

Appendix G.3

ACOUSTIC ASSESSMENT





KROMHOF WIND ENERGY FACILITY

ENVIRONMENTAL ACOUSTIC SCOPING REPORT INPUT

INTRODUCTION

Kromhof Wind Energy Farm (Pty) Ltd are proposing to establish the Kromhof Wind Energy Facility (WEF) near the town of Harrismith in the Free State Province. The Kromhof facility will include wind energy generation infrastructure, a battery energy storage system (BESS) as well as the required grid connection including on-site substations and 33 kV cabling powerlines.

This report presents the environmental acoustic baseline assessment for the Kromhof WEF, to be used as input into the Scoping Report, which will be submitted in fulfilment of the Environmental Impact Assessment (EIA) application process. For the proposed Kromhof WEF, noise impacts are anticipated from the wind turbines, however, noise from the powerlines, substations and BESS will be negligible, and as such impacts for these will not be assessed.

PROJECT DESCRIPTION

The applicant is proposing to construct the Kromhof WEF, near Harrismith within the Phumelela Local Municipality of the Thabo Mofutsanyana District Municipality, in the Free State Province. The site itself will extend across twelve existing farm portions, covering an area of 7,269 ha. The energy produced will be fed via underground cables to four 33 kV/132 kV on-site collector substations (Independent Power Producer (IPP) portion), located adjacent to the common grid infrastructure. The details of the Kromhof WEF, as applicable to the Environmental Acoustic Impact Assessment, are outlined in **Table 1**. A map indicating the location of the proposed WEF is presented in **Figure 1**, with the preliminary turbine layout presented in **Figure 2**.

Table 1: Project summary of the Kromhof WEF

Municipality	Phumelela Local Municipality of the Thabo Mofutsanyana District Municipality
Extent	7,269 ha
Capacity	Up to 300 MW
Number of Turbines	Up to 55
Turbine Capacity	To be decided
Turbine Hub Height	Up to 140 m
Rotor Diameter	Up to 200 m

