11 NOISE IMPACTS

The potential noise impacts associated with the proposed Richtersveld Wind Farm include noise resulting from construction related activities and noise generated by wind turbine operation. ERM appointed Jongens Keet Associates to conduct a noise impact assessment for the Richtersveld site to assess the potential impact of noise that might emanate from the operation of the proposed Richtersveld Wind Farm. The findings of this study are detailed in *Annex H* and are summarised in this chapter.

The Richtersveld site is located in a rural setting, removed from towns and main roads with the nearest town being Alexander Bay, 30 km north west of the site. There is a secondary road (R382) that runs parallel to the site, internal farm tracks and there are several small temporary stock-post structure scattered on the site. The residual noise level of 37 dBA was measured on a Friday afternoon between 17h00 and 17h30 at the western site boundary with the R382 boundary. During the measurements there was a south easterly wind with an average speed of approximately 4.5 m/s.

There are no permanent dwellings located on the Richtersveld site, although approximately ten active or recently active stock-posts were identified on site. The stock posts are used by Nama herders who move around the landscape from stock-post to stock-post, however, many herdsmen own vehicles and commute to their stock posts from the various small towns and villages of the Richtersveld.

The noise impacts associated with the construction and operational phases of the proposed wind farm are summarized in *Table 11.1*.

Table 11.1 Impact characteristics: Noise Impact

Summary	Construction	Operation
Project Aspect/Activity	Noise resulting from construction vehicles, generators and activities such as piling, concrete mixing and steel works.	Noise generated by the wind turbines at the site.
Impact Type	Direct	Direct
Resources / Receptors Affected	On-site residents, no other sensitive receptors were identified in the immediate vicinity of the site	On-site residents, no other sensitive receptors were identified in the immediate vicinity of the site. The impact assessment takes into account the noise impact on the boundary of the site.

11.1 CONSTRUCTION NOISE

11.1.1 Impact Description and Assessment

Construction activities are temporary by nature, however, in some circumstances such noise can cause disturbance or inconvenience to persons living in the locality. During construction the main sources of noise would be heavy earthmoving vehicles, delivery vehicles and construction equipment for concrete mixing, sheet piling and steel works. Noise emitted during construction activities would increase the ambient noise levels at the site since current noise levels are considered to be low at 37 dBA. Increased noise during the construction phase would be short-lived for specific work areas since the construction work would be progressive across the site. Noisy operations such as blasting (if required) will be limited to day light hours.

Box 11.1 Construction Impact: Noise generated by construction activities

Nature: Construction activities would result in a **negative direct** noise impact.

Impact Magnitude – Medium

- **Extent**: The extent of the impact is **local** as it will be confined to the vicinity of the site.
- **Duration**: The duration would be **short-term** as the impacts are predicted to last only the duration of the construction of the facility, approximately 24 months and construction activity will occur in phases.
- **Intensity**: The intensity of the impact is expected to be **medium** since ambient noise levels are low.

Likelihood – There is a **definite** likelihood of the impact occurring.

IMPACT SIGNIFICANCE (PRE-MITIGATION) –MODERATE (-VE)

Degree of Confidence: The degree of confidence is **medium**.

11.1.2 Mitigation measures

The following mitigation measures will be implemented to reduce noise impacts during the construction phase.

- Mechanical equipment with lower sound power levels will be selected to ensure that permissible occupation noise-rating limit of 85 dBA is not exceeded. Construction workers and personnel will wear hearing protection when required.
- Vehicles and machines will be properly serviced and well maintained.
- Mainstream SA will require drivers to adhere to the speed limit of 40km/hr on gravel roads.
- A grievance procedure will be established whereby noise complaints by neighbours are recorded and responded to.

11.1.3 *Residual Impacts*

Implementing the above mitigation measures would reduce the magnitude of the above stated impact and consequently lower the overall significance to moderate-minor.

Table 11.2 Pre- and Post- Mitigation Significance

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	MODERATE (-VE)	MINOR - MODERATE (-VE)

11.2 *WIND TURBINE NOISE DURING OPERATION*

11.2.1 *Impact Description and Assessment*

The two main sources of wind turbine noise are mechanical noise generated by machinery such as generators and gearboxes in the nacelle and aerodynamic noise emanating from movement of air around the turbine blades and tower. The aerodynamic noise may include continuous broadband noise, noise with a noticeable tone, as well as impulsive noise. Human hearing is particularly sensitive to tonal and impulsive sounds. Although these were emitted by some of the first wind turbines thereby eliciting community complaints, extensive improvements in design have resulted in the virtual elimination of both tonality and impulsivity in the latest generation of wind turbines.

In rural settings, like the Richtersveld site, there are few sources of noise to mask the noise emanating from the operation of the wind turbines. At high wind speeds this is not necessarily a problem as the noise may be masked by the wind moving the vegetation, but at lower wind speeds, background noise may not be sufficient to mask noise emanating from turbines. The impact assessment has therefore been based on a wind operating speed of 6 m/s since the masking effect of wind noise would be the lowest and the potential noise impact the highest at this speed. In trying to interpret the potential noise impact associated with the establishment of a wind farm, it may be useful to compare this to other environmental noise sources (see *Table 11.3*).

