WIND ENERGY FACILITY IN THE WESTERN CAPE

VISUAL ASSESSMENT REPORT FOR INPUT INTO THE SCOPING REPORT

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Lourens du Plessis from MetroGIS (Pty) Ltd. undertook the visual assessment in his capacity as a visual assessment and Geographic Information Systems specialist. Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

Savannah Environmental (Pty) Ltd. appointed MetroGIS (Pty) Ltd. as an independent specialist consultant to undertake the Visual Impact Assessment and neither the author, nor MetroGIS will benefit from the outcome of the project decision-making.

Lourens is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilise the principles and recommendations stated therein to successfully undertake visual impact assessments.

1. Introduction

Eskom Holdings Limited identified the coastal area north-west of Vredendal in the Western Cape as an ideal location for the construction and operation of a Wind Energy Facility (WEF). The WEF generates electricity by means of wind turbines that harness the coastal and berg wind conditions of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred too, is generally considered to be an environmentally friendly electricity generation option.

The effectiveness of the WEF, or amount of power generated by the facility, is dependent on the amount of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography and each other in order to optimise the use of the wind resource. Eskom intends to construct up to 100 turbines over an identified area of 25 km^2.

Each turbine consists of a concrete foundation (15m x 15m), a 78m high steel tower, a hub (placed at approximately 80m above ground level) and three 45m long blades attached to the hub. Other infrastructure associated with the facility includes internal service roads, an access road from the R363 provincial road, a 50m x 50m substation (placed within the facility), a 132 kV distribution line (overhead power line) linking with the substation at Koekenaap and a proposed transmission line linking the aforementioned substation to the Juno substation near Vredendal.

The photograph below, taken at Eskom's Klipheuwel test facility, indicates the dimensions of a single wind turbine. The turbine displayed in the photograph is slightly smaller than the structures envisaged at the proposed facility. Also note the colour of the turbine (white).

The construction phase of the Wind Energy Facility is dependent on the number of turbines erected and is estimated at one week per turbine. The lifespan of the facility is approximated at 20 to 30 years.

Figure 1: Photograph of a wind turbine indicating the approximate dimensions

2. Scope of work

The scope of the work for the WEF project includes a scoping level visual assessment of the issues related to the visual impact.

The study area for the visual assessment encompasses a considerable geographical area that includes a 50km buffer zone from the proposed development area. It includes the towns of Bitterfontein, Nuwerus, Koekenaap, Lutzville, Papendorp, Strandfontein, Doringbaai and Vredendal as well as some smaller places of interest such as Brand se Baai, Gert du Toit se Baai, Duiwegat and Die Toring.

3. Methodology

3.1. General

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The methodology utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of facility.

3.2. Issues Related to the Visual Impact

Specific spatial criteria needs to be applied to the visual exposure of the proposed WEF in order to successfully identify the issues related to the visual impact.

Visual Distance / Observer Proximity

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for this type of structure. It is envisaged that the nature of the structure and the relatively natural state of the environment would create a significant contrast that would make the facility visible and recognisable from a great distance.

The proximity radii for the proposed sites were created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

The proximity radii chosen, based on the dimensions of the proposed development area, are:

- 0 - 10km. Short distance view where the WEF would dominate the frame of vision and constitute a very high visual prominence.

- 10 - 25km. Medium distance view where the structures would be easily and comfortable visible and constitute a high visual prominence.

- 25 - 50km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.

- Greater than 50km. Long distance view of the facility where the facility could potentially still be visible thought not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

Viewer Incidence / Viewer Perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed wind energy facility and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Site Specific Issues

In addition to the spatial criteria mentioned above, another set of issues related to the potential visual impact of the WEF plant was identified. These issues are often a refinement of the spatial criteria and relate to issues that are not easily quantifiable or spatially presentable. It is also often linked to issues of which the detailed design and planning have not yet been finalised and that will have to be addressed during the EIA phase of the project. The list of issues include:

- The visibility of the facility to, and visual impact on, major routes in the area (i.e. R363, R362 and the N7).
- The visibility of the WEF to, and visual impact on, not only major built-up centres or populated places (i.e. Koekenaap, Lutzville, Papendorp, Vredendal, etc.) but also individual/isolated landowners (e.g. Skaapvlei, Skilpadvlei, Kommandokraal, etc.)
- The potential visual exposure of the facility to protected areas in the region (i.e. the Lutzville and Moedverloren Nature Reserves as well as the Olifants River Mouth Important Bird Area).
- The potential visual impact of the exposure of the WEF to water related recreational activities and tourism potential of the Olifants River.
- The potential visual impact on the future tourism potential of the coastline and specific coastal tourist attractions (Brand se Baai, Gert du Toit se Baai, Die Toring, Duiwegat, etc.) including coastal towns such as Strandfontein and Doringbaai.

