# PROPOSED OLIFANTS RIVER WIND ENERGY FACILITY

*IN THE WESTERN CAPE PROVINCE*

## VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

**Produced for:**

## South African Renewable Green Energy (Pty) Ltd (SARGE)


**Produced by:**
MetroGIS (Pty) Ltd.
PO Box 384, La Montagne, 0184
Tel: (012) 349 2884/5 Fax: (012) 349 2880
E-mail: lourens@metrogis.co.za Web: www.metrogis.co.za

**On behalf of:**
Savannah Environmental (Pty) Ltd.
PO Box 148, Sunninghill, 2157
Tel: (011) 234 6621 Fax: 086 684 0547
E-mail: karen@savannahSA.com Web: www.savannahSA.com


**- November 2011-**

**CONTENTS**



**MAPS**



**FIGURES**

MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in collaboration with V&L Landscape Architects CC.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team 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 utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape Province of South Africa, the core elements are more widely applicable.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Olifants River Wind Energy Facility. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

## 1. INTRODUCTION

**South African Renewable Green Energy (Pty) Ltd (SARGE)** is proposing the establishment of a wind energy facility (WEF) and associated infrastructure on a number of farms located some 12km east-south-east of Lutzville within the Matzikama Local Municipality of the Western Cape Province.

The project is proposed on the following farm portions (refer to attached map), and is referred to as the Olifants River Wind Energy Facility project:

- Remainder of the Farm Zoutpans Klipheuvel 268
- Portion 1 of the Farm Zoutpans Klipheuvel 268
- Erf 618 of the Olifants River Settlement

A broader area of approximately 3 000 ha is being considered within which the facility is to be constructed.

The wind energy facility is proposed to accommodate up to 114 wind turbines with a generating capacity of ~342 MW.

A wind energy facility generates electricity by means of wind turbines that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option.

The efficiency of a wind energy facility, or amount of power generated, is dependent on the number 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.
The wind energy facility will connect to the national grid at Eskom's existing Juno Substation which is located approximately 23km east of the site.

A locality map indicating the proposed development site is shown on **Map 1**. Primary and ancillary infrastructure is expected to include the following:

- Up to 114 wind turbines and concrete foundations or rock adaptors to support them.
- A small transformer outside each turbine tower, depending on the make and model of turbine selected. Such a transformer would have its own foundation and housing.
- Crane hard standings.
- Cabling between the turbines, to be laid underground where practical.
- Internal access roads to each turbine.
- A workshop area for control, maintenance and storage.
- Temporary and permanent wind monitoring masts for calibration and site monitoring.
- Small mast for telecommunications.
- An on-site substation to facilitate the connection between the wind energy facility and the grid.
- New overhead power line to connect to Eskom's existing Juno Substation, 23km east of the site.

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub or 'nacelle' (100m above ground level housing the generator / turbine) and three 60m long blades attached to the hub.

Variations of these dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction. Refer to **Figure 1**.


**Figure 1:** Illustration of the main components of a wind turbine[1]

A turbine is designed to operate continuously, with low maintenance. The length of the construction period for the wind energy facility is estimated to be approximately 12 months. The lifespan of the facility is approximated at 20-30 years.

It is expected, from a visual impact perspective, that the wind turbines would constitute the highest potential visual impact of the wind energy facility.

## 2. SCOPE OF WORK

The project is proposed on the following farm portions

- Remainder of the Farm Zoutpans Klipheuvel 268
- Portion 1 of the Farm Zoutpans Klipheuvel 268
- Erf 618 of the Olifants River Settlement

The scope of work for the proposed facility includes a scoping level visual assessment of the issues related to the potential visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment.

The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 1750km² (the extent of the maps displayed below) and includes a minimum 20km buffer zone from the proposed site boundary.

[1] Illustration courtesy of Savannah Environmental (Pty) Ltd.

## 3. METHODOLOGY

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.

The procedure utilised to identify issues related to the visual impact includes the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment.
- The sourcing of relevant spatial data. This includes 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 the proposed structures.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed facility.

## 4. THE AFFECTED ENVIRONMENT

Regionally, the proposed site for the Olifants River Wind Energy Facility is located approximately 12km east south east of Lutzville, 27 km east-north-east of Vredendal and approximately 8 km inland of the West Coast in the Western Cape Province.