Table 11.3 Indicative noise levels from various sources[1]

Source/Activity	Indicative noise level dB(A)
Threshold of pain	140
Jet aircraft at 250m	105
Pneumatic drill at 7m	95
Truck at ± 48 km/hr at 100m	65
Busy general office	60
Car at ± 65 km/hr at 100m	55

[1] These indicative noise levels were taken from the Scottish Government Planning Advice Note 45 on Renewable Energy Technologies, 2002

Source/Activity	Indicative noise level dB(A)
Wind farm at 350m	35 – 45
Quiet bedroom	35
Rural night-time background	20 – 40
Threshold of hearing	0

The noise emitted by a wind turbine extends over most of the audio frequency range. The level of noise varies over the operating wind speeds ranging from the cut-in wind speed of approximately 3 m/s (10.8 km/hr) to a maximum wind generating speed of approximately 12 m/s (43 km/hr). The noise emission level is lowest at the cut-in speed but it is not linearly related to wind speed with the maximum emission level generally occurring around 8 m/s; thus not at the maximum wind speed. It is noteworthy that, for most modern wind turbines, the maximum change in overall noise emission level (L_{Aeq}) rarely exceeds 3 dB over the entire operating wind speed range. This difference is considered insignificant in terms of human response to sound/noise. Most humans would barely notice a difference in "loudness" for a 3 dB change in noise level.

The noise impact modelling was conducted on layout Alternative 1 provided by G7, without turbines removed to accommodate other environmental constraints, thus representing a worst case scenario. The anticipated noise contours are shown in *Figure 11.1,* the site boundaries are shown by a red line and the proposed wind turbine locations are displayed by a red dot.

The land adjacent to the proposed wind farm site boundary is zoned for agricultural use (rural). In terms of SANS 10103 (Table 11.4), a "rural" district would apply with typical outdoor day time noise level or $L_{Req,d}$ of 45 dBA and a night time level ($L_{Req,n}$) of 35 dBA. The intensity of the noise impact on the boundary of the site is assessed using the lower of the two, i.e. the night-time $L_{Req,n}$ of 35 dBA. In accordance with SANS 10328, the predicted impact that noise emanating from a proposed development would have on surrounding land is assessed by determining whether the daytime rating level, $L_{Req,d}$, and/or the night-time rating level, $L_{Req,n}$, of the predicted ambient noise would exceed the typical rating level of noise on that land as indicated in *Table* 11.4 (which is a reproduction of Table 2 of SANS 10103).

If the rating level of the ambient noise under investigation exceeds the typical rating level, it is probable that the noise is annoying or otherwise intrusive to a community exposed to the noise i.e. sensitive site. This excess is then related to the probable response of a community to the noise as indicated in *Table 11.5* (Table 5 of SANS 10103). In estimating the response of a community (such as residents) in a particular district to a particular noise under investigation SANS 10103 incorporates the diversity of response of individuals of a particular community to the same noise level. The estimated response to an excess of $L_{Req,T}$ of noise under investigation over the residual or typical $L_{Req,T}$ is thus not in discrete 5 dB changes, but in overlapping ranges of excess.

Table 11.4 Typical rating levels for noise in districts (Source:SANS 10103 (2008), Table 2)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req.T}$) for noise,** dBA					
	Outdoors			**Indoors, with open windows**		
	Day-night $L_{R,dn}$[a]	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**	**Day-night $L_{R,dn}$[a]**	**Day-time $L_{Req,d}$[b]**	**Night-time $L_{Req,n}$[b]**
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with one or more of the following: workshops; business premises; and main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Table 11.5 Categories of community/group response (Source: SANS 10103 (2008), Table 5)

1	2	3
Excess ($\Delta L_{Req,T}$)[a] dBA	**Estimated community/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

The intensity of a predicted noise impact was determined in relation to the categories of community response and is qualified as none, low, medium or high as outlined in *Table 11.6*.

Table 11.6 Noise intensity qualifiers

Rating	**Intensity qualifier**
None	Predicted $L_{Req,T}$ does not exceed the typical $L_{Req,T}$
Low	Predicted $L_{Req,T}$ exceeds the typical $L_{Req,T}$ by between 0 & 5 dB
Medium	Predicted $L_{Req,T}$ exceeds the typical $L_{Req,T}$ by between 5 & 10 dB
High	Predicted $L_{Req,T}$ exceeds the typical $L_{Req,T}$ by more than 10 dB

Noise on the boundary

Much of the land beyond the site boundaries would be exposed to L_{Aeq} less than 35 dBA. No noise impact would occur on that land.

One of the proposed wind turbine locations is close the north western boundary of the site and this would result in the L_{Aeq} just beyond the boundary to exceed 45 dBA for a distance of 400 m along the boundary and extending up to 100 m beyond the boundary (see *Figure 11.1*).