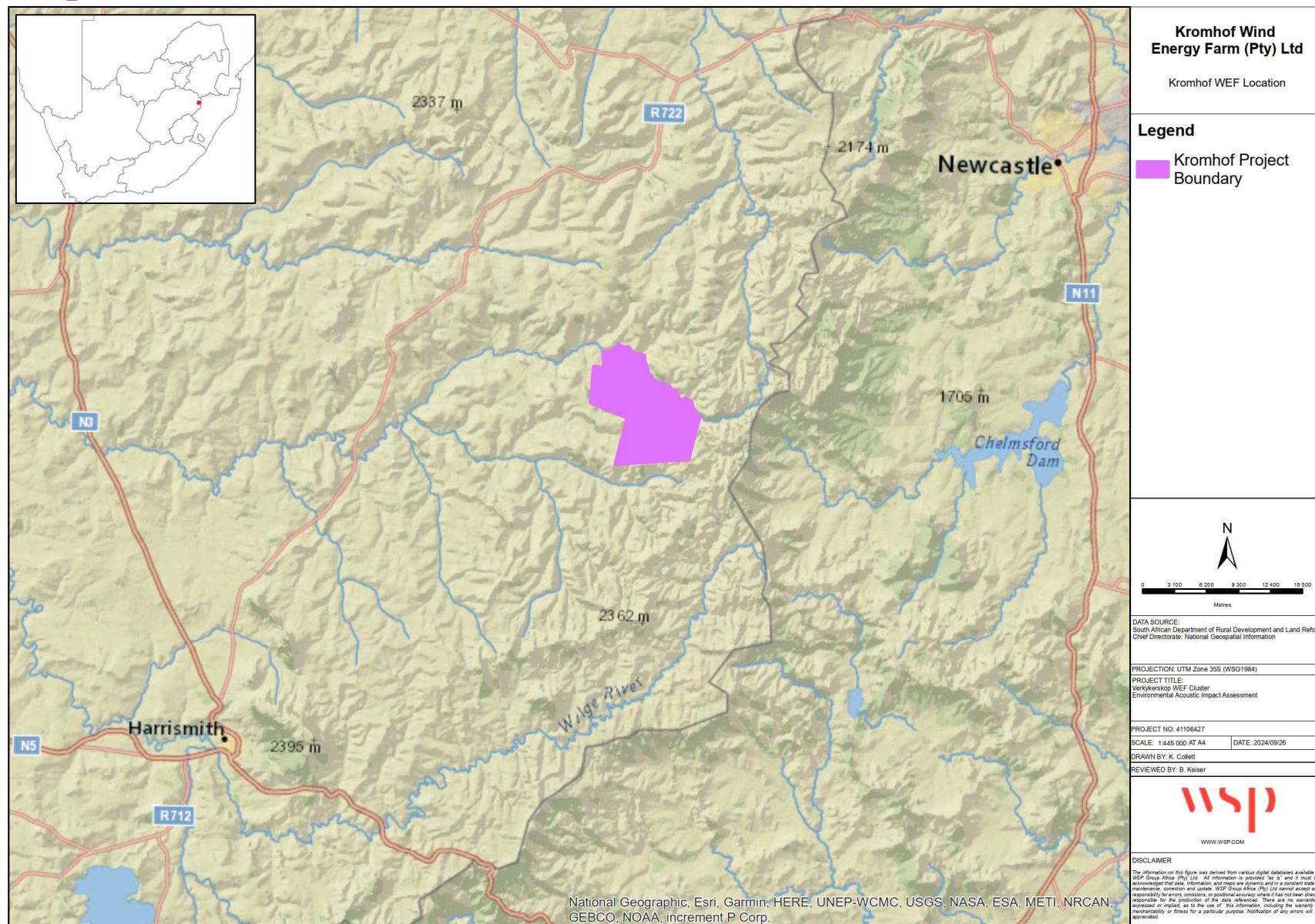


Figure 1: Location of the Kromhof WEF

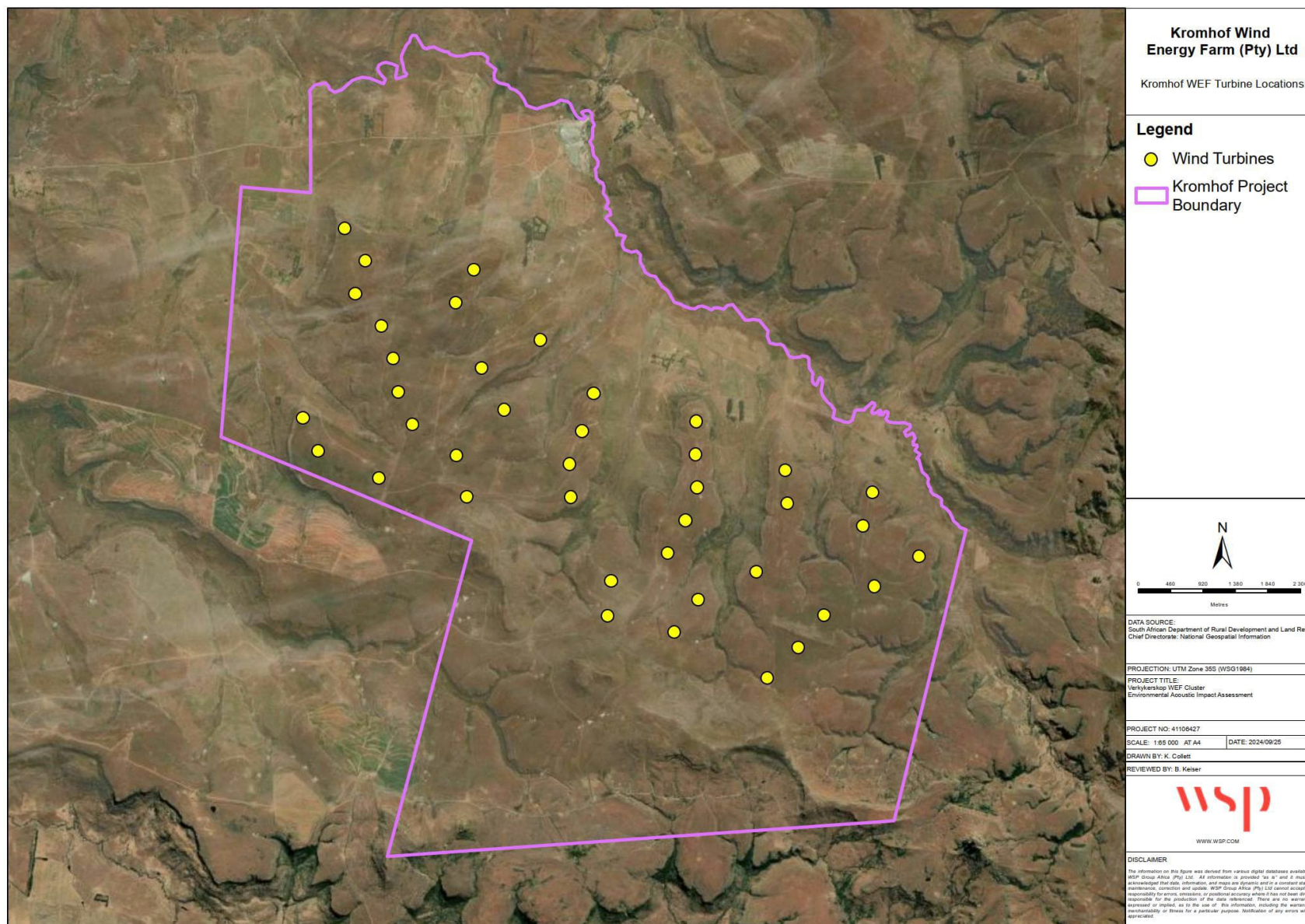


Figure 2: Kromhof WEF - Preliminary Turbine Layout

LEGISLATIVE FRAMEWORK

South Africa

In South Africa, environmental noise control has been in place for three decades, beginning in the 1980s with codes of practice issued by the South African National Standards (formerly the South African Bureau of Standards, SABS) to address noise pollution in various sectors of the country. Under the previous generation of environmental legislation, specifically the Environmental Conservation Act 73 of 1989 (ECA), provisions were made to control noise from a National level in the form of the Noise Control Regulations (GNR 154 of January 1992). In later years, the ECA was replaced by the National Environmental Management Act 107 of 1998 (NEMA) as amended. The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) was published in line with NEMA and contains noise control provisions under Section 34.

Under the NEMAQA, the Noise Control Regulations were updated and are to be applied to all provinces in South Africa. The Noise Control Regulations give all the responsibilities of enforcement to the Local Provincial Authority, where location-specific by-laws can be created and applied to the locations with the approval of the Provincial Government. Where province-specific regulations have not been promulgated, acoustic impact assessments must follow the Noise Control Regulations. Furthermore, the NEMAQA prescribes that the Minister must publish maximum allowable noise levels for different districts and National noise standards. These have not yet been accomplished and as a result, all monitoring and assessments are done in accordance with the South African National Standards (SANS) 10103:2008 and 10328:2008.

