown that the wind noise mask the noise from the wind turbine in such a manner that the turbine noise is not audible above the noise created by the trees and/or vertical structures.

Agricultural farming takes place within the proposed wind farm and the areas abutting the proposed wind farm. There is a busy feeder road the R43 with a constant flow of traffic (heavy-duty vehicles and motor-vehicles) during the night and daytime periods.

The recommended noise levels within the boundaries of the proposed wind farm are given in Table 2 of SANS 10103 of 2008 and such noise levels is illustrated in Table 2.

Table 2: Recommended noise levels for different districts

<table>
<thead>
<tr>
<th>Type of district</th>
<th>Equivalent continuous rating level $L_{R\text{eq,T}}$ for ambient noise</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outdoors</td>
<td>Indoors, with open windows</td>
</tr>
<tr>
<td></td>
<td>$L_{Rdn}^{1)}$</td>
<td>$L_{Rd}^{1)}$</td>
</tr>
<tr>
<td>a) Rural districts</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>b) Suburban districts with little road traffic</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>c) Urban districts</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>d) Urban districts with some workshops, with business premises and with main roads</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>e) Central business district</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>f) Industrial districts</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

The study area can be divided into (a), (b), (c) and (d) districts because of the prevailing linear and point sources within the study area. The areas in close proximity of the linear and/or point sources will have higher ambient noise levels than areas some distances from these sources.

The effect of noise on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noise source, the time of day or night and the day of the week (Pederson & Larsman, 2008).
The placement of the wind turbines in the vicinity of existing noise sources will be an important aspect of the wind farm lay-out as there are already areas with higher prevailing ambient noise levels within the proposed wind farm boundaries.

2.1 General Study Area

2.1.1 Proposed wind farm

The proposed wind farm is wedged in between a mountain range to the east and a busy feeder road to the west with agricultural land within and to the north and to the south. There is an existing sub-station to the north-eastern side of the wind farm with existing overhead power lines within the boundaries of the proposed wind farm.

2.1.2 The measuring points within and abutting the proposed wind farm

The measuring points as illustrated in Figure 2 are the measuring points that will be monitored to determine the prevailing ambient noise level of the district.

![Figure 2: Measuring points](image-url)
3 POTENTIAL IMPACTS AND ISSUES IDENTIFICATION

3.1 Impacts During Different Phases

The Scoping Study identified the following potential impacts:

3.1.1 Construction Phase

- Grading and building of new roads

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

- Preparation of the footprint, earthworks and construction of the base of the wind turbine

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

- Construction of the wind turbines

  The construction of the wind turbines could generate localised noise increase in particular the use of cranes and generators during the assembly stage of the wind turbine.

- Construction traffic

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

3.1.2 Operational Phase

- Noise generated by the wind turbines

  The blade and the tip speed of the blade may cause an increased noise level in the vicinity of the turbine.

- Wind turbines – mechanical noise

  Mechanical noise generated by the gearbox and generator which is situated at 80 to 110m from ground level.
• Wind turbines - normal wear and tear, poor component design and the lack of preventative maintenance.

Noise could be generated through the lack of a cyclic maintenance programme to identify normal wear and tear of the essential components such as the gear-box, generator and blades.

• Wind turbines – aerodynamic noise

The source of aerodynamic noise can be divided into a low frequency noise, in-flow turbulence noise, and airfoil noise. The low frequency noise is caused by the aerodynamic interaction between the tower and the rotating blades. The in-flow turbulence noise is caused by the interaction of upstream atmospheric turbulence with the leading edge of the blade and depends on the atmospheric conditions. The airfoil self-noise is caused by the interaction between the turbulent boundary layer and the trailing edge of the blade during undisturbed inflow of air. The inflow turbulence noise and the airfoil self noise can contribute to the overall noise which can be the broad band or tonal noise of the rotating turbine (Oerlemans et al 2007).