The intensity of noise impact within this distance would be **High**.

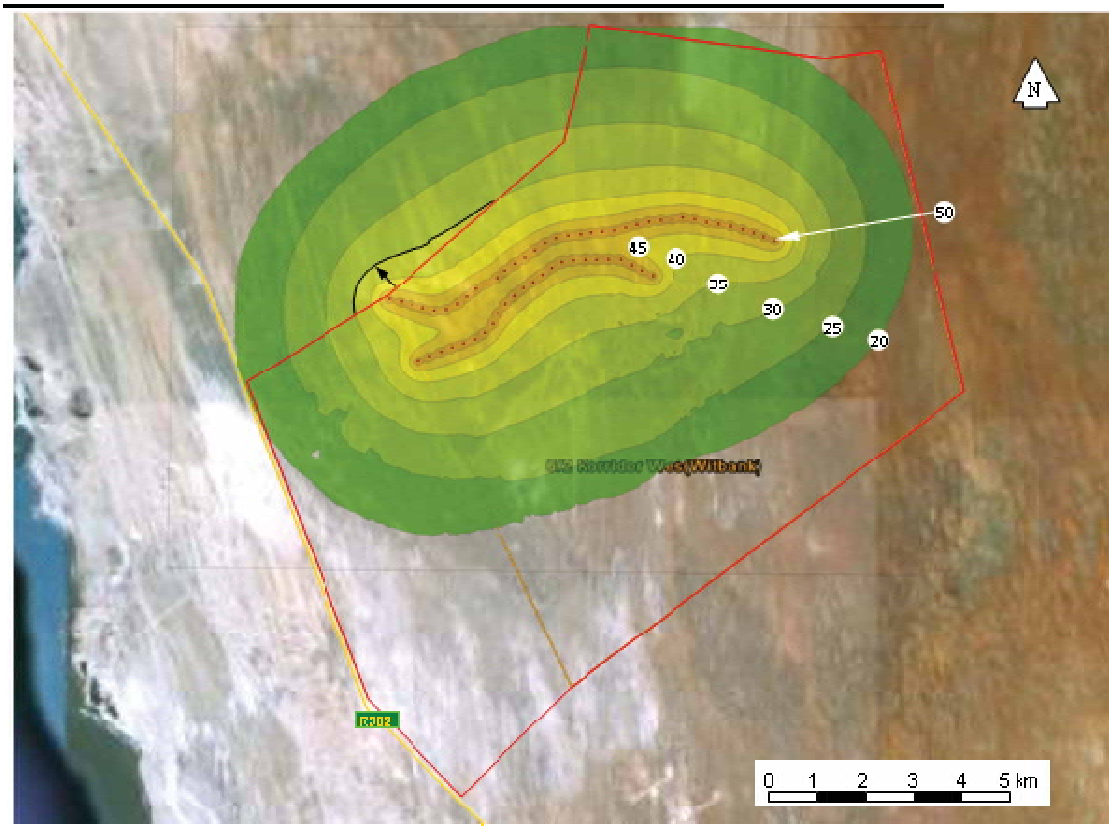
The 40 dBA contour line would extend up to 300 m beyond the boundary with an associated **Medium** intensity of noise impact. In the same direction the 35 dBA contour would be located approximately 700 m from the boundary with a **Low** intensity of noise impact between 300 m and 600 m (*Figure 11.1*). Land areas exposed to L_{Aeq} in excess of 35 dBA are indicated by an arrow and black line.

In terms of the NCR the noise levels would exceed the residual level of 37 dBA measured during daytime by 7 dB or more on a small portion of land within a very small distance beyond the boundary. Although this would constitute a disturbing noise, the portion of land affect is relatively small, as outlined in black in *Figure 11.1.* It should be noted, that there are no receptors within this area of the predicted high or medium intensity, however taking this, as well as the long term duration and the high intensity into consideration, the magnitude of the potential negative noise impact is rated as medium to high. Considering the medium to high magnitude and the fact that the potential impact would definitely occur, the overall significance of the potential direct negative operational impact from wind turbine generated noise on surrounding land is considered moderate to major.

Noise within the site

There are no permanent dwellings located on the Richtersveld site, although approximately ten active or recently active stock-posts were identified on site (see *Figure 16.6*), and at least three within close enough proximity that they may experience a "disturbing noise". The stock-posts may at times be occupied by Nama herders who move around the landscape from stock-post to stock-post, however, many herdsmen own vehicles and commute to their stock-posts from the various small towns and villages of the Richtersveld. It is anticipated that if the Nama herders experience a disturbing noise at stock-posts in close proximity to the turbines, these stock-posts may be relocated.

Figure 11.1 *Richtersveld proposed wind farm with site boundaries demarcated by red lines; wind turbine locations shown in red; and calculated L_{Aeq} contours due to noise from the wind turbines*



Box 11.2 *Operational Impact: Noise on the boundary*

Nature: The operation of the REF will result in a **negative direct** noise impact.