- The potential visual impact of the construction of ancillary infrastructure (i.e. the construction of a distribution line from the facility to Koekenaap or Vredendal, substation at the facility, etc.)
- The potential visual impact of operational, safety and security lighting of the facility at night.
- The visual absorption capacity of the natural vegetation.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts.

It is envisaged that the issues listed above may constitute a significant visual impact at a local and/or regional scale. These need to be addressed in greater detail during the EIA phase of the project.

4. The Affected Environment

The location of the proposed area for the development of the Wind Energy Facility includes portions (parts of) of the following farms:

- Portion 5 of Gravewaterkop 158
- Portion 620 of the farm Olifants Rivier Nedersetting
- Portion 617 of the farm Olifants Rivier Nedersetting

These farms are located approximately 40km north-west of the town of Vredendal in the Western Cape Province adjacent to the Atlantic Ocean (at least 2km from the coastline/high water mark at the closest boundary). The study area for development is about 16km north of the Olifants River Mouth and encompasses a surface area of 37km^2. The final area of the WEF will be approximately 25km$^{2.}$ Primary access to this region is by means of the N7 national road and the R363 provincial main road.

Figure 2: View from south of the development site (Note: De Punt and Papendorp in the background)

The topography of the area surrounding the WEF is described as undulating plains with the coastline (or coastal forelands) to the west characterised by steep cliff faces. Two major river valleys occur within the region, these being the Olifants River south of the site and the Klein Goerap River approximately 40km north of the site. Moving inland the terrain becomes more undulating and hilly, and is characterised by hills and low mountains east of the R363.

Figure 3: Shaded Relief Map (indicating topography and elevation above sea level) of the broader study area

The Olifants River valley forms a distinct hydrological feature within the study area. It has to a large degree dictated the settlement patterns in this arid region by providing a source of perennial water for irrigated agriculture. Irrigated cultivation/crops in close proximity to the river is the primary agricultural activity of this district, whilst cattle and sheep farming practises also occur at a less intensive degree. The population density of the region is less than 10 people per km^2 with most of the population concentrated within the small towns. Dry land agriculture occurs over large areas south of the Olifants River as well as over large scattered areas north of the WEF area. The relatively deserted coastline is host to a number of mining houses focussing mainly on diamond and heavy minerals mining.

Figure 4: View of the WEF Development Area looking east

Large tracts of land within the study area are still in an untransformed state with varying degrees of degradation. The predominant vegetation type or land cover, in terms of surface area, is described as Namaqualand Shrubland and Low Fynbos. These vegetation types are, due to the arid nature of this region, not very dense or tall in growth but rather scattered and low and represent a typical semi-desert environment. Riverine vegetation is found along the Olifants River but has, due to the cultivation of grapes and other crops, been altered to a large degree.

Figure 5: Land Cover/Land Use Map

Sources: DEA&T (ENPAT Western Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2000 (ARC/CSIR) and site observations.

5. Visual Exposure

The result of the preliminary viewshed analyses for the proposed Wind Energy Facility is shown on the map below. The initial viewshed analyses were undertaken from various vantage points within, and along the perimeter of the proposed development area at an offset of 100m above average ground level (i.e. the approximate height of the wind turbines). This was done in order to determine the

general visual exposure of the area under investigation simulating the proposed structures associated with the WEF. The viewshed analyses will be refined once a preliminary layout of the wind farm is completed and will be regenerated per turbine position during the EIA phase of the project.