The study area occurs on land that ranges in elevation from 0m above sea level (asl) to about 380m asl at the tops of the Matsikamma mountains the north east of the study area. The site itself ranges in elevation from about 20m asl to approximately 80m asl.

The topography is classed as *moderately undulating plains* in the west of the study area to *undulating hills in the north east.* In the north east of the study area lie the Matsikamma mountains, and to the south east, the foothills of the Cedar mountain range. The terrain immediately surrounding the site is moderately undulating.

The proposed property identified for the facility straddles the Olifants River, which forms the main hydrological feature within the broader study area.

In addition to the above river, a number of small farm dams and water bodies occur throughout the broader study area. A large farm dam measuring approximately 100m x 500m is located within the Olifants River floodplain area on the site. Refer to **Map 1**.

With its arid west coast climate, the broader study area receives between 97 mm and 205 mm of rainfall per year and the proposed site is situated in the *Succulent Karoo (Fynbos)* vegetation types[2].

Economic activities in the area include *Irrigated Agriculture*, especially along the riverine floodplain of the Olifants River, and well as limited tourism. The land type is dominated by *Shrubland* throughout the coastal plain and in the mountainous areas. *Dryland agriculture occurs sporadically within the study area, especially towards the south east*. Refer to **Map 2.**

The broader study area includes the small towns / settlements of Lutzville and Koekenaap as well as a number of farms and homesteads. The closest main urban center falls outside the study area (Vredendal, approximately 28km to the south east). The average population density within the Matzikama Municipality[3] is 8,4 people per km$^2$.

A number of roads are found in the study area and include the R362 which roughly follows the coastline from Strandfontein to Lutzville, the R363 which runs to from Koekenaap northwards through the Matsikamma mountains towards Bitterfontein and a number of lower order secondary roads. A secondary road traverses the study site on the northern bank of the Olifants River.

Industrial type infrastructure is limited to the proposed (authorized Eskom Sere Wind Energy facility and substation approximately 5 km north east of the proposed site. This will use the Juno/Sere 1132kV line running west east 7km north of the proposed site.

The study area has an arid character and is located within a particularly dry part of the country, about 5km from the western seaboard of the Western Cape. All of the towns and settlements within the study area (i.e. Lutzville, Koekenaap, Doringbaai, Strandfontein, Papendorp Olifants drift and Ebenhaeser, are largely very small farming settlements and local centers of agricultural economic activity, although Strandfontein does support a limited seasonal tourism market.

Large areas within the broader study area have been given over to conservation, or remain in a natural state. A number of protected areas of differing status exist within the study area (Refer to **Map 2**)[4].

Conservation area, which include a Provincial Nature Reserve an important birding area and a conservancy as well as private and provincial nature reserves and conservancies are not limited to those which have been formally proclaimed. These protected and conservation areas include the following:

<u>Provincial Reserve:</u>

- The Lutzville Provincial Nature Reserve (10km south east of the site) and its associated Viewshed Protection Zone.

<u>Conservancies and other conservation worthy areas:</u>

- The Lambertsbay – Strandveld Conservancy runs 30km along the coastline north of Strandfontein and approximately 5km to 10km inland, encompassing the site.

[2] Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Western Cape Province (ENPAT Western Cape)*