Impact Magnitude – Low-medium

- **Extent**: The extent of the impact is **on-site** since the impacts are limited to the boundary of the site with the exception of a small portion along the north western boundary of the site.
- **Duration**: The duration would be **long-term** as the impacts are predicted to last for at least 25 years until the operation ceases.
- **Intensity**: The intensity of the impact is expected to be **medium - high** since the intensity at the boundary would generally be **low** with a **High** intensity predicted for a section along the north western boundary.

Likelihood – There is a **definite** likelihood that the wind turbines will generate noise during the operational phase.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR - MODERATE

Degree of Confidence: The degree of confidence is **high**.

11.2.2 Mitigating noise impacts

G7 would need to ensure that the proposed development is compliant with the appropriate Noise Control Regulations (NCR) applicable to the Namakwa District Municipality. Based on the findings above it is recommended that wind energy turbine located closest to the North West wind energy farm boundary be removed. In view of the fact that there is no human habitation within the study area, the feasible mitigation option is compliance with the applicable NCR which could be achieved by:

- Applying for and obtaining, an exemption from the Richtersveld Local Municipality where prohibitions determined in the applicable NCR would be contravened by the establishment of the proposed wind farm.

- Incorporating land adjacent to the north western boundary into the proposed site or negotiating an agreement with the adjacent land owner that the noise impact will be acceptable.

During operation, should be necessary for stock-posts to be relocated on account of a disturbing noise, G7 will provide assistance to the Nama in relocating the stock posts.

11.2.3 Residual Impacts

The turbine in the north west corner of the site will not be removed and G7 will follow the necessary protocol in order to comply with the relevant NCR. Therefore it should be noted any exemption applied for and granted in terms of the applicable NCR, would be an exemption of the potential moderate-major potential noise impact.

Table 11.8 Pre- and Post- Mitigation Significance: Operation noise

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	**N/A**	**N/A**
Operation (boundary impacts)	**MAJOR - MODERATE (-VE)**	**MAJOR - MODERATE (-VE)**

12 VISUAL IMPACT

This chapter discusses the potential visual impacts the proposed Richtersveld Wind Farm may have on the landscape of the proposed site, surrounding area, characteristic features and on the people who view it. ERM appointed Bernard Oberholzer Landscape Architects in association with MLB Architects and Urban Designers to undertake the required visual specialist study for the proposed development, which is appended to this report as *Annex I*. The potential impacts are assessed and mitigation measures to reduce the impacts are outlined below.

The proposed Richtersveld site is located on the sparse plains of the West Coast, 25 km south east of the town of Alexander Bay and 50 km north of the town of Port Nolloth (see *Figure 4.1*). The topography of the area consists of rolling dunes with intervening valleys and plains. There are sparse rocky outcrops on the site and twin hills of Boegoeberg North and Boegoeberg South are prominent features in an otherwise fairly flat landscape. The coastal plains to the west of the site have been mined extensively for alluvial diamonds and the open trenches are now largely abandoned. The indigenous vegetation of the area (Northern Richtersveld Yellow Duneveld and Richtersveld Coastal Duneveld) typically consists of low succulents and shrubs. The site can be considered rural and isolated and there are no permanent dwellings located on the site. The site is currently utilised for grazing (sheep and goats), however, it does not appear to be permanently occupied. There is an existing 220kV transmission line that traverses the site.

The visual impact will be largely limited to the operation phase, however, large machinery will be visible on site as soon as site preparation begins and aspects of the Wind Farm will be visible during the construction phase. The visual impacts will be perceived by two types of receptors, namely:

- receptors located at a fix point, i.e. dwelling on the site and surrounding areas; and
- receptors who will temporarily come into contact with the Wind Farm, such as passing motorists and tourists in the area.

The potential visual impacts are summarised in *Table 12.1.*

Table 12.1 Impact characteristics: Visual Impacts

Summary	**Construction**	**Operation**
Project Aspect/ activity	Construction of the Wind Farm	Operation of the Wind Farm
Impact Type	Direct negative	Direct negative
Stakeholders/ Receptors Affected	Fixed receptors only	Affected landowners, neighbouring land owners, road users, visitors to the area.

In undertaking the assessment of visual impacts it is necessary to acknowledge that varying attitudes to wind energy development are expressed by different individuals and constituencies. Aesthetic perceptions have been identified as the strongest single influence on these attitudes, particularly with respect to visual impacts, and these can be positive or negative depending on individual attitudes to the principle and presence of wind generation (Warren *et al.*, 2005). There is also an increasing body of evidence that negative attitudes can reduce with time particularly for those living in proximity to sites, as they become familiar with operational sites (1). It is therefore not possible to arrive at a definitive view on the duration of impact caused by a project because this will vary with different individuals who will view the development in their own way. However, in this chapter ERM provides an assessment based on the professional judgment of Quinton Lawson (MLB Architects and Urban Design) and Bernard Oberholzer (Bernard Oberholzer Landscape Architects) (see *Annex I*).