The SANS 10328:2008 (*Methods for Environmental Noise Impact Assessments*) presently inform environmental acoustic impact assessments in South Africa. This standard defines that the purpose of an Environmental Acoustic Impact Assessment is to determine and quantify the acoustical impact of, or on, a proposed development. It also stipulates the methods used to assess impacts as well as the minimum requirements to be investigated and included in the Environmental Acoustic Impact Assessment report as part of the EIA.

The SANS 10103:2008 document (*The measurement and rating of environmental noise with respect to speech communication*) provides methods and guidelines to assess working and living environments with respect to acoustic comfort as well as respect to possible annoyance by noise. As applicable to this assessment, the SANS 10103 provides the typical rating levels for noise in different districts. These rating levels are presented in **Table 2**.

Table 2: Typical rating levels for noise in districts (adapted from SANS 10103:2008)

Type of District	Classification	Equivalent Continuous Rating Level for Noise ($L_{Req, \tau}$) (dB(A))	
		Outdoors	
		Daytime ($L_{Req,d}$)	Night-Time ($L_{Req,n}$)
a) Rural	A	45	35
b) Suburban (with little road traffic)	B	50	40
c) Urban	C	55	45
d) Urban (with one or more of the following: workshops, business premises and main roads)	D	60	50
e) Central Business Districts	E	65	55
f) Industrial District	F	70	60

* Guidelines highlighted in red are applicable to this assessment

As stipulated in the SANS 10103:2008, noise can pose as an annoyance to a community if the increase in average noise levels exceeds the ambient noise by a certain degree. These specified increases together with the relevant estimated community responses are presented in **Table 3**.

Table 3: Categories of community/group response (adapted from SANS 10103:2008)

Excess ($\Delta L_{Req,T}$) ^a dB(A)	Estimated Community or Group Response	
	Category	Description
0 – 10	Little	Sporadic Complaints
5 – 15	Medium	Widespread Complaints
10 – 20	Strong	Threats of Community/Group Action
>15	Very Strong	Vigorous Community/Group Action

Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

^a $\Delta L_{Req,T}$ should be calculated from one of the following methods:

- 1) $L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation);
- 2) $L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level of the ambient noise given in Table 1 of the code;
- 3) $L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from Table 2 of the code; or
- 4) $L_{Req,T} =$ Expected increase in $L_{Req,T}$ of ambient noise in the area because of the proposed development under investigation.

Since there is no specific guidance or legislation governing the acoustic impacts of WEFs in South Africa, for this assessment the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines for Wind Energy will be followed (IFC, 2015). Such guidelines are primarily based on the Energy Technology Support Unit's (ETSU) ETSU-R-97 report.

The Assessment and Rating of Noise From Wind Farms (ETSU)

The ETSU-R-97 report describes the framework for the measurement of noise associated with wind farms and provides indicative noise levels that offer a reasonable degree of protection to communities surrounding wind farm developments, without placing unreasonable restrictions on the wind farm developers. The assessment was developed by a Working Group on Wind Turbine Noise, facilitated by the United Kingdom Department of Trade and Industry. The key findings identified in the assessment include:

- Absolute noise limits applied at all wind speeds are not suited to wind farms. Limits set relative to background noise are more appropriate.
- The L_{A90} descriptor is much more accurate when monitoring and assessing wind turbine noise.
- Limits should be set on noise over a range of wind speeds up to 12 m/s when measured at a 10 m height.
- The effects of other wind energy facilities in a specific area should be added to the effect of the proposed wind energy facility in order to determine the cumulative effect.
- Increases in noise levels as a result of a wind energy facility should be restricted to 5 dB(A) above the current ambient noise level at a specified receptor location.
- Noise from wind farms should be limited to a range between 35 and 40 dB(A) (daytime) in a low noise environment. A fixed limit of 43 dB(A) should be implemented during the night-time. This should increase to 45 dB(A) (day and night) if the potential receptors have financial investments in the facility.
- For turbines spaced further apart, if noise is limited to an L_{A90} of 35 dB(A) at wind speeds up to 10 m/s (at a 10 m height), then this condition alone offers sufficient protection of amenity, and background noise surveys would not be necessary.

SENSITIVE RECEPTORS

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed WEF. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. Being such a remotely located site, dominant receptors in the area surrounding the site include small farmsteads and farmhouses. From a desktop assessment of the site using Google Earth™ imagery (and input from the Client), 21 farmhouse receptors have been identified within and adjacent to the site boundary (**Figure 3**),



which will all be considered in this study. As per the IFC EHS guidance for Wind Energy, receptors within 2 km of the proposed site are considered.

EXISTING NOISE CLIMATE

The existing noise climate surrounding the Kromhof WEF is predominantly rural with very low baseline noise levels anticipated. Noise sources include birds, insects, livestock and the activities of resident farmers. Vehicular influences may include traffic on local roads.