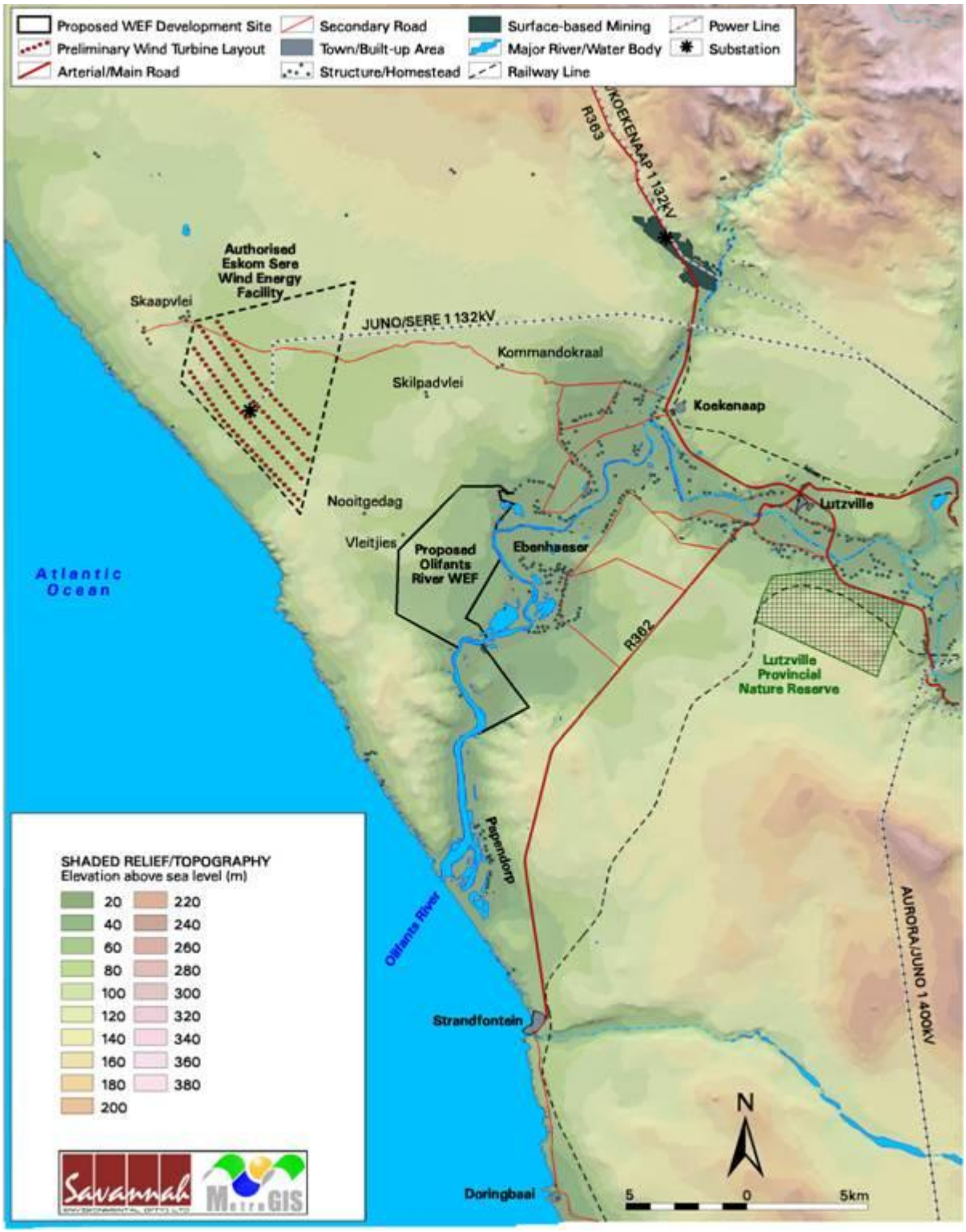
[3] www.wikipedia.org/wiki/Overstrand_Local_Municipality