• Traffic

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

• Sub-station

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

3.1.3 Maintenance Phase

This is the regular maintenance of the wind turbine to ensure that the wind turbines are in a good working state at all times. The regular maintenance activities may give rise to site-specific increase in the noise levels.

3.1.4 Decommissioning Phase

This the period when the project reached the end life cycle and the wind turbines must be dismantled and the area returned to its original state. It is assumed that similar activities will be undertaken as during the construction phase with similar noise levels.
3.2 Noise Generated by Wind

The noise created by the wind will also be investigated and the impact such has on noise sensitive areas will be investigated as the study area is covered with trees, fruit trees and vineyards. Most of the farm houses are surrounded by high trees which increase the ambient noise level during periods when the wind is blowing.

3.3 Response to Noise

People exposed to an increase in the prevailing ambient noise level will re-act differently to the increased noise levels and the response to increased noise levels are given in Table 3.1

Table 3: Response when ambient noise is exceeded.

<table>
<thead>
<tr>
<th>Excess $L_{Req,T}$) dB</th>
<th>Category</th>
<th>Estimated community/group response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>No observed reaction</td>
</tr>
<tr>
<td>0-10</td>
<td>Little</td>
<td>Sporadic complaints</td>
</tr>
<tr>
<td>5-15</td>
<td>Medium</td>
<td>Widespread complaints</td>
</tr>
<tr>
<td>10-20</td>
<td>Strong</td>
<td>Threats of community/group action</td>
</tr>
<tr>
<td>&gt;15</td>
<td>Very</td>
<td>Vigorous community/group action</td>
</tr>
</tbody>
</table>

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

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

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

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

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

The recommended noise level for a residential area according to the General Environmental Health and safety Guidelines is 55.0dBA during the daytime and 45.0dBA during the night time period (IFC, 2006).


4 TERMS OF REFERENCE FOR IMPACT ASSESSMENT PHASE

The following methodology will be employed for the noise impact assessment undertaken in the Impact Assessment phase:

- Identify all the noise sensitive areas within the vicinity of the proposed wind farm and power lines and to identify such by means of their spatial position on Google Imagery;
- Determine the prevailing ambient noise level at each of the above measuring points by means of the recommended noise measuring procedure in SANS 10103 of 2008;
- Calculate or determine the acceptable rating level for each measuring point;
- Calculate, determine and/or research the projected noise level of each noise source that is part of the construction and/or operational phase of the project;
- Calculate the noise impact at each of the noise sensitive areas;
- Assess the proposed project in terms of the SANS 10103 of 2008, SANS 10328 of 2008, Western Cape Noise Control Regulations, Environmental Health and Safety Guidelines for Wind energy by the World Bank, World Health Organizations Health Guidelines and any other International Guidelines on wind energy;
- Evaluate all possible noise mitigatory measures to reduce, minimize or eliminate the alleged noise intrusion;
- The field study noise data and available noise data on the wind turbines, substation and overhead power lines will be evaluated and the noise impact assessment report will be compiled for the EIA process.

The noise study of the proposed site and noise sensitive areas in the vicinity of the wind farm boundaries will be done to determine the prevailing ambient noise levels and subsequent noise regime of the area. The noise survey will be undertaken as detailed below.

As noted previously, there is valuable information regarding noise from wind turbines already in use by other countries that will be used in this noise impact study. Some research has also been done on the long time measurements of noise from wind turbines, location, the quantification of noise sources and the impact on noise annoyance amongst people living in the vicinity of wind turbines (Moe, 2008; IFC, 2007; Heiman & Salomons, 2009; Ragheb, 2010; Pedersen & Larsman, 2008; MOE, 2009).

In summary, using the existing wind farm information, the projected noise levels will be plotted on the existing noise regime of the site and abutting areas and the resulting increase in noise levels assessed.