12.1 VISUAL ASSESSMENT CRITERIA

The potential visual impacts of the Wind Farm are determined using a series of quantitative and qualitative criteria. These are rated to determine both the expected level and significance of the visual impacts (Oberholzer et al, 2010). *Table 12.2* below describes the visual assessment criteria in relation to the proposed Richtersveld Wind Farm.

Table 12.2 Criteria used to Assess Visual Impacts

Criteria	Description	Comment
Visibility of facilities Distance from selected viewpoints	View points are selected based on prominent viewing positions in the area, where uninterrupted views of the proposed site could be obtained.	Views of wind turbines from the R382 tend to be the most significant 3.5km away (*Figure 12.2* and *12.4*). The nearest farmstead is about 2km away.
Visibility of lights at night	How visible the facility would be when viewed at night time.	Depends on number of turbines with navigation lights, and amount of security lighting. Indicated that navigation lights would have reflectors.
Visibility	Determined by the distance between the wind farm and the viewer. The degrees of visibility of the key components of the wind farm in relation to distance are given in *Table 12.3.*	Given the size of the turbines, visibility tends to be significant up to 5km from the wind farm, *Figure 12.1* shows the distance radii around the site.

(1) See primary research findings and various other references quoted in Warren CR (2005), p 858; op cit.

Criteria	Description	Comment
Visual Exposure	Determined by the geographical features of the area surrounding the site. Certain areas may fall within view shadows, where geographical features intervene with the line of sight from the wind farm to the receptor.	Extensive viewshed because of the location of the turbines on high ground (see*Figure 12.1*). The zone of visual influence of the wind farm tends to fade out beyond 5 km from the site.
Visual Sensitivity	Determined by the presence of topographical features, steepslopes, rivers, protected areas, scenic routes or airfields.	Exposed arid landscape and visually sensitive skyline. The turbines create a distinctive feature in the open landscape. Largely uninhabited area.
Landscape Integrity	Determined by the lack of other visual intrusions.	Contrasts with wilderness landscape. Existing power lines cross the site. Existing mining disturbance along the coast.
Cultural landscape Heritage value of the landscape	Besides natural attributes, landscapes have a cultural value, enhanced by the presence of historical settlements, old routes, graves and farmsteads. See detailed heritage impact assessment by others.	Isolated farmsteads within the viewshed.
Visual Absorption Capacity	This is the potential for the landscape to screen or absorb the wind farm.	Low potential of open landscape and exposed ridgeline to visually absorb wind turbines. Large number of turbines.
Cumulative impacts Accumulation of impacts in the area	This is the accumulation of visual impacts in the area, particularly in relation to other existing or proposed wind energy farms and industrial-type facilities. There are currently no other wind farms or other industrial facilities proposed within a 30km radius of the site.	No other wind energy farms proposed in the area.

Table 12.3 Visibility of the Wind Turbines

Degree of Visibility	Comments	Distance
Highly Visible	Clearly noticeable within the observers' viewframe	0 – 2.5 km
Moderately Visible	Recognisable feature within observer's viewframe	2.5 – 5 km
Marginally Visible	Not particularly noticeable within observer's viewframe	5 – 10 km
Hardly Visible	Practically not visible unless pointed out to the observer	10 – 15 km +

No formal guidelines have been published for the wind energy industry to assist in the design and assessment of wind energy development at the local scale. However, a draft report has been prepared by the Provincial Government of the Western Cape and CNdV Africa (2006) called "A Strategic