[4] DEAT (ENPAT Eastern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

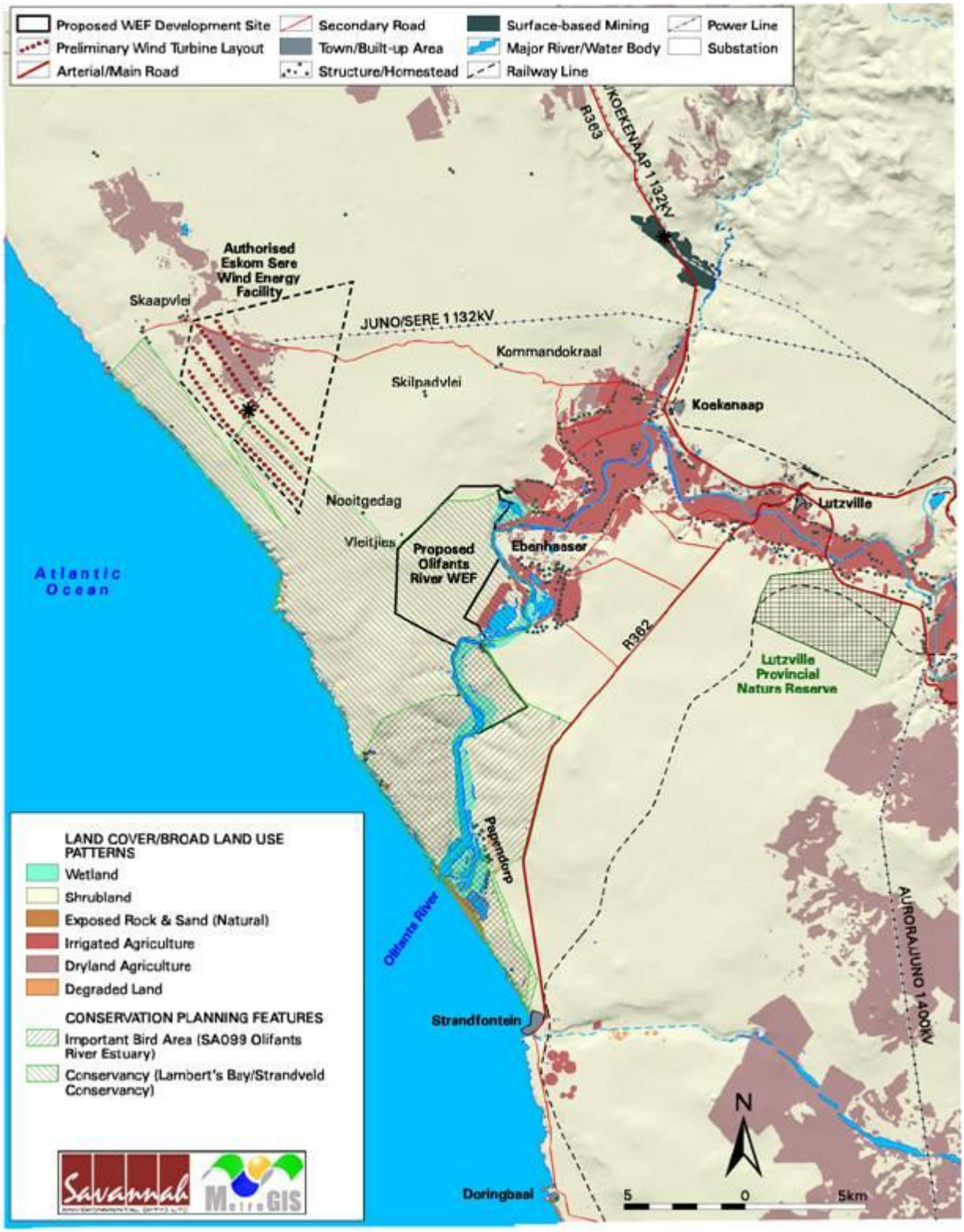
- An 'Important Bird Area' (SA099 Olifants River Estuary) is located within the above conservancy including the estuary at Papendorp (Olifants River mouth), up to and including the southern portion of the site.

*Note: This study does not include any record of the nature or status of facilities present within these protected areas, or if indeed any facilities exist at all. The visual assessment assumes that visitor access is possible and permitted, and that the potential exists to develop tourist facilities and amenities of a private or public nature.*

The character of the landscape is one of undeveloped, wide open spaces. The visual quality is generally low and is characterized by arid scrubland, and unspoiled coastline.




**Map 1:** Location of the proposed facility indicating shaded relief (topography and elevation above sea level) of the study area.




**Map 2:** Broad land cover and land use patterns of the study area.

## 5. POTENTIAL VISUAL EXPOSURE

The result of the initial viewshed analyses for the proposed Olifants River Wind Energy Facility is shown on **Map 3**.

The viewshed analysis was undertaken from a number of provisional turbine positions as at offsets of 100m[5] above average ground level (i.e. the approximate hub height of the proposed wind turbines).

This was done to determine the general visual exposure of the area under investigation, simulating the proposed turbine structures associated with the facility. It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.

Map 3 indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible as well as proximity offsets from the proposed development area.

The following is evident from the viewshed analyses:

- The proposed facility will have a large core area of potential visual exposure on the project site itself, and within a 5km offset. The entire site will be visually exposed, but some adjacent areas to the south west (along the coast) will be visually protected.