4.1 Noise Survey

Due to the lack of existing noise data it will be required to do a noise survey of the proposed wind farm area and the following procedure will be used.
4.1.1 Instrumentation

The noise survey will be conducted in terms of the provisions of SANS 10103 of 2008 - The measurement and rating of environmental noise with respect to annoyance and to speech communication and the Western Cape Noise Control Regulations.

The instruments that will be used in the noise survey:

Instrument 1

Larsen Davis Integrated Sound Level meter Type 1 – Serial no. S/N 0001072
Larsen Davis Pre-amplifier – Serial no. PRM831 0206
Larsen Davis ½” free field microphone – Serial no. 377 B02 SN 102184
Larsen Davis Calibrator 200 – Serial no.3073

4.1.2 Measuring points

The measuring points for the Woieseley wind farm area will be at representative measuring points within and in the vicinity of the wind farm.

4.1.3 Site Characteristics

Topography, ground conditions, vertical structures and ground cover will be recorded for each measuring point. The study area is agricultural land with an undulated type landscape towards the south, mountain range to the east.

4.1.4 Current Noise Sources

Traffic noise, railroad noise, wind noise, domestic type noise and farming activity noise are the main contributors to the prevailing ambient noise level of the different areas. The prevailing noise level is proportional to the distance from the main noise sources.

4.1.5 Atmospheric Conditions

The wind speed, temperature, humidity and wind direction will be determined at each measuring position. Information will also be obtained from the static weather station.
CONCLUSIONS AND RECOMMENDATIONS

The area where the proposed wind turbines will be situated is within disturbed land as agricultural activities are taking place at a large scale within the boundaries of the proposed wind farm. The area is covered with fruit trees and vineyards and this result that there is an increased noise level when the wind is blowing. The farm houses which are scattered throughout the site have large trees which create an increased noise level during windy periods. The existing linear noise sources such as the R43, railway line and gravel roads run from the north to the south and the R43 is used by heavy-duty vehicles on a continuous basis during the day and night time periods. The R43 road is used by heavy-vehicles to avoid the toll fees and weigh bridge as the vehicles divert from the N1 before Paarl via Wellington, Wolseley and join up with the N1 Freeway at Worcester. The railway line is used by passenger trains and goods trains from Gauteng to Cape Town.

The wind turbines can only operate when the wind is blowing. During these periods the prevailing ambient noise level is increased according to the wind speed. A study was done at a wind farm site with farm houses with trees and the following noise levels were recorded:

- 75.4dBA at a wind speed of 15m/s;
- 67.4dBA at a wind speed of 7.7m/s;
- 57.6dBA at a wind speed of 5.0m/s.

These noise levels recorded during natural atmospheric conditions in an area where there are permanent windy conditions are higher than the recommended noise levels for a residential area of 55.0dBA during daytime and 45.0dBA during night time. This higher noise levels with the noise levels from the roads creates the prevailing noise levels of an area. This will also be investigated and assessed in the Wolseley study area.

The sound to be created by the wind turbines will become part of the noise regime of the specific site where the wind turbines will be positioned. This noise will however be masked by the wind noise and the noise impact is not predicted to be intrusive as the wind turbines will be situated at a distance from noise sensitive areas. This will be taken into account at the placing of the wind turbines so as to comply with the recommendations for wind farms by the Provincial Government of the Western Cape. It is recommended that the position of the wind turbines be controlled in such a manner that it is not within 400m from any noise sensitive area.

By doing this, the possible impacts can be controlled and managed by the placing of the wind turbines in areas where there are higher prevailing ambient noise levels and such not to have a negative impact on the noise sensitive areas.

Barend van der Merwe
Environmental Acoustic Consultant
REFERENCES


Ragheb, 2010 – Modern wind generators.


MOE, 2008 – Noise guidelines for wind farms. Queens Printer f


South African National Standards 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication.


The Guidelines for the Assessment and Rating of noise from wind farms, ETSU 1997.