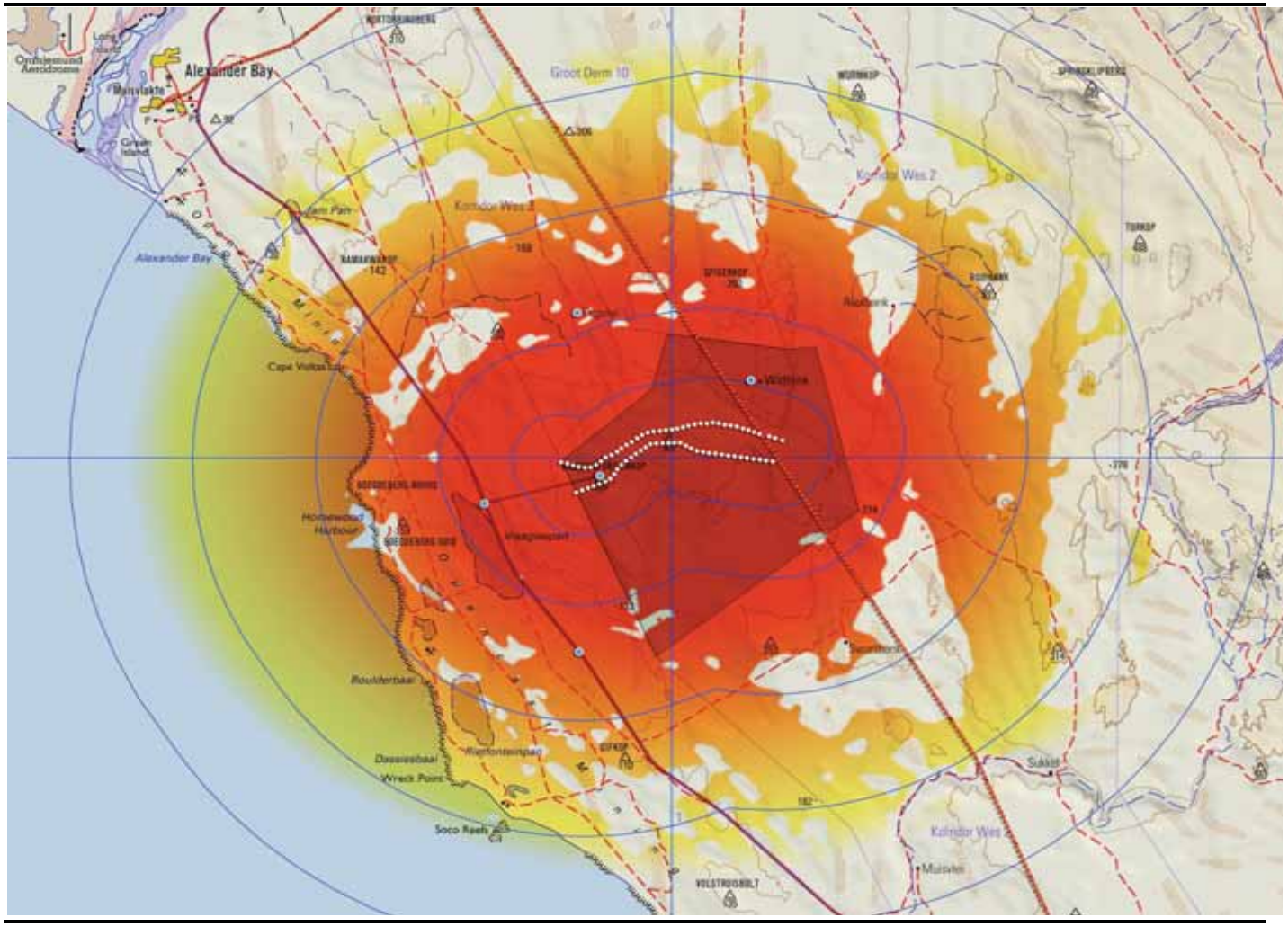
Initiative to Introduce Commercial and Land Based Wind Energy Development to the Western Cape".

The report goes on to prescribe guidelines and buffers, including key criteria to be mapped at a local project level, for proposed wind farms. *Table 12.4* below shows the Richtersveld Wind Farm in relation to the suggested buffers.

Table 12.4 Criteria for Visual Buffers at the Richtersveld Site

Criteria	**PGWC Regional Level Mapping : Recommended Buffers (2006)**	**Local Project Level Mapping for the Richtersveld Site: Suggested Buffers**
Urban Areas	800m	N/A to this site.
Residential Areas, including rural dwellings	400m	Nearest dwelling is over 400m away
National Roads	13km buffer. Depends on scenic value. Can be reduced.	No national roads in the area.
Local Roads (district roads)	500m Review if high scenic value.	The R382 is about 3.5km from nearest turbine.
Provincial Tourist Route	4km buffer. Statutory scenic drives.	N/A to this site.
Local Tourist Route	2.5km Assumption. Can be reduced.	The R382 is about 3.5km from nearest turbine.
Railway lines	250m	N/A to this site.
Local airfield	To be confirmed with agency.	An aerodrome at Alexander Bay about 22km to the northwest.
National Parks, Provincial Nature Reserves	2km Should be eliminated at regional level.	The Richtersveld National Park is about 45km away.
Private Nature Reserves	500m Could be negotiated at local level.	Nearest reserve is over 500m away.
Coastlines of Scenic Value	4km Should be eliminated at regional level.	The coastline is about 7.5km away.
Rivers	500m Perennial rivers at regional level. Hydrology to be determined at site level.	N/A to this site.

Figure 12.1 Viewshed for the Proposed Richtersveld Wind Farm, including View Points and Distance Radii



12.2 VISUAL IMPACT ON FIXED POINTS

12.2.1 Impact Description and Assessment

Construction Phase Impacts

Although the turbines would be manufactured off site and the construction phase would be relatively short-term in duration (24 months), it would still require large equipment or infrastructure such as the turbines themselves when being erected as well as cranes on site. Additionally, the presence of bare soil and borrow pits would increase the potential visual impact. The significance of the visual impacts will reduce at increasing distance from the development.

Box 12.1 Construction Impact: Fixed Receptors

Nature: Construction activities would result in a **negative direct** impact on the visual landscape in the area surrounding the site.

Impact Magnitude – Medium to High

- **Extent:** The extent of the impact is **local**, as the facility would be hardly visible beyond 10 km from the site.
- **Duration:** The duration would be **short-term** as the construction phase would last approximately 24 months.
- **Intensity:** The intensity would be **medium,** as the increased vehicles and large equipment/ infrastructure would be moderately visible from the surrounding areas.