  Visual receptors within the visually exposed zone include the R362 road which bypasses the site from Strandfontein to Lutzville south of the Olifants River and a number of settlements, residences and homesteads. These include the following:

  - Skilpadvlei;
  - Nooitgedag;
  - Vleitjies
  - Ebenhaeser;
  - Papendorp;

- Much of the Lambertsbay – Strandveld Conservancy and the 'Important Bird Area' will also be exposed to a potential visual impact.

- Potential visual exposure is slightly reduced in the medium distance (i.e. between 5 and 10km). Visually exposed areas are segmented by the falling topography along the coastline and towards the south of the study area.

  Visual receptors include stretches of the R362 and R363, a number of secondary roads and the town of Koekenaap and surrounds. Residences and homesteads likely to be exposed to potential visual impact include the following:

  - Various isolated farmsteads along the Olifants River between Lutzville and the site;

[5] The final designed hub height of the turbines (i.e. between 80m and 120m) will be used to generate results in the EIA phase.

Large parts of the Authorised Eskom Sere WEF will also be exposed.

- In the longer distance (i.e. between 10km and 20km), visual exposure is further reduced due to the undulating topography and the incised Olifants River valley. Areas beyond the Matsikamma and Cedar mountains are visually protected, as is most of the coastal plain. Visually exposed areas lie mainly to the north west, the east and the south. This includes the west facing slopes of the Matsikamma mountains and the north facing slopes of the Cedar mountains.

  Visual receptors include approximately half of the Lutzville Provincial Nature Reserve, as well as the town of Lutzville itself.

  Residences and homesteads likely to be exposed to potential visual impact are very limited and include Skaapvlei in the North west:

The figure overleaf helps to place the above explanations in context, illustrating what scale a turbine structure will be perceived at different viewing distances.