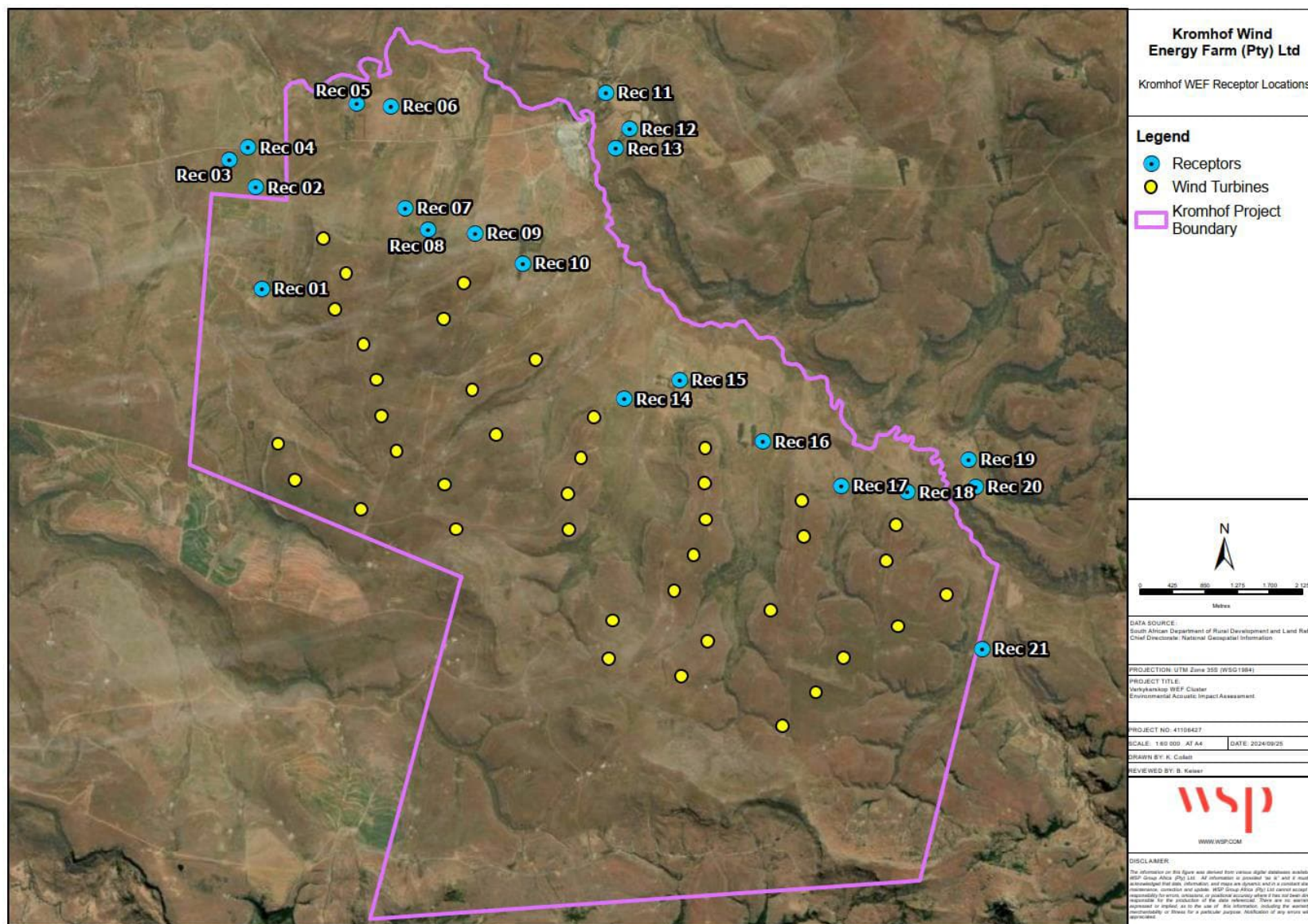


Figure 3: Sensitive receptors surrounding the Kromhof WEF

WIND TURBINES AND NOISE

Noise from wind turbines can be classified into two categories, namely mechanical noise generated from the turbine's mechanical components and aerodynamic noise, produced by the flow of air over the turbine blades.

MECHANICAL NOISE

The mechanical noise generated by a wind turbine is predominantly tonal (dominated by a narrow range of frequencies), but may also be broadband in character, displaying a wide range of frequencies (Council of Canadian Academics, 2015). Such noise is produced by the physical movement of the following components:

- Gearbox
- Generator
- Yaw drives
- Cooling fans
- Auxiliary equipment

Over time, appropriate design and manufacturing have reduced the mechanical noise produced by wind turbines. As such, the aerodynamic noise from the blades has become the dominant source of noise for modern turbines, however, low-frequency tones associated with mechanical sources are audible for some turbines (Hau, 2006; Manwell *et al.*, 2009; Oerlemans, 2011).

AERODYNAMIC NOISE

Aerodynamic noise is typically broadband in nature and is generated by the interaction between airflow and different parts of the turbine blades. These interactions depend on the speed and turbulence of the wind; the shape of the blade; the angle between the blade and relative wind velocity flowing over the blade; and the distance from the hub. The noise levels produced are relative to the velocity of the airflow, with higher rotor speeds resulting in higher noise levels. Specifically, parts of the blade closer to the tips move faster than those closer to the hub, resulting in faster relative air velocities and creating higher aerodynamic noise levels. As such, most of the aerodynamic noise is produced near (but not at) the blade tips. This is partly why turbines with longer blades have a higher sound power level (Oerlemans, 2011).

Aerodynamic noise from wind turbines also has a strong directional component, projecting primarily downward, upward, or even perpendicular depending on the dominant mechanism (Oerlemans, 2011). As such, noise levels measured at a particular location can vary depending on the direction, speed and turbulence of the prevailing wind. Furthermore, as the rotor turns, the orientation of each blade changes in relation to a stationary receiver. As such, the noise levels at the receiver will vary as the blades rotate, resulting in periodic regular changes in noise levels over time (Renewable UK, 2013).

As wind speed increases, the aerodynamic noise of the turbines also increases. At low speeds, the noise created is generally low and increases to a maximum at a certain speed (around 10 m/s) where it either remains constant or can even slightly decrease.

LOW FREQUENCY NOISE AND INFRASOUND

Wind turbines also produce some steady, deep, low-frequency sounds (between 1 – 100 Hz), particularly under turbulent wind conditions. Sound waves below 20 Hz are called infrasound. These infrasound levels are only audible at very high sound pressure levels. Older wind turbines that had downwind rotors created noticeable amounts of infrasound. Levels produced by modern-day, up-wind style turbines are below the hearing threshold for most people (Jakobsen, 2005).