Likelihood – There is a **definite** likelihood that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MAJOR-MODERATE (-VE)

Degree of Confidence: The degree of confidence is **HIGH**.

Operational Phase Impacts

The Richtersveld site is located along the rural West Coast, close to the South Africa-Namibia border. There is a sense of remoteness and spaciousness about the landscape. The proposed wind farm will introduced a maximum 75 wind turbines into the area, as well as associated infrastructure such as a substation, Operation and Maintenance (O&M) buildings and an 80 m wind measuring mast which has already been installed. It is anticipated that the wind turbines will have the greatest visual significance in the landscape, due to their large scale (100 m hub height).

The construction of the Richtersveld Wind Farm may alter the visual character of the landscape, as these features are in contrast to the rural surrounding landscape. The proposed wind turbines would be located on a high point at Visagiesfonteinkop, and therefore visible from the surroundings for a considerable distance. However, the wilderness landscape has been disturbed

in the past by diamond prospecting, and open trenches and open cast mines are visible along the coast.

From inspection of the visual exposure and taking into account farmsteads, main routes through the area, locations of known tourist/visitor importance, nature reserves and hills from which elevated views may be possible, viewpoints were selected to represent the main areas from which the Richtersveld development may be seen. These viewpoints were selected based on Layout Alternative 1. Details of the location of these viewpoints are described in *Table 12.5* and mapped in *Figure 12.1*.

Table 12.5 Potential Visibility from Surrounding Area (i.e. Viewpoints)

View Pt	Location	Distance	Comments
VP2	Visagiesfontein Kop	335 m	Highly visible in close proximity.
VP3	Pagvlei	5.84 km	Clearly visible in the distance.
VP4	Witbank farmstead	2.06 km	Highly visible in the middle distance.

Figure 12.1 shows the result of the viewshed analysis for the Richtersveld site, from this it is clear that because of the location of the turbines on the slightly elevated ridges, the Wind Farm will have a fairly extensive viewshed, visible from about 50% of the area within 10 km from the site.

The proposed wind turbines would be visible to a small number of scattered farmsteads (as shown in *Figure 12.3*), however, the area is largely uninhabited and the site is considered remote. The Richtersveld Wind Farm would not be visible from Alexander Bay or Port Nolloth. The site will not be visible from Richtersveld National Park, which is located over 40km north east of the site,

Security and navigational lights at night could have an effect on the characteristic 'dark skies' of the Richtersveld. These could be particularly visible on the ridgelines.

Figure 12.2 Viewpoint 1 looking east from R382 access road

Figure 12.3 Viewpoint 4 looking south-west from Witbank farmstead

Figure 12.4 Viewpoint 5 looking north-east from the R382

Box 12.2 ***Operational Impact: Wind Turbines on Fixed Receptors***

Nature: The presence of the wind turbines would result in a **negative direct** impact on the visual landscape in the area surrounding the site.

Impact Magnitude – Medium

- **Extent:** The extent of the impact is **local to district**, as the turbines will be marginally visible beyond 10 km.
- **Duration:** The duration would be **long-term** since it will persist for as long at the facility remains operational.
- **Intensity:** The intensity will be **high,** as the turbines will be highly visible from the surrounding areas as the landscape does not have the potential to absorb the turbines. However, given the relatively low number of recpetors, the intensity will be reduced to **medium-high**.

Likelihood – There is a **definite** likelihood that the turbines will result in visual impacts.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE - MAJOR (-VE)

Degree of Confidence: The degree of confidence is **HIGH** as the assessment is based on a view shed analysis and photomontages.

The substation complex would house site offices, storage areas and ablution facilities in addition to the substation building. The substation would be a single-storey structure of approximately 2,500 m^2 in size. The potential visual impact of the substation complex would be lower than that of the proposed turbines due to the single storey nature of the proposed complex (*Figure 12.3*).

Box 12.3 ***Operational Impact: Substation Complex on Fixed Receptors***

Nature: The presence of the wind turbines and associated substation complex would result in a **negative direct** impact on the visual landscape in the area surrounding the site.

Impact Magnitude – Medium

- **Extent:** The extent of the impact is **local**, as the facility will be marginally visible beyond 5 km.
- **Duration:** The duration would be **long-term** since it will persist for as long at the facility remains operational.
- **Intensity:** The intensity will be **low- medium,** as the substation complex is a single story complex, but does introduce more pylons into the landscape.

Likelihood – There is a **definite** likelihood that the substation complex will result in visual impacts.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MINOR - MODERATE (-VE)

Degree of Confidence: The degree of confidence is **HIGH** as the assessment is based on a view shed analysis and photomontages.

12.2.2 Mitigating Visual Impacts at Fixed Points

Design Phase

- The design of the buildings should be compatible in scale and form with buildings of the surrounding area and yards and storage areas to be enclosed by masonry walls.

- Cables should be located underground where possible to minimise visual clutter.

- The substation transformers, which have a high degree of visual intrusion, to be screened by the various buildings.

- Provision should be made for rehabilitation/ re-vegetation of areas damaged by construction activities.