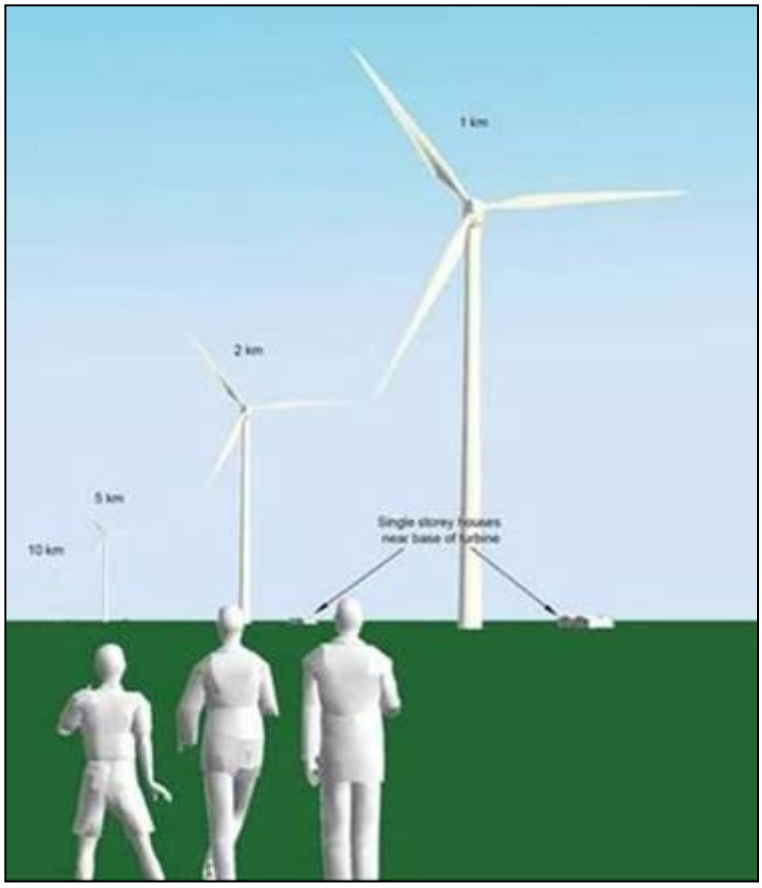
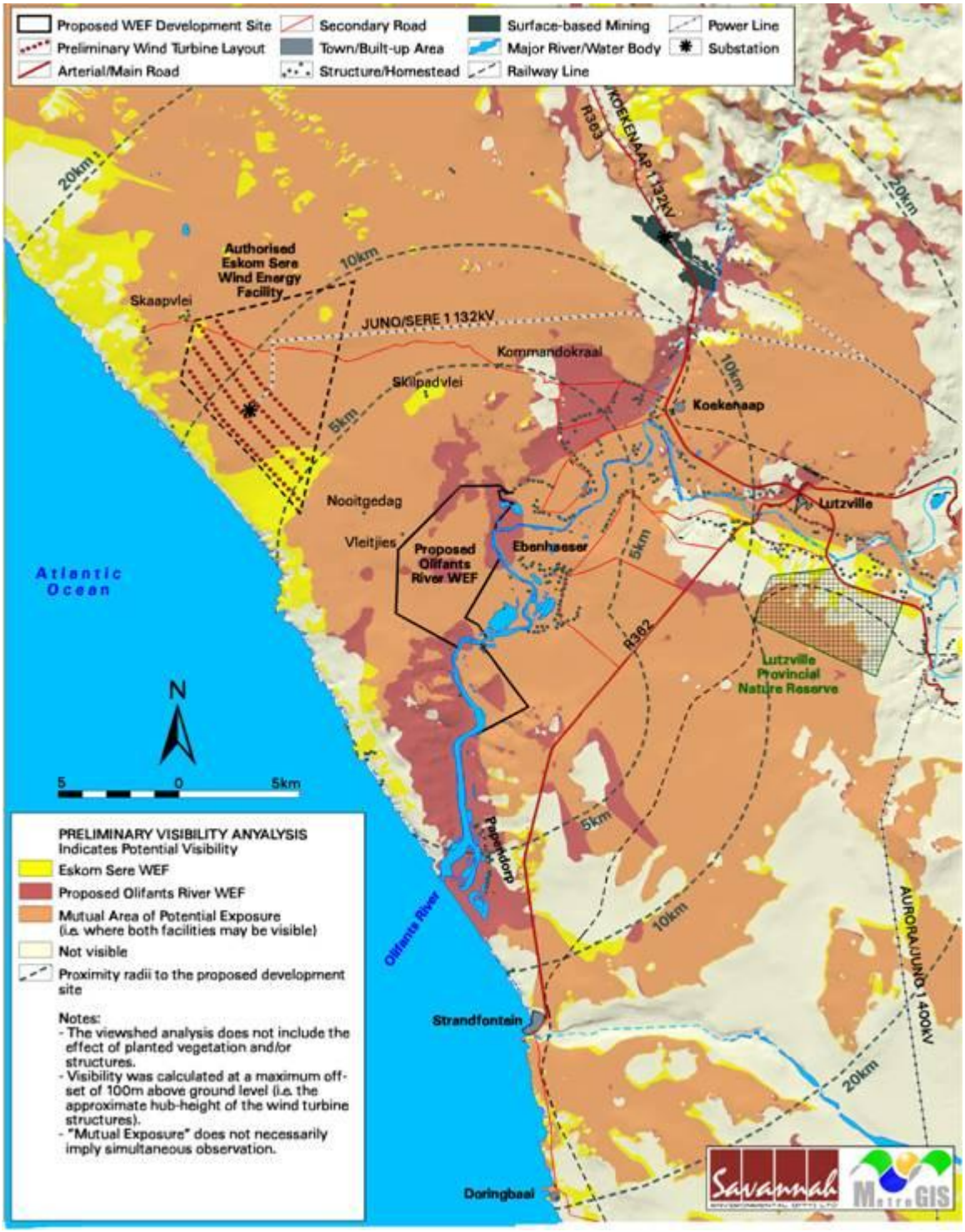



**Figure 2:** Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km.




**Map 3:** Potential visual exposure of the proposed facility.
*Note: the visible area indicates areas from which any number of wind turbines, or parts thereof (with a minimum of one turbine) may be visible.*

## 6. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed Olifants River Wind Energy Facility include the following:

- The visibility of the facility from, and potential visual impact on observers travelling along arterial (i.e. the R362 and the R363) and secondary roads in close proximity[6] to the proposed facility and within the region[7].