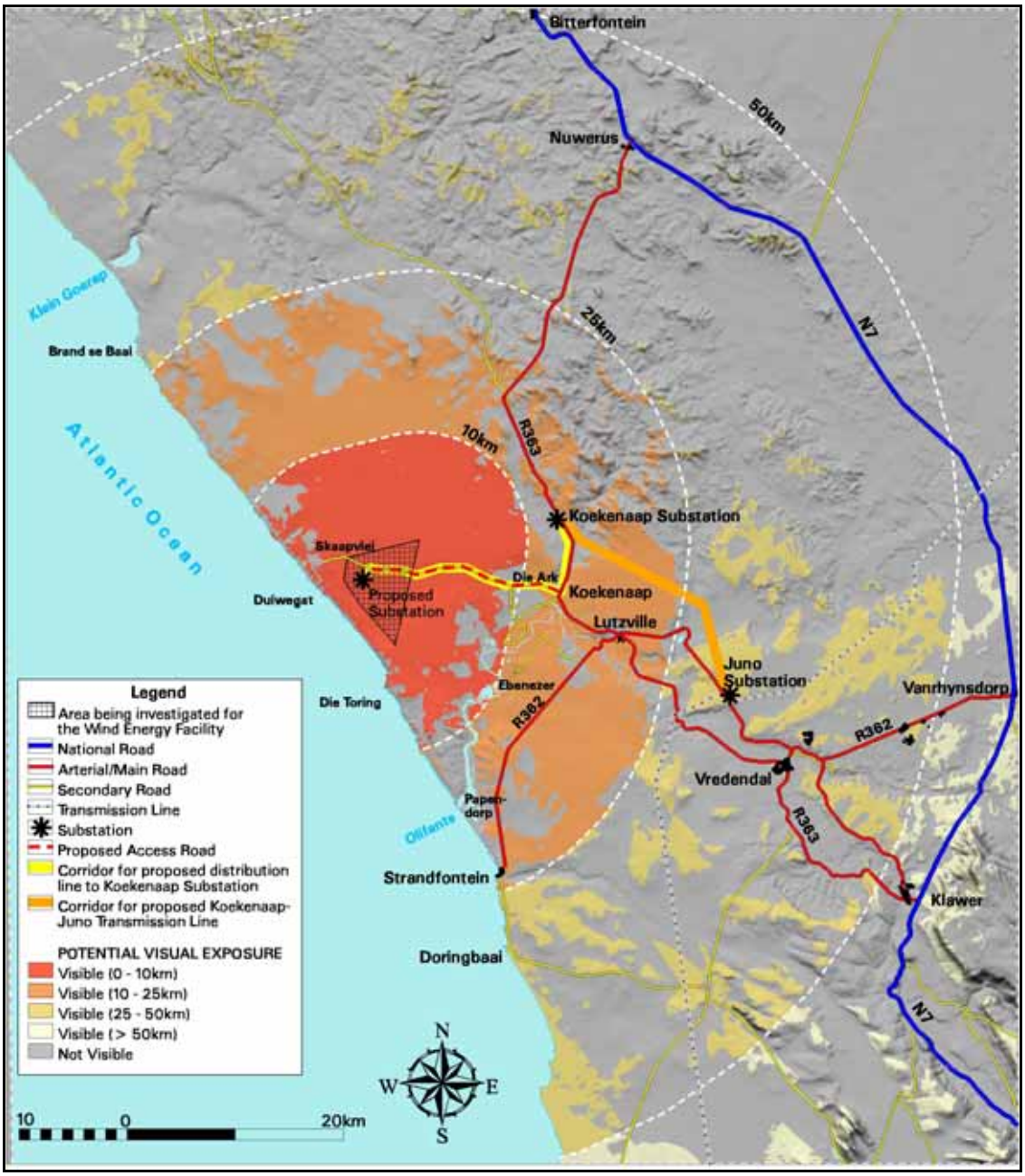

Figure 6: Map Indicating the Potential Visual Exposure of the WEF

The map above indicates the potential visual exposure of the proposed WEF at various distances from the facility. This is done in order to highlight the decreasing visual impact over distance.

The result of the viewshed analysis shows the core area of potentially uninterrupted exposure of the facility as being greatly contained within the 25km buffer zone. The majority of which occurs within the 0 - 10km zone. Visibility beyond the 25km mark becomes scattered and broken and ultimately negligible as it nears the 50km buffer distance. Visibility, even on a perfectly clear day, within this zone (25 - 50km), and beyond the 50km mark, would theoretically be possible although highly unlikely to constitute a negative visual impact. In practical terms this rationale implies that although the facility may potentially be visible from sections of the N7 national road (50km away), it would be difficult to distinguish within the larger landscape.

The 0 - 25km zone contains other areas and potential sensitive visual receptors (as mentioned under the section 3.2. Issues Related to the Visual Impact) that would be exposed to the WEF. Some of these include the towns of Koekenaap and Lutzville, sections of the R362 and R363 provincial roads, and other communities such as De Ark and Ebenezer Kolonie along the Olifants River. High-lying areas of Strandfontein could also have a potential view of the facility from approximately 22km where the wind turbines protrude above the skyline. It is envisaged that the structures would be easily and comfortable visible and would constitute a high visual prominence, potentially resulting in a high visual impact.

Similar viewshed analyses will be undertaken for each of the support infrastructure components during the EIA phase of the project. These analyses will include the substation, access road, distribution line and Koekenaap-Juno transmission line.

6. Conclusion / Recommendations

The construction and operation of the Wind Energy Facility will in all likelihood have a negative visual impact on a number of observers or sensitive visual receptors within a 30km buffer zone from the facility. These sensitive receptors should be identified and the severity of the visual impact assessed within the EIA phase. Photo simulations of critical viewpoints should be undertaken, where required, in order to aid in the visualization of the envisaged visual impact.

The WEF will form a stark and noticeable contrast within the relatively natural environment with its rural character within which it is planned. The area, notwithstanding the mining activities along the coastline, has a high potential for future tourism development due to its scenic vistas and uninterrupted seascapes. Indirect visual impacts of the facility on the future potential for tourism development should be considered. Areas (localities) with potential for future tourism development should be identified and assessed as sensitive visual receptors.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the core wind energy facility as well as the ancillary infrastructure, as these (the substation, access road, distribution line and Koekenaap-Juno transmission line) are envisaged to have varying levels of visual impact at a more localized scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

7. References

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