The human ear is substantially less sensitive to sound at very low or very high frequencies. For most people, a very low-pitch sound (20 Hz) must have a sound pressure level of 70 dB to be audible. Levels of infrasound near modern commercial wind turbines are far below this level and are generally not perceptible to people (Leventhall, 2006).

Low-frequency sound, like all other sound, decreases as it travels away from the source. Siting wind turbines further away from sensitive receptors will therefore decrease the risk of infrasound. It is, however, important to note that in flat terrain, low-frequency sound can travel more effectively than high-frequency sound. Most environmental sound measurements and noise regulations are based on the A-weighted decibel scale (dB(A)), which under-weights low frequency sounds in order to mimic the human ear. Thus, noise limits based on the dB(A) levels do not fully regulate infrasound. The dB(C) scale offers an alternative to measuring sound that provides more weight to lower frequencies (Jakobsen, 2005; Bolin *et al.*, 2011).

SANS 10103 proposes a methodology to identify whether low-frequency noise could be an issue. The method suggests that if the difference between L_{Aeq} and L_{Ceq} is greater than 10 dB, then a predominantly low-frequency component may be present. However, in all cases, the existing acoustic energy in low frequencies associated with wind must be considered.

SUBSTATION AND TRANSFORMER NOISE

In addition to the noise from wind turbines, wind farms require a substation and transformers, which produce a characteristic “hum” or “crackle” noise. Utility companies have experience with building and siting such sources to minimise their impact. Substation-related noise is relatively easy to mitigate should this be required, based on the use of acoustic shielding and careful planning regarding placement away from sensitive receptors. As such, noise associated with this source is not considered in this assessment.

ASSUMPTIONS AND LIMITATIONS

For this Environmental Acoustic Impact Assessment, various assumptions will be made that may impact the results obtained. These include:

- The turbine specifications provided are assumed to be representative of what will be installed in reality.
- The turbine locations provided are assumed to be an accurate representation of where these will be located in reality. It is noted that the layout presented herein is a preliminary layout and may change slightly based on the sensitivity analysis from all specialist scoping studies.
- Identification of sensitive receptors is based on a desktop assessment, as well as input from the Client. It is assumed that all key receptors have been included. It is noted that the receptor locations will need to be confirmed/ground-truthed during the EIA phase of the Project.

HIGH-LEVEL SCREENING OF IMPACTS

Wind turbines have the ability to generate noise, causing disturbance for receptors within close proximity of the turbines. There are numerous receptors within the Project site area, and although most of the turbines are positioned away from these receptors, some of the receptors are within close proximity (~500 m) of the proposed wind turbines (based on the preliminary layout). The Kromhof WEF, therefore poses a “medium” noise sensitivity impact on such receptors, which does not correlate with the Department of Forestry, Fisheries and the Environment’s screening tool sensitivity results, which classifies the sensitivity impacts as “very high” (the full Site Sensitivity Verification Report is available in **Appendix A**). The status of these receptors (inhabited or uninhabited) needs to be confirmed (ground-truthed) in the EIA phase in order to effectively quantify the noise impacts of the WEF.

Based on some basic initial modelling, in order to keep L_{A90} noise levels within the acceptable 35 dB(A) threshold stipulated by the IFC EHS guidance, a minimum buffer zone of 1,336 m from each turbine to the nearest receptor is recommended. Should receptors be financially vested in the Project, this L_{A90} threshold increases to 45 dB(A) and the suitable buffer for locating turbines will decrease to 543 m from each receptor. It must be noted that such calculations

are based on a worst-case scenario of turbines with a hub height of 140 m and maximum sound power level of 111.6 dB(A).

Impact Assessment

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the Scoping Phase. The screening tool is based on two criteria, namely probability and consequence, where the latter is based on general consideration of the intensity, extent, and duration. The specific impact screening methodology utilised for the scoping assessment, is further detailed in **Appendix B**.

In terms of the potential acoustic impacts of the Kromhof WEF, **Table 4** outlines the impact of each parameter and the resulting risk level. Based on the location of the majority of the turbines away from the identified receptors, the resultant acoustic impacts are anticipated to be low for the construction and decommissioning phases and medium for the operational phase. From previous experience, turbines within a close distance of sensitive receptors may cause impacts and complaints. Additionally, based on the number of wind turbines being proposed, the cumulative impact of many turbines on receptor locations may result in impacts and complaints. Specific impacts can, however, only be determined during the modelling exercise in the EIA phase of the Project once the final layout is available.

Table 4: Impact assessment of risks associated with the Kromhof WEF

Description	Probability	Consequence	Impact Significance
Acoustic impacts on surrounding sensitive receptors (Construction Phase)	3 (Highly Probable)	Negative – 1 (Negligible)	Low
Acoustic impacts on surrounding sensitive receptors (Operational Phase)	3 (Highly Probable)	Negative - 2 (Moderately Severe)	Medium
Acoustic impacts on surrounding sensitive receptors (Decommissioning Phase)	3 (Highly Probable)	Negative – 1 (Negligible)	Low

Potential Mitigation Measures

CONSTRUCTION PHASE

To minimise the acoustic impacts from the construction phase of the proposed Project, various mitigation techniques can be employed. These options include both management and technical options:

- Planning construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to all local communities. Such information includes:
 - Proposed working times.
 - Anticipated duration of activities.
 - Explanations on activities to take place and reasons for activities.
 - Contact details of a responsible person on site should complaints arise.