- The potential visual impact on urban centers and populated places in close proximity to the proposed facility and within the region. These include the towns of Lutzville and Koekenaap (8km to 12km to the east)

- The visibility of the facility from, and potential visual impact on residences and homesteads in close proximity to the proposed facility and within the region (including Skilpadvlei, Nooitgedag, Vleitjies, Olifantsdrift, Ebenhaeser, Papendorp)

- The visibility of the facility from and potential visual impact on the Lutzville Provincial Nature Reserve and the Lambertsbay – Strandveld Conservancy and the 'Important Bird Area'. The latter two both straddle the site.

- The potential visual impact of ancillary infrastructure (i.e. access roads, workshop, wind monitoring masts, telecommunications masts, the substation and the power line) on observers in close proximity to the proposed facility.

- The potential visual impact of shadow flicker on observers residing on or in close proximity to the proposed facility. This is the flicker of shadow as the rotor blades pass between the receptor and the sun. It occurs when the sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low).

- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.

- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed facility.

- The potential cumulative visual impact of the proposed wind energy facility in relation to other proposed wind energy facilities (notably the authorized Eskom Sere Wind Energy Facility) and associated infrastructure in relation to other built forms.

- Potential residual visual impacts after the decommissioning of the proposed facility.

- The potential to mitigate visual impacts and inform the design process.

[6] For the purpose of this study, close proximity is considered to be within 10km of the proposed wind energy facility. This would be a medium distance view where the structures would be easily and comfortably visible and constitutes a high visual prominence.

[7] For the purpose of this study, the region is considered to be beyond the 10km radius of the proposed wind energy facility. This would be a longer distance view where the facility would become part of the visual environment, but would still be visible and constitutes a medium to low visual prominence.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale. Refer to **Map 3.**

These anticipated visual impacts should be assessed in further detail during the EIA phase of the project as this report is only focused on defining the potential visual exposure of the proposed development and identifying the potential issues associated with the visibility of the development.

## 7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the proposed Olifants River Wind Energy Facility will have a visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 10km radius of the proposed project development site.

Such visual receptors include people travelling along roads, residing in the towns and on farms and homesteads and tourists visiting and passing through the area.

The area potentially affected by the proposed development has a low visual quality, and is characterized by arid scrubland, and an unspoiled, largely desolate coastline.

The area is not a known tourism area although large areas have also been given over to conservation (Lutzville Provincial Nature Reserve, estuary, conservancies and birding areas).

It is therefore recommended that the severity of the potential visual impact be assessed in further detail in the EIA phase. Additional spatial analyses must be undertaken in order to create a visual impact index that will further aid in determining potential visual impact.

Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine visual impact and ultimately the significance of the visual impact. In addition, photo simulations of critical viewpoints will be undertaken where required, in order to aid in the visualization of the envisaged visual impact. In this respect, the proposed Plan of Study for EIA is as follows:

- **Determine visual distance / observer proximity to the facility**

  In order to refine the visual exposure of the facility on surrounding areas / receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the turbine structures.

  Proximity radii for the proposed development site are 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.

  MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure). MetroGIS developed this methodology in the absence of any known and / or acceptable standards for South African wind energy facilities.

The proximity radii (calculated from the boundary lines of the farm selected for the facility) are as follows:

- 0 - 5km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 5 - 10km. Medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 10 - 20km. 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 20km. Long distance view of the facility where the facility could potentially still be visible, though not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

- **Determine 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, then there would be no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed 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, and purpose of sighting which would create a myriad of options.

- **Determine the Visual Absorption Capacity of the environment**

This is the capacity of the receiving environment to absorb or screen the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the region. It is therefore necessary to determine the VAC by means of the interpretation of the natural visual characteristics, supplemented with field observations.

- **Determine the Visual Impact Index**

  The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the severity of each impact.

The above exercise should be undertaken for the core wind energy facility as well as the ancillary infrastructure, as these structures (i.e. the access roads, workshop, wind monitoring masts, telecommunications masts, substations and power line) are envisaged to have varying levels of visual impact at a more localised 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.

In addition, cumulative visual impact should be addressed, as well as suggested mitigation measures for all identified impacts (if any).

## 8. REFERENCES/DATA SOURCES


Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral maps and digital data.*

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Western Cape Province (ENPAT Western Cape).*

Mucina, L. and Rutherford, M.C. (eds). 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19.

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.*

Scenic Landscape Architecture (2006). *Cullerin Range Wind Farm; Visual Impact Assessment.* Unpublished Report.