It is recommended that if environmental authorisation is granted by DEA, the final micro-siting of the turbines and substation complex, as well as designs for the various buildings be reviewed by a visual specialist, prior to the commencement of construction activities and final mitigation measures to be incorporated in the final EMP. Any future additional infrastructure, such as buildings, lighting, masts, or other elements, which could visually intrude on the landscape, should first be reviewed by a visual specialist, before being included in the EIA permit.

Construction Phase

- The extent of the construction camp and stores should be limited in area to only that which is essential.

- Disturbed areas rather than pristine or intact landscape areas should preferably be used for the construction camp.

- Measures to control waste and litter should be included in the contract specification documents.

- Provision should be made for rehabilitation/ re-vegetation of areas damaged by construction activities.

- Potential borrow pits for the construction (the need for which has not yet been ascertained nor whether if needed whether it will be established on site), would be subject to permits from the relevant authorities. However, any borrow pits on the site are to be rehabilitated and re-vegetated according to the botanist's recommendations.

Operational Phase

- Signage related to the Wind Farm must be discrete and confined to entrance gates. No other corporate or advertising signage, particularly billboards, to be permitted.

- The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas of the site.

- The operations and maintenance areas should be screened by buildings, walls, hedges and/or tree planting, and should be kept in a tidy state to minimise further visual impacts.

- The navigation lights on the wind turbines should be fitted with reflectors so that the lights are not directly visible from below.

12.2.3 Residual Impact

The significance of the residual impacts associated with potential visual impacts on fixed points would be reduced as indicated below (see *Table 12.6*)

Table 12.6 Pre- and Post-Mitigation Significance: Visual Impact on Fixed Points

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction **(Short Term)**	**MODERATE - MAJOR (-VE)**	**MODERATE - MAJOR (-VE)**
Operation (wind turbines)	**MODERATE - MAJOR (-VE)**	**MODERATE - MAJOR (-VE)**
Operation (substation complex)	**MINOR - MODERATE (-VE)**	**MINOR (-VE)**
Operation (at night)	**MODERATE (-VE)**	**MINOR - MODERATE (-VE)**

12.3 VISUAL IMPACT ON TEMPORARY RECEPTORS

12.3.1 Impact Description and Assessment

Operational Phase Impacts

The wind turbines would also be visible from the R382 linking Port Nolloth with Alexander Bay at a distance of about 3.5km at the closest point, and a travelling distance of about 24 km along the R382 in both directions (as shown in Figure *12.2* and *12.4*). There are no national roads or other secondary roads within 50 km of the site and there are no designated scenic routes surrounding the site.

Motorists travelling north or south along the R382 will be able to see the wind farm from distances up to 15 km from the site as shown in *Figure 12.1*, due to the flat nature of the landscape. As motorist get within a 5 km radius of the site, it is likely that the wind farm will be clearly visible on the ridgeline. The Wind Farm will be highly visible to motorists from the R382 (see *Figure 12.1*).

Table 12.7 identifies the visibility of the Richtersveld Wind Farm from identified viewpoints along the surrounding roads.

As the wind turbines will only be visible at various points along the road, visual impacts to motorists will be intermittent and short term in duration.

Table 12.7 Potential Visibility from Surrounding Roads

View Pt	Location	Distance	Comments
VP1	R382 at access road to wind farm	3.59 km	Clearly visible on the ridgeline.
VP2	Visagiesfontein Kop	335 m	Highly visible in close proximity.
VP5	R382 southwest of the site	6.83 km	Clearly visible in the distance on the skyline.

Box 12.4 Operational Impact: Temporary Receptors

Nature: The presence of the wind turbines and associated substation complex would result in a **negative direct** impact on temporary receptors, including passing motorists and tourists in the area.

Impact Magnitude – Medium

(i) **Extent:** The extent of the impact is **local**, as the turbines will be hardly visible beyond 15 km from the site.
(ii) **Duration:** The duration would be **short-term** as the Wind Farm will be visible to the receptor temporarily.
(iii) **Intensity:** The intensity will be **medium - high,** as motorists will be passing the wind farm and it will be highly visible.

Likelihood – There is a **definite** likelihood that this impact will occur.

IMPACT SIGNIFICANCE (PRE-MITIGATION) – MODERATE (-VE)

Degree of Confidence: The degree of confidence is **HIGH**.

12.1.2 Mitigating Visual Impacts on Temporary Receptors

The proposed mitigation measures to reduce visual impacts on temporary receptors are similar to those for fixed receptors, mentioned in *Section 12.2.2*.

12.3.2 Residual Impact

The significance of the residual impacts associated with potential visual impacts on temporary receptors would be reduced for operation at night as indicated below (see *Table 12.8*).

Table 12.8 ***Pre- and Post-Mitigation Significance: Visual Impact on Temporary Receptors***

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Operation (day time)	**MODERATE - MAJOR(-VE)**	**MODERATE - MAJOR (-VE)**
Operation (night time)	**MODERATE (-VE)**	**MINOR - MODERATE (-VE)**