- When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible.
- Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines.
- Selecting equipment with the lowest possible sound power levels.
- Ensuring equipment is well-maintained to avoid additional noise generation.

OPERATIONAL PHASE

Micro-siting turbines sufficiently away from receptors is the best practical measure to limit annoyance on receptors within the Kromhof WEF site. Should this not entirely be possible, various mitigation measures can be employed during the operational phase (IFC, 2015):

- Operating turbines in reduced noise mode.
- Selecting turbines with lower noise level specifications.
- Building walls/appropriate noise barriers around potentially affected buildings.
- Limiting turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances.
- Consideration of installing larger capacity wind turbines, limiting the number of turbines to be installed but having the same power generation potential.

DECOMMISSIONING PHASE

Since activities during the decommissioning phase will be similar to those of the construction phase, the same mitigation measures would be applicable. These are detailed in the construction phase section above.

CUMULATIVE IMPACT

Cumulative impacts with existing and planned facilities may occur during construction and operation of the proposed Kromhof WEF. While one project may not have a significant negative impact on sensitive receptors, the collective impact of the projects may increase the severity of the potential impacts.

The only other projects within the vicinity of the Kromhof WEF site, include the proposed Groothoek WEF (located immediately west) and the proposed Normandien WEF (located immediately east). Common receptors shared between the sites include Rec 11, Rec 12, Rec 13, Rec 15, Rec 16, Rec 17, Rec 18, Rec 19 and Rec 20. Based on the close proximity of these receptors to the wind turbines at the Normandien WEF, cumulative noise impacts at these locations may be noted.

NO-GO OPTION

From a noise perspective, should the proposed Project not go ahead, the status quo will remain the same.

PLAN OF STUDY – EIA PHASE: ACOUSTIC SPECIALIST STUDY

The environmental acoustic specialist study for the Kromhof WEF will follow the NEMA *Protocol For Specialist Assessment And Minimum Report Content Requirements For Noise Impacts* (GNR 320, Government Gazette 43110, March 2020). The study will form part of the EIA phase and will comprise the following:

PRELIMINARY MODELLING

As per the IFC EHS Guidelines for Wind Energy methodology (IFC, 2015), a preliminary modelling exercise will be conducted using a simple model, which assumes hemispherical propagation of noise from each turbine. Such modelling will focus on receptors located within a 2 km radius of the turbines.

If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an L_{A90} level of 35 dB(A) at a wind speed of 10 m/s (at a 10 m height) during the daytime and night-time, then this preliminary modelling is likely to be sufficient to assess the noise impact of the proposed Project. If the L_{A90} levels at any receptor location are above 35 dB(A) then a more detailed acoustic study may need to be conducted, which includes comprehensive baseline monitoring. Alternatively, input into the micro-siting of the turbines will be provided to avoid unwanted impacts or further detailed studies.

In low noise environments, the ETSU-R-97 report itself, however, stipulates that noise from wind farms should be limited to a range between 35 and 40 dB(A) (daytime). Additionally, a fixed limit of 43 dB(A) should be implemented during night-time. This should increase to 45 dB(A) (day and night) if the potential receptors have financial investments in the facility. With the Kromhof WEF being located within a low noise environment, a combination of the IFC and ETSU methodology will be followed in the assessment.

ENVIRONMENTAL ACOUSTIC IMPACT ASSESSMENT REPORT

A detailed Environmental Acoustic Impact Assessment report will be provided detailing the findings of the preliminary modelling, associated impacts, any inputs into micro-siting, as well as detailed recommendations, including mitigation measures if deemed necessary. The Environmental Acoustic Impact Assessment report will align with the requirements of the NEMA *Protocol For Specialist Assessment And Minimum Report Content Requirements For Noise Impacts* (GNR 320, Government Gazette 43110, March 2020), with the relevant sections cross-referenced therein.

REFERENCES

- Bolin, K. Bluhm, G. Eriksson, G. and Nilsson, M.E. (2011): Infrasound and low frequency noise from wind turbines: exposure and health effects. *Environ. Res. Lett* 6 035103.
- Council of Canadian Academics (2015): understanding the Evidence: Wind Turbine Noise. Ottawa (ON): The Expert Panel on Wind Turbine Noise and Human Health, Council of Canadian Academies.
- ETSU (1996): The Assessment and Rating of Wind Farm Noise. The Working Group on Noise from Wind Turbines. ETSU-R-97.
- Hau, E. (2006): Wind Turbines Fundamentals, Technologies, Application, Economics (2nd ed.). New York (NY): Springer.
- International Finance Corporation (IFC) (2015): Environmental, Health and Safety Guidelines for Wind Energy, 4 – 6.
- Jakobsen, J. (20015): Infrasound emission from wind turbines. *Journal of Low Frequency Noise Vibration and Active Control*. 24: 145-155.
- Leventhall, G. (2006): Infrasound from wind turbines – fact, fiction or deception. *Canadian Acoustics* 34(2):29-36.
- Manwell, J. F., McGowan, J. G., & Rogers, A. L. (2009): Wind Energy Explained: Theory, Design and Application (2nd ed.). Chichester, United Kingdom: John Wiley & Sons Ltd.
- Oerlemans, S. (2011): Chapter 2. Primary Noise Sources. In D. Bowdler & G. Leventhall (Eds.), Wind Turbine Noise. Essex, United Kingdom: Multi-Science Publishing Company, Ltd.
- Renewable UK, (2013): Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect. London, United Kingdom: RenewableUK.
- Republic of South Africa (2004): National Environment Management: Air Quality Act, Act No. 39 of 2004.
- Republic of South Africa (2020): National Environmental Management Act, 1998 (Act No. 107 of 1998) Procedures for the Assessment and Minimum criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when Applying for Environmental Authorisation (Government Notice 320 of 2020, Government Gazette 43110).
- South African National Standards (2008): SANS – Code of Practice 10103:2008, The measurement and rating of environmental noise with respect to annoyance and to speech communication, Standards South Africa, 6th Edition (ISBN 978-0-626-20832-5).
- South African National Standards (2008): SANS – Code of Practice 10328:2008, Methods for Environmental Noise Impact Assessments, Standards South Africa, 3rd Edition (ISBN 978-0-626-20831-8).



APPENDIX A: NOISE SITE SENSITIVITY VERIFICATION REPORT

WSP Group Africa (Pty) Ltd (WSP) has been appointed to conduct an Environmental Acoustic Impact Assessment as part of the Scoping and Environmental Impact Assessment (S&EIA) process for the proposed Kromhof Wind Energy Facility (WEF) near Harrismith in the Free State Province. The Kromhof WEF will have generation capacity of up to 300 MW and will also require a grid connection.

This report serves as the Noise Site Sensitivity Verification Report for the proposed Project.

This Noise Site Sensitivity Verification Report relates to the Department of Forestry, Fisheries and the Environment's (DFFE) Screening Tool Report completed for the site in February 2024. A site visit was not conducted by the noise specialist, as a desktop-based assessment to inform the specialist report required for the proposed Project and confirm the site sensitivity (identified by the screening tool), was deemed sufficient in this case at this time.

The table below provides information regarding the outcome of the Screening Tool in terms of the noise theme sensitivities associated with the proposed Project and the specialist sensitivity verification.

Table 1: Noise theme sensitivity for the Kromhof WEF

ENVIRONMENTAL THEME	DFFE SCREENING TOOL SENSITIVITY	APPLICABLE PROTOCOL	SPECIALIST SENSITIVITY VERIFICATION
Noise	Very high sensitivity	Protocol For Specialist Assessment And Minimum Report Content Requirements For Noise Impacts.	Medium sensitivity

The DFFE's screening tool identified the noise impact from the Kromhof WEF as being "very high" based on the occurrence of one temporarily or permanently inhabited residence within the site boundary. The noise sensitivity map, as generated by the screening tool, is presented in **Figure 1**.

It is understood that the proposed Kromhof WEF will consist of up to 55 wind turbines (300 MW in total), with a hub height of 140 m and a maximum sound power level of 111.6 dB(A) each. The WEF will be located ~46 km northeast of the town of Harrismith, located sufficiently far away enough to not create noise impacts in the town itself, however, with various nearby receptors identified, impacts are anticipated. From a desktop assessment of the site using Google Earth™ imagery (and input from the Client), 21 farmhouse receptors have been identified within and adjacent to the site boundary. As per the International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines for Wind Energy, receptors within 2 km of the proposed site are considered. Wind turbines have the ability to generate noise, causing disturbances for receptors within close proximity of the turbines. From a noise perspective, based on previous experience with similar projects, a minimum buffer zone (in relation to nearby receptors) is recommended for a WEF. This buffer zone is project-dependant and is based on the number of turbines, hub height, sound power level specifications and topography.

Based on the proposed preliminary specifications of the Kromhof WEF, a minimum buffer zone of 1,336 m from each turbine to the nearest receptor is recommended in order to ensure noise levels remain below the acceptable 35 dB(A) threshold stipulated by the IFC EHS guidance. Should receptors be financially vested in the Project, this L_{A90} threshold increases to 45 dB(A) and the suitable buffer for locating turbines will decrease to 543 m from each receptor. Although there are a relatively low number of receptors within the Project site area, some of these are within close proximity (~500 m) of the proposed wind turbines (based on the preliminary layout) and as such, impacts may be anticipated. The site sensitivity from a noise perspective is therefore classified as "medium", which does not correlate with the

DFFE screening tool results (**Table 1** and **Figure 1**). It must be noted, however, that the status of these receptors (inhabited or uninhabited) needs to be confirmed (ground-truthed) in the EIA phase in order to effectively quantify the noise impacts of the WEF.

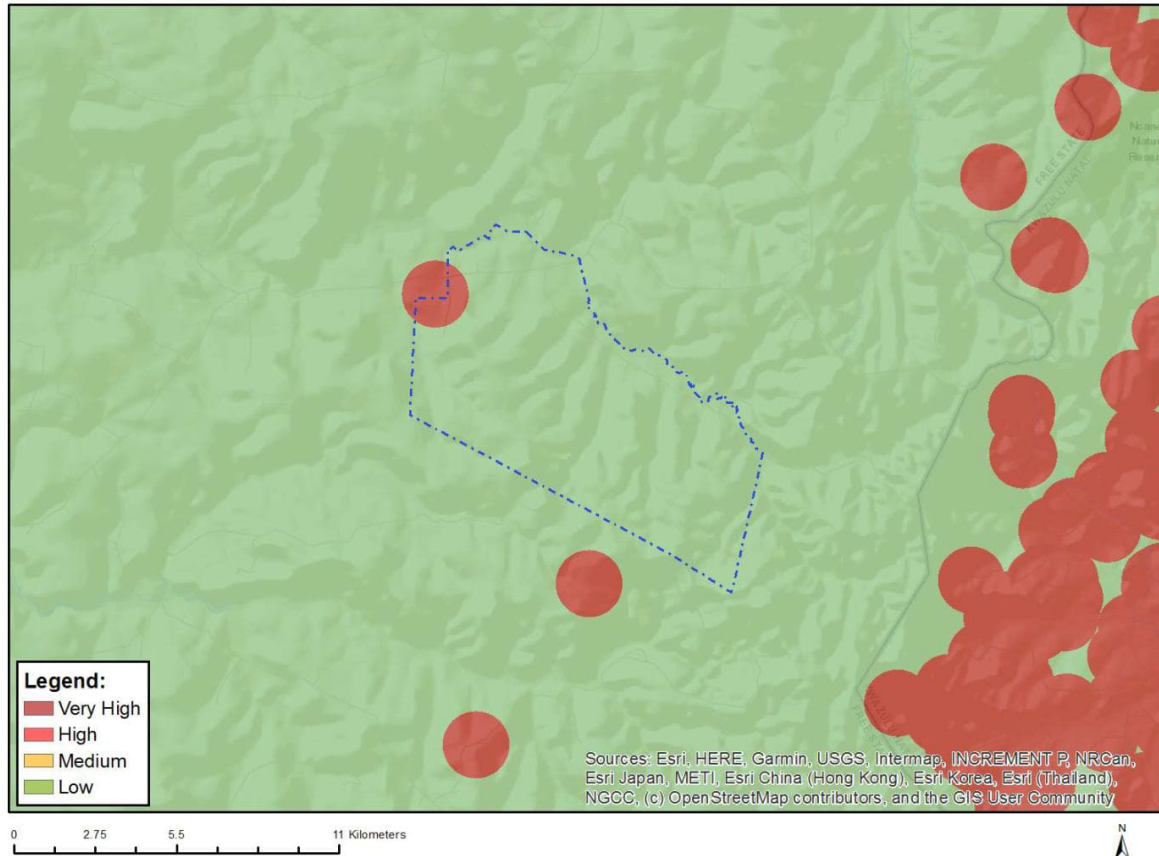


Figure 1: Map of relative noise theme sensitivity

To determine the acoustic impacts of the proposed Kromhof WEF, an Environmental Acoustic Impact Assessment will be conducted. The assessment will follow the National Environmental Management Act's (NEMA) *Protocol For Specialist Assessment And Minimum Report Content Requirements For Noise Impacts* (GNR 320, Government Gazette 43110, March 2020). The study will form part of the EIA phase and will comprise the following:

PRELIMINARY MODELLING

The IFC EHS guidelines for Wind Energy will be followed for the assessment, which is primarily based on the Energy Technology Support Unit's (ETSU) ETSU-R-97 report. A preliminary modelling exercise will be conducted using a simple model, which assumes hemispherical propagation of noise from each turbine. Such modelling will focus on receptors located within a 2 km radius of the turbines.

If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an L_{A90} level of 35 dB(A) at a wind speed of 10 m/s (at a 10 m height) during the daytime and night-time, then this preliminary modelling is likely to be sufficient to assess the noise impact of the proposed project. If the L_{A90} levels at any receptor location are above 35 dB(A) then a more detailed acoustic study may need to be conducted, which includes comprehensive baseline monitoring. Alternatively, input into the micro-siting of the turbines will be provided to avoid unwanted impacts or further detailed studies.

In low noise environments, the ETSU-R-97 report itself, however, stipulates that noise from wind farms should be limited to a range between 35 and 40 dB(A) (daytime). Additionally, a fixed limit of 43 dB(A) should be implemented during night-time. This should increase to 45 dB(A) (day and night) if the potential receptors have financial



investments in the facility. With the Kromhof WEF being located within a low noise environment, a combination of the IFC and ETSU methodology will be followed in the assessment.

ENVIRONMENTAL ACOUSTIC IMPACT ASSESSMENT REPORT

A detailed Environmental Acoustic Impact Assessment report will be provided detailing the findings of the preliminary modelling, associated impacts, any inputs into micro-siting, as well as detailed recommendations, including mitigation measures if deemed necessary. The assessment and report will align with the requirements of the *Protocol For Specialist Assessment And Minimum Report Content Requirements For Noise Impacts* (GNR 320, Government Gazette 43110, March 2020).

This site sensitivity verification was undertaken by Kirsten Collett from WSP Group Africa (Pty) Ltd.

A handwritten signature in black ink, appearing to read 'K Collett'.

Kirsten Collett – Associate (Air Quality and Acoustics)

APPENDIX B: IMPACT ASSESSMENT SCREENING METHODOLOGY

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase. The screening tool is based on two criteria, namely probability; and consequence (**Table A-3**), where the latter is based on general consideration to the intensity, extent, and duration.

The scales and descriptors used for scoring probability and consequence are detailed in **Table A-1** and **Table A-2** respectively.

Table A-1: Probability scores and descriptors

SCORE	DESCRIPTOR
4	Definite: The impact will occur regardless of any prevention measures.
3	Highly Probable: It is most likely that the impact will occur.
2	Probable: There is a good possibility that the impact will occur.
1	Improbable: The possibility of the impact occurring is very low.

Table A-2: Consequence Score Descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impact on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impact on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impact on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

Table A-3: Significance screening tool

CONSEQUENCE SCALE					
PROBABILITY SCALE		1	2	3	4
	1	Very Low	Very Low	Low	Medium
	2	Very Low	Low	Medium	Medium
	3	Low	Medium	Medium	High
	4	Medium	Medium	High	Very High

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (**Table A-4**) has been applied according to the nature and significance of the identified impacts.

Table A-4: Impact Significance Colour Reference System to Indicate the Nature of the Impact

NEGATIVE IMPACTS (-VE)		POSITIVE IMPACTS (+VE)	
Negligible		Negligible	
Very Low		Very Low	
Low		Low	
Medium		Medium	
High		High	
Very High		